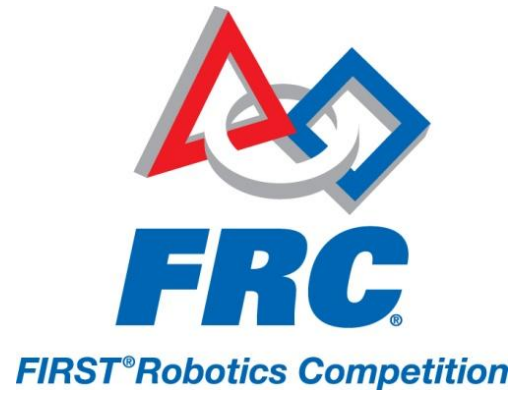


Section  
**2**



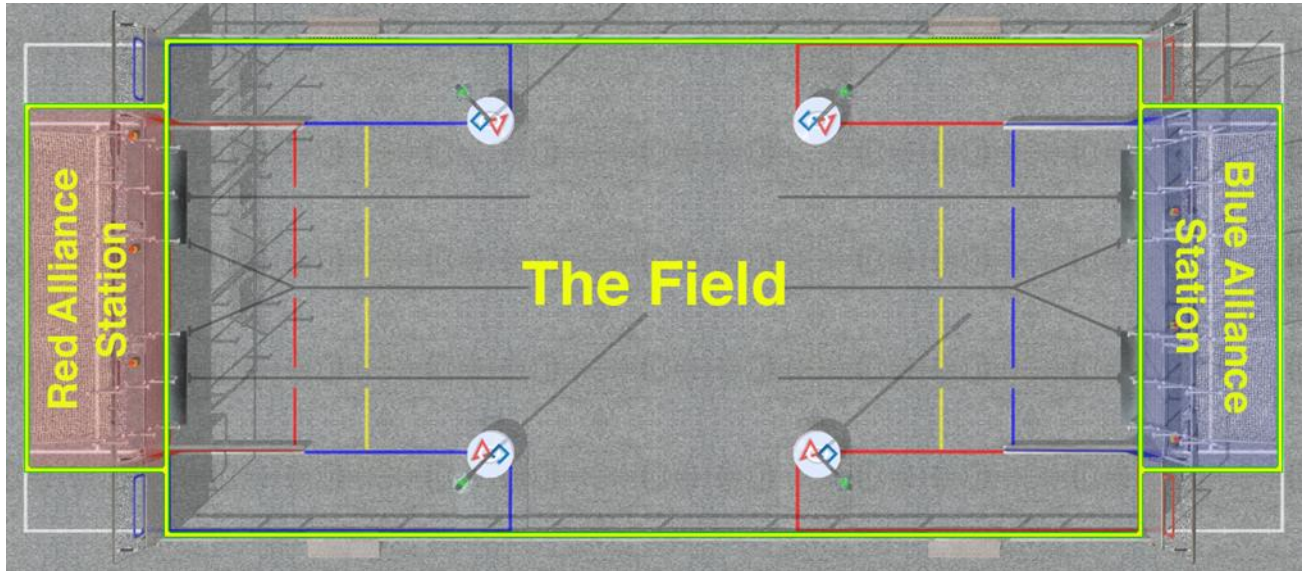
# THE ARENA

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## 2 THE ARENA

### 2.1 OVERVIEW



*Note: These illustrations are for a general visual understanding of the LogoMotion ARENA only. Please refer to the official drawings for exact dimensions and construction details.*

The ARENA includes all elements of the game infrastructure that are required to play *LogoMotion*: the FIELD, the ALLIANCE STATIONS, the GAME PIECES, and all supporting communications, arena control, and scorekeeping equipment.

ROBOTS play *LogoMotion* on a 27 by 54-foot rectangular field known as the FIELD. The FIELD is bordered by a set of guardrails and ALLIANCE WALLS. During the game MATCHES, the ROBOTS are controlled from ALLIANCE STATIONS located outside the ends of the FIELD. These rectangular zones consist of three TEAM PLAYER STATIONS that provide connectivity between the controls used by the ROBOT operators and the ARENA. SCORING GRIDS are located directly in front of the PLAYER STATIONS, attached to the surface of the ALLIANCE WALLS facing the FIELD.

The specifications for the *LogoMotion* ARENA used in competition are listed below in Section 2.1.1. The referenced specifications and construction details of the ARENA can be found on the *FIRST* web site at [www.usfirst.org/frc/2011/officialdrawings.html](http://www.usfirst.org/frc/2011/officialdrawings.html) . Note that the web site also contains drawings for low-cost versions of the important elements of the ARENA. TEAMS may choose to build these versions for their own use during the construction and testing of the ROBOT. These drawings can be found at [www.usfirst.org/frc/2011/teamdrawings.html](http://www.usfirst.org/frc/2011/teamdrawings.html) .

