

Section  
**6**



# THE ARENA

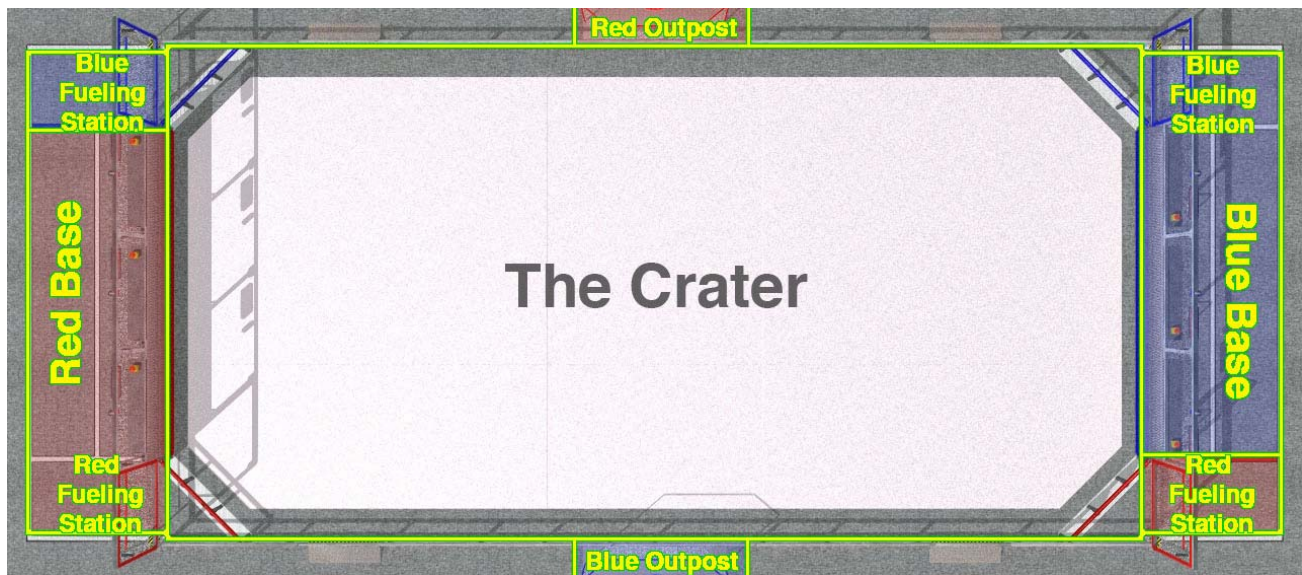
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## 6 THE ARENA

### 6.1 OVERVIEW

The following sections of the manual describe the arena, game, robots and tournament structure used in the 2009 *FIRST* Robotics Competition. Please be sure to read and thoroughly understand Sections 6, 7, 8, and 9 to fully understand the game and ensure the best opportunity for success during the competition season.



*Note: These illustrations are for a general visual understanding of the Lunacy 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 *Lunacy*: the CRATER, the ALLIANCE BASES, the OUTPOSTS, the FUELING STATIONS, the PAYLOAD TRAILERS, the GAME PIECES, and all supporting communications, arena control, and scorekeeping equipment.

ROBOTS play *Lunacy* on a 27 by 54-foot rectangular field known as the CRATER. The CRATER is bordered by a set of guardrails and Alliance Station Walls. During the game matches, the ROBOTS are controlled from BASES located outside the ends of the CRATER. These rectangular zones consist of three team Player Stations that provide connectivity between the controls used by the ROBOT operators and the ARENA. FUELING STATIONS are located outside the corners of the CRATER, behind the Alliance Station Wall and adjacent to the BASES. OUTPOSTS are located at the centerline of the CRATER, immediately outside the guardrail. Each FUELING STATION and OUTPOST is assigned to either the red or blue ALLIANCE (when looking at the CRATER from the BASE, the FUELING STATIONS corresponding to the alliance are to the right, and the corresponding OUTPOST is to the left).

The specifications for the *Lunacy* ARENA used in competition are listed below in Section 6.1.1. The referenced specifications and construction details of the ARENA can be found on the *FIRST* web

site at <http://www.usfirst.org/community/frc/content.aspx?id=452>. 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 <http://www.usfirst.org/community/frc/content.aspx?id=452>.

### 6.1.1 Dimensions and Tolerances

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

<b>2009 FRC DRAWINGS</b>			
<b>TITLE</b>	<b>CATEGORY</b>	<b>DWG NO.</b>	<b>SHEET/S</b>
<i>Payload Trailer Assembly*</i>	<i>2009 Game Specific</i>	<i>GE-09000*</i>	<i>5 Sheets</i>
Base Outpost	2009 Game Specific	GE-09032	