#### 2.1.1 Dimensions and Tolerances

The exact dimensions and construction details of the ARENA are contained on the official arena drawings. The relevant drawings include:

2011 FRC DRAWINGS			
TITLE	CATEGORY	DWG NO.	SHEET/S
<i>2011 Arena Assembly*</i>	<i>Overall Arena Assembly</i>	<i>FE-00034*</i>	<i>5 Sheets</i>
<i>Outer Pole Assembly*</i>	2011 Game Specific	GE-11000	1 Sheet
<i>Middle Pole Assembly*</i>	2011 Game Specific	GE-11003	1 Sheet
Base	2011 Game Specific	GE-11020	3 Sheets
Mounting Angle, Left	2011 Game Specific	GE-11021	2 Sheets
Mounting Angle, Right	2011 Game Specific	GE-11022	2 Sheets
<i>Lane Divider Assembly*</i>	2011 Game Specific	GE-11025	1 Sheet
Corner Glass Right	2011 Game Specific	GE-11027	1 Sheet
Corner Glass Left	2011 Game Specific	GE-11028	1 Sheet
Modified End Panel, Corner	2011 Game Specific	GE-11041	8 Sheets
Tower Assembly*	2011 Game Specific	GE-11049	2 Sheets
Net Support	2011 Game Specific	GE-11051	1 Sheet
Net	2011 Game Specific	GE-11055	1 Sheet
Guard	2011 Game Specific	GE-11060	1 Sheet
Fueling Port Rear Plastic	2009 Game Specific	GE-09023	1 Sheet
Top Rail	2009 Game Specific	GE-09031	1 Sheet
Drivers Station Support	Generic Field Drawing	FE-00001	2 Sheets
Corner Supports, Left and Right	Generic Field Drawing	FE-00002	2 Sheets
Rail Pin Assembly	Generic Field Drawing	FE-00003	1 Sheet
End Panel	Generic Field Drawing	FE-00004	3 Sheets
Field Top Rail	Generic Field Drawing	FE-00007	1 Sheet
Field Plastic "A"	Generic Field Drawing	FE-00008	1 Sheet
Field Plastic "B"	Generic Field Drawing	FE-00009	1 Sheet
Field Plastic "C"	Generic Field Drawing	FE-00010	1 Sheet
Field Plastic "G"	Generic Field Drawing	FE-00011	1 Sheet
Drivers Station Acrylic	Generic Field Drawing	FE-00012	1 Sheet
Field Outrigger	Generic Field Drawing	FE-00013	1 Sheet
Field Entry Ramp	Generic Field Drawing	FE-00014	2 Sheets
Field Trip Guard	Generic Field Drawing	FE-00015	1 Sheet
Hanger, Plastic "G"	Generic Field Drawing	FE-00016	1 Sheet
<i>Field Rail Assembly - Middle*</i>	<i>Generic Field Drawing</i>	<i>FE-00022*</i>	<i>1 Sheet</i>
<i>Field Rail Assembly - End*</i>	<i>Generic Field Drawing</i>	<i>FE-00023*</i>	<i>1 Sheet</i>
<i>Field Rail Assembly – Gate*</i>	<i>Generic Field Drawing</i>	<i>FE-00029*</i>	<i>1 Sheet</i>

*\*Refer to drawing for all part numbers required to build assemblies.*

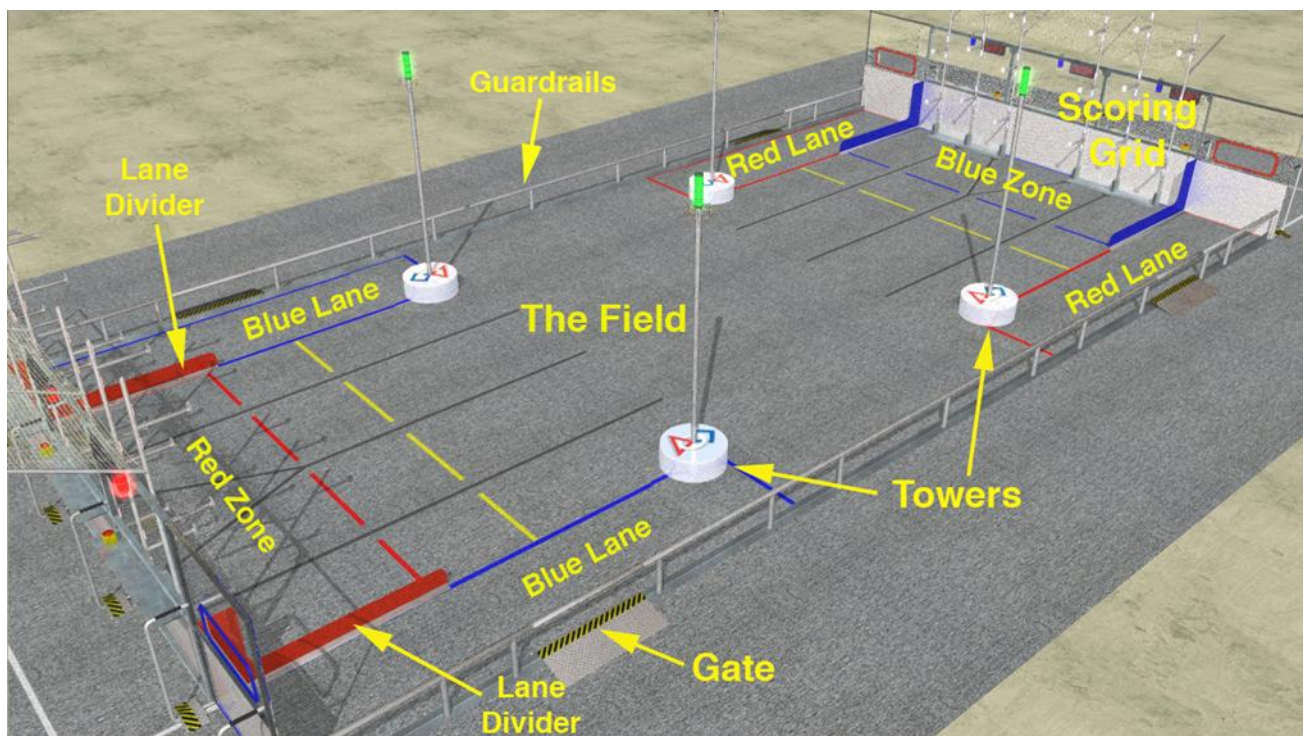
The competition ARENAS are modular constructions that are assembled, used, disassembled, and shipped many times during the competition season. They may undergo a significant amount of wear and tear. The ARENA is designed to withstand rigorous play and frequent shipping, and every effort is made to ensure that the ARENAS are as identical from event to event as possible. However, as the ARENAS are assembled in different venues by different event staff, some small variations do occur. Fit and tolerance on large assemblies (e.g. the TOWER) are ensured only to within 1/4 inch. Overall gross dimensions of the entire field may vary up to 4 inches. Successful TEAMS will design ROBOTS that are insensitive to these variations.

## 2.2 THE ARENA

*Note: The official LogoMotion ARENA description, layout, dimensions and parts list are contained in the "FE-00034 - 2011 Arena Layout and Marking" Drawing. Diagrams and dimensions below are for illustrative purposes only.*

### 2.2.1 The FIELD

The playing FIELD for *LogoMotion* is a 27-foot by 54-foot carpeted area, bounded by two ALLIANCE WALLS and a Guardrail System. The FIELD is covered with carpet (S&S Mills, Sequoia 20 Oz. Level Loop Pile, Color: Ground Pepper). SCORING GRIDS are located at the ends of the FIELD, immediately in front of the ALLIANCE STATIONS. Tape markings on the surface of the FIELD denote LANES, ZONES, CAUTION LINES, and TRACKING LINES used during the game. Four TOWERS are located near the mid-field and used during the END GAME period of *LogoMotion*.



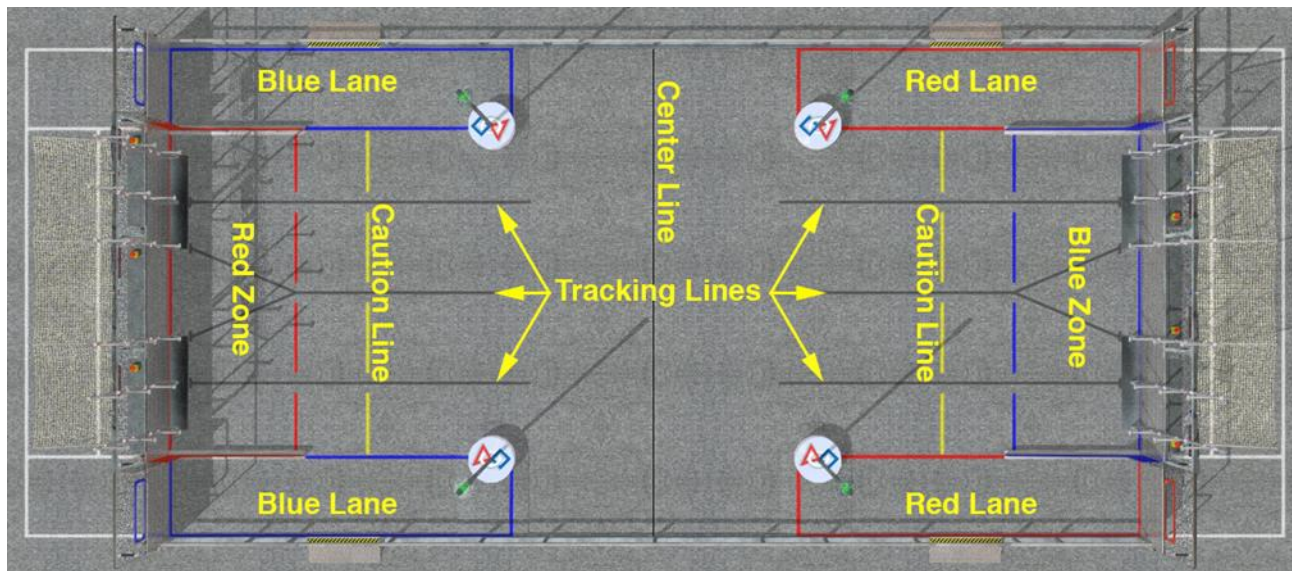
The ALLIANCE WALL is 6-1/2 feet high, 27 feet wide, and defines the ends of the FIELD. The ALLIANCE WALL is a barrier protecting the PLAYER STATIONS. This barrier is composed of a three-foot high base of diamond plate aluminum topped with a 3-1/2-foot high transparent polycarbonate panel. A protective safety net extends above the top of the ALLIANCE WALL to prevent GAME PIECES and/or ROBOT parts from exiting the FIELD and entering the ALLIANCE STATION area. At each side of the PLAYER STATION barrier is a 4-1/2 foot wide panel containing a FEEDING SLOT through which GAME PIECES can be passed.

The Guardrail System is a horizontal pipe 20 inches above the floor, supported by vertical struts mounted on a three-inch aluminum angle. A shield is attached on the inside of the Guardrail System, extending from the floor to the top of the guardrail, and running the length of the guardrail. The shield is intended to help prevent ROBOTS, in whole or in part, from inadvertently exiting the FIELD during a match. The Guardrail System defines the borders of the FIELD, except where it is bounded by the ALLIANCE WALL.

Four gates in the Guardrail System allow easy access to the FIELD for placement and removal of ROBOTS. The gates are 38 inches wide, and are closed and shielded during game play.

## 2.2.2 FIELD Markings

The FIELD is divided into several regions by 3-inch wide colored gaffers tape attached to the carpet. The regions are known as “ZONES” and “LANES.” The color of the ZONES and LANES are indicated by the color of the gaffers tape used to mark them on the carpet (Pro Gaff Tape, “red” and “electric blue”). ZONES and LANES are areas safe from incursion by ROBOTS from the opposing ALLIANCE. The tape boundaries are considered “in” the bounded areas.



*FIELD markings. For illustrative purposes only - please refer to Drawing FE-00034 for precise size and location of the FIELD markings.*

There is one ZONE for each ALLIANCE, located immediately in front of the ALLIANCE WALL for that ALLIANCE. The ZONE is approximately 18 feet wide and 7 feet deep. There is a 2-inch wide yellow CAUTION LINE located 4 feet in front of the ZONE (Pro Gaff Tape, “yellow”). The CAUTION LINE is used as a visual warning indicator to the opposing ALLIANCE that their ROBOTS are getting close to the ZONE.

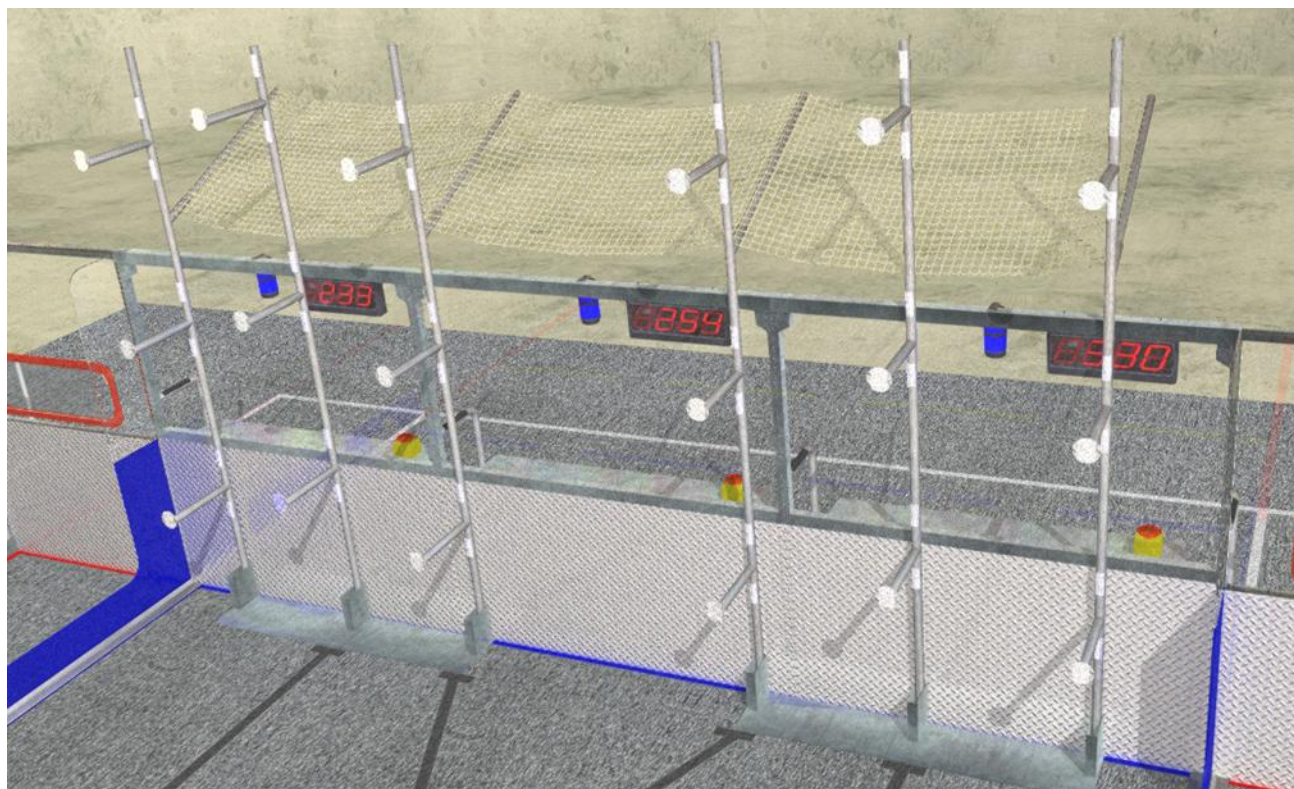
At the end of the FIELD opposite from the ALLIANCE STATION, LANES are marked on the carpet for each ALLIANCE. There are two LANES for each ALLIANCE, located in each of the opposing corners of the FIELD. Each LANE extends for approximately 19-1/2 feet from the opposing ALLIANCE WALL toward the center of the FIELD. Each LANE extends inwards approximately 4 feet 3 inches from the edge of the FIELD.

A mid-field is marked on the carpet with black permanent marker which equally divides the width of the FIELD in half.

TRACKING LINES are marked on the carpet with 2-inch wide grey gaffers tape (Pro Gaff Tape, “grey”). The TRACKING LINES are intended for use by the ROBOTS to locate the columns of SCORING PEGS on the SCORING GRIDS. Each of the outer TRACKING LINES extends from approximately one foot past the ends of the lanes to the base of the center columns of each of the SCORING GRIDS. The center TRACKING LINE extends approximately one foot past the ends of the lanes toward the SCORING GRIDS, and then bifurcates approximately 7 feet from the end, with each branch then leading to one of the two inner columns of the SCORING GRIDS. Each TRACKING LINE ends in a T to assist the ROBOT with recognizing when the end has been reached.

## 2.2.3 The SCORING GRID

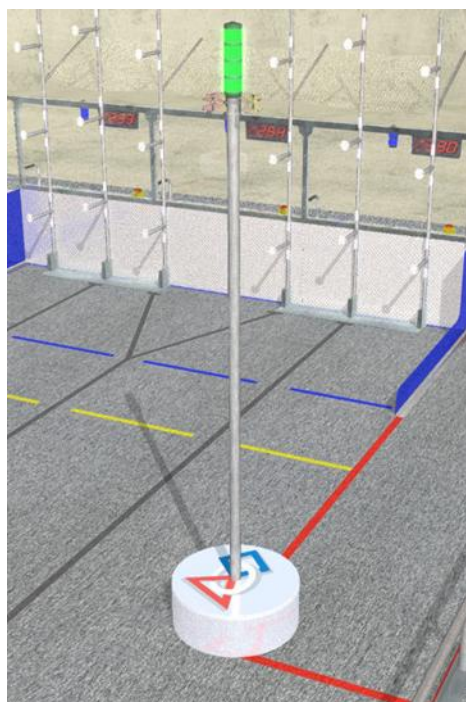
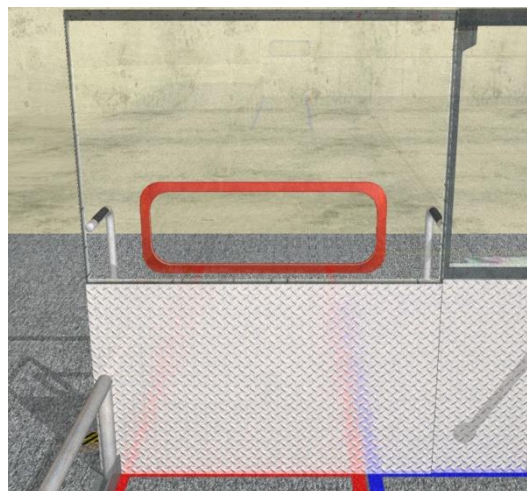
The SCORING GRIDS are used to receive GAME PIECES placed by the ROBOTS as they play *LogoMotion*. There are four SCORING GRIDS on the FIELD. Two are located immediately in front of each ALLIANCE STATION and are owned by the ALLIANCE associated with the ZONE in which they are located (i.e. the two SCORING GRIDS in the red ZONE are the red ALLIANCE SCORING GRIDS). SCORING GRIDS are attached to the inside of the ALLIANCE WALL. Each SCORING GRID is composed of three vertical columns, with three horizontal SCORING PEGS attached to each column. The vertical columns are held in place by column bases. Each column base consists of three open-ended rectangular tubes affixed to a flat steel plate, which rests on the carpet. One base is used for each SCORING GRID. The rectangular tubes are approximately 2 inches wide, 8 inches high and 6 inches deep. One column is positioned inside each rectangular tube, toward the rear of the tube, to provide support. The columns and SCORING PEGS are constructed of 1.66-inch OD aluminum pipe. The columns within each SCORING GRID are spaced 30 inches center-to-center. The three SCORING PEGS located on each column extend 16 inches horizontally inward toward the center of the FIELD. The height of the SCORING PEGS on each of the three “levels” is staggered from their adjacent neighbor by up to 8 inches. This spacing is intended to allow tight visual “packing” of adjacent GAME PIECES, while leaving just enough room to minimize interference with GAME PIECES already located on SCORING PEGS as new pieces are placed.



A small “foot” is placed on the end of each SCORING PEG. The foot is a 2-3/4-inch diameter disk of 3/8-inch aluminum. The foot is intended to help retain any GAME PIECES on the SCORING PEG, and help prevent them from being knocked off once placed in position. A retro-reflective VISION TARGET, approximately the same size as the foot, is attached to the FIELD-facing surface of the foot. Additional retro-reflective VISION TARGETS, approximately 1 inch by 4 inch in size, are attached to each column, starting two inches above and below each foot. Each SCORING PEG, therefore, has associated with it three VISION TARGETS, one on the foot, one above the foot and one below the foot. These retro-reflective VISION TARGETS may be used to aid ROBOTS in locating SCORING PEGS.

## 2.2.4 The FEEDING SLOTS

The FEEDING SLOTS are openings in the ALLIANCE WALL that can be used by the FEEDER to pass GAME PIECES to a ROBOT and enter them into play. One FEEDING SLOT is located in the ALLIANCE WALL at the end of each LANE, in front of the FEEDER'S position. Each FEEDING SLOT is approximately 35 inches wide and 10 inches tall, and is centered 45 inches above the floor.



## 2.2.5 The TOWERS

TOWERS are located near the mid-field end of each LANE and are owned by the ALLIANCE associated with the LANE in which it is located (i.e. the TOWER intersecting the red LANE is owned by the red ALLIANCE). The TOWERS are climbed by MINIBOTS during the END GAME of a *LogoMotion* match. Each TOWER is composed of a BASE, a POST, and a TARGET. The BASE is a cylindrical section approximately 30 inches in diameter by 12 inches tall. The sides and top of the BASE are covered in translucent white LDPE plastic.

The BASE rests on a 48-inch by 76-inch floor protector made of 3/16-inch HDPE. The floor protector is velcroed to the FIELD surface, and covered with a piece of similar carpet. The edges of the floor protector cover are taped to the FIELD carpet (Pro Gaff Tape, "black", 2-inch). This taped seam forms a slight (approximately 1/4-inch) ridge in the FIELD

around the TOWER.

The POST extends upwards from the center of the BASE. The POST is constructed from a piece of 1.5" Steel Electrical Metal Tubing (EMT) with a nominal outer diameter of 1.74". The DEPLOYMENT LINE is located on the POST, approximately 18 inches above the top surface of the BASE. The DEPLOYMENT LINE is marked on the POST with black permanent marker to avoid significant changes to the surface properties of the POST (other than color).

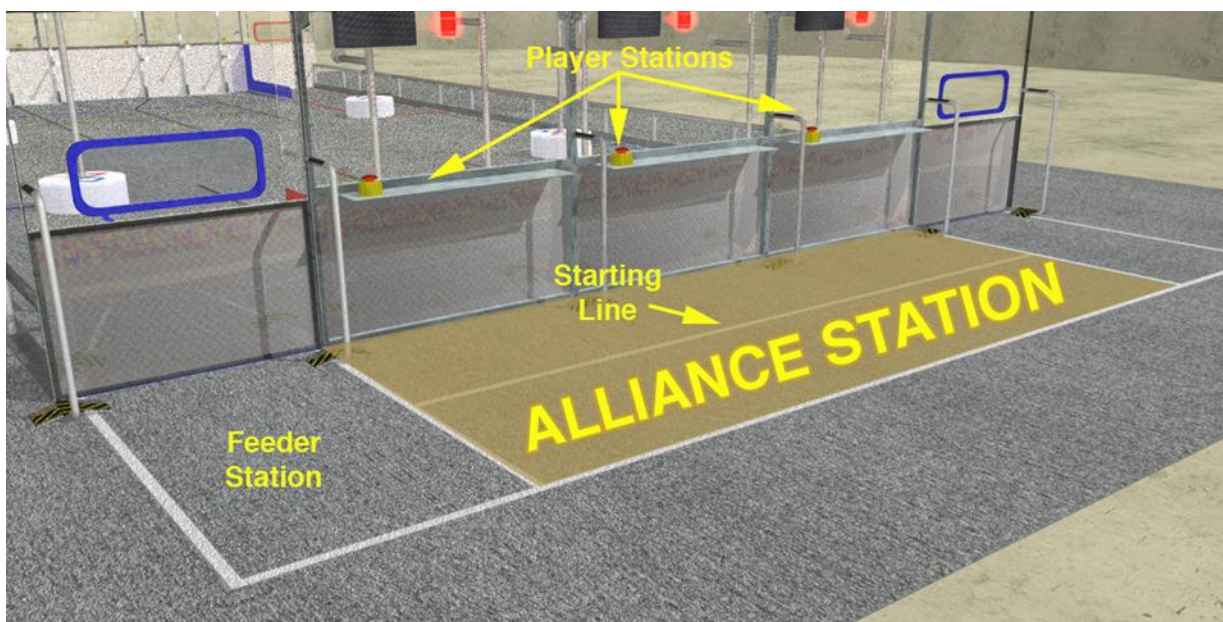
The TARGET is attached to the top of the POST. The TARGET is the "finish line" that indicates the MINIBOT has reached the top of the POST. The TARGET consists of a pair of 12-inch diameter polycarbonate disks, spaced approximately 2 inches apart. The bottom of the lower disk (i.e. the portion of the TARGET contacted by the climbing MINIBOT) is approximately 122 inches above the floor. As the MINIBOT climbs the POST and contacts the lower disk of the TARGET, the disk translates upwards approximately 1/4 inch as the sensors internal to the TARGET register the contact. A minimum contact force of approximately 2-4 Newtons, depending on contact location, is required to ensure the contact sensors in the TARGET trip reliably. The contact sensors and associated electronics are located between the upper and lower disks of the TARGET.

Colored lights inside the BASE and TARGET lights will illuminate at various stages of the MATCH.

## 2.2.6 The ALLIANCE STATIONS

The ALLIANCE STATIONS are located at either end of the ARENA, behind the ALLIANCE WALLS. The DRIVERS and COACHES of the competing TEAMS stand in their assigned ALLIANCE

STATION during the MATCH, from where they operate their HOSTBOTS and play *LogoMotion*.



The ALLIANCE STATION extends back eight feet from the ALLIANCE WALL, and across the 18-foot wide center section of the wall. The ALLIANCE STATION includes the three identical PLAYER STATIONS. The STARTING LINE is marked on the floor four feet back from the ALLIANCE WALL, and extends across the width of the ALLIANCE STATION. The ALLIANCE STATION includes the area behind the STARTING LINE. All boundaries for the ALLIANCE STATIONS are marked on the carpet with white tape (Pro Gaff Tape, “white”, 2-inch). The tape boundaries are considered “in” the bounded areas.

## 2.2.7 FEEDER STATIONS

A FEEDER STATION is located on either side of the ALLIANCE STATION. A FEEDER from the opposing ALLIANCE stands in the FEEDER STATION during the MATCH. The FEEDER STATION extends back eight feet from the ALLIANCE WALL, and from the line at the edge of the ALLIANCE STATION to the edge of the FIELD width.

A 50.5” x 29” polycarbonate sheet is mounted vertically, with its lowest edge resting on the carpet, between the rearmost vertical supports of the uprights to the left and right of the FEEDING SLOT in each FEEDER STATION. This polycarbonate spans the width of the FEEDING STATION, forming a narrow protective box with the ALLIANCE WALL. This helps prevent contact between FEEDERS and field electronics located near the ALLIANCE WALL.

## 2.2.8 The PLAYER STATIONS

Attached to the ALLIANCE WALL are three aluminum shelves to support the OPERATOR CONSOLES for the three TEAMS on the ALLIANCE. The support shelf measures approximately 60 inches wide by 12 inches deep. There is a 4-1/2-foot long by two-inch wide strip of Velcro tape (“loop” side) along the center of the support shelf that may be used to secure the OPERATOR CONSOLES to controls the ROBOT. Each setup location includes a competition cable (to provide Ethernet connectivity) that attaches to the Ethernet Port of the OPERATOR CONSOLE. The cable provides communications with the ROBOT.

Once plugged in to the Field Management System via the Ethernet cable provided, the ports that the teams will be able to access on the playing field are as follows:

- TCP 1180: This port is typically used for camera data from the cRIO to the DS when the camera is connected to port 2 on the cRIO. This port is bidirectional on the field.
- UDP 1130: Dashboard-to-Robot control data, directional



- UDP 1140: Robot-to-Dashboard status data, directional
- HTTP 80: Camera connected via switch on the robot, bidirectional
- HTTP 443: Camera connected via switch on the robot, bidirectional

All these ports are open on the playing field, so a team can use them as they wish if they do not employ them as outlined above (i.e. TCP 1180 can be used to pass data back and forth between the robot and the DS if the team chooses not to use the camera on port 2).

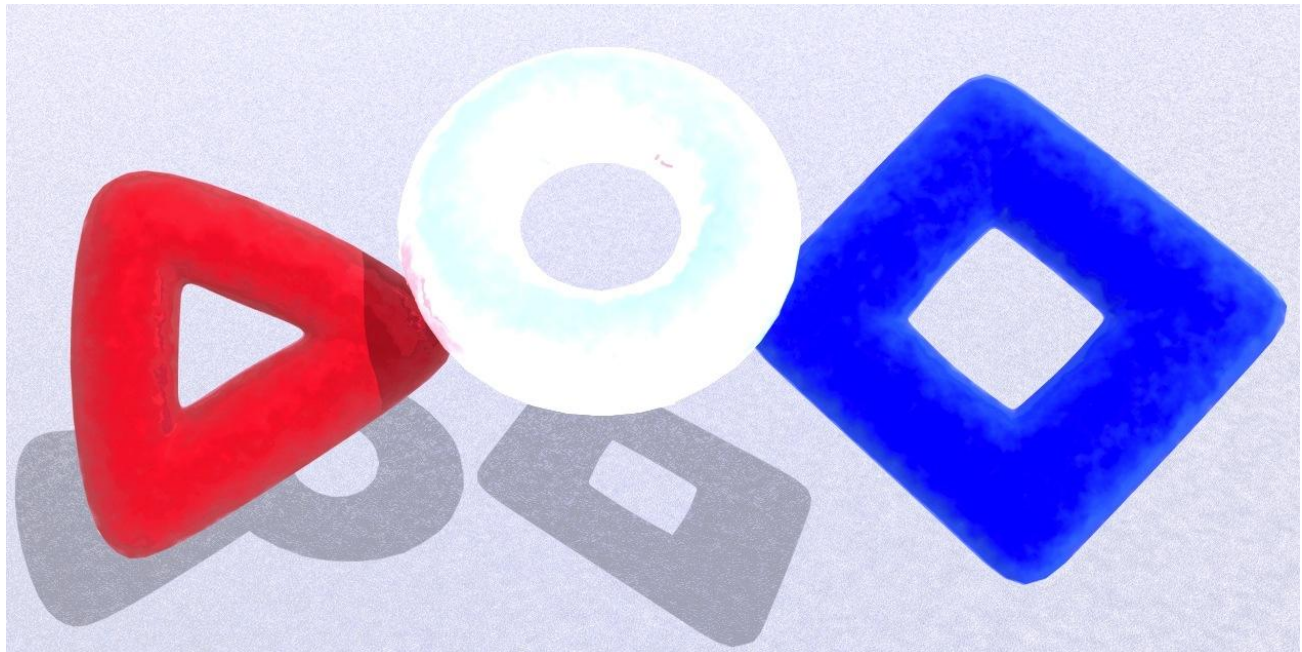
Each setup location also includes a power adaptor cable that may be used to power the Classmate laptops that were provided to teams in 2010 and 2011. Emergency Stop (E-Stop) buttons for each TEAM are located on the left end of each PLAYER STATION shelf. ARENA components (including team number displays, competition arena hardware, alliance lights, control hardware cabinets and clock displays) are also located above the PLAYER STATIONS and below the shelf.

## 2.2.9 GAME PIECES

While playing *LogoMotion*, HOSTBOTS manipulate GAME PIECES to accomplish the objectives of the game. Each GAME PIECE is an inflatable object constructed of 0.3 mm thick vinyl. The body of each GAME PIECE has a tubular cross-section, nominally between 7 and 8 inches in diameter at their narrowest. The GAME PIECES are inflated to nominal size, not a specific pressure.

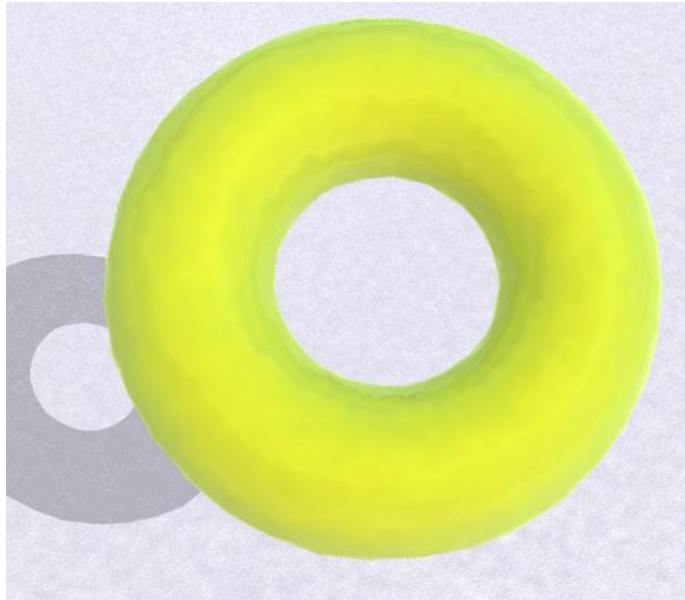
### 2.2.9.1 LOGO PIECES

During the majority of the MATCH, the HOSTBOTS manipulate GAME PIECES that are constructed in one of three shapes: a TRIANGLE, a CIRCLE or a SQUARE. The exterior dimensions of the GAME PIECES range between 25 inches (from side to side of the SQUARE) to 30 inches (from corner to corner of the TRIANGLE). The central opening in each GAME PIECE ranges between 9-1/2 inches (for the TRIANGLE) to 12 inches (for the CIRCLE and SQUARE) across. The TRIANGLE GAME PIECES are colored red, the CIRCLES are white, and the SQUARES are blue.



### 2.2.9.2 UBERTUBES

UBERTUBES are the GAME PIECES manipulated by the HOSTBOTS during the AUTONOMOUS PERIOD of the MATCH. UBERTUBES are constructed in the same manner as the CIRCLE, except they are colored yellow



## 2.3 REVISION HISTORY

Revision	Release Date	Changes
-	1/5/11	Original release
A	1/18/11	Throughout: added detail for tape used on the ARENA. Section 2.2.5: included better description of material used for the POST. Added <b>Section 2.3, Revision History</b>
B	1/25/11	Section 2.2.8: Added detail regarding port access
C	2/4/11	Updated Drawing table in Section 2.2.1 to include the plastic that will be used in the FEEDER STATION. Updated Section 2.2.7 to include a description of the plastic included in the FEEDER STATION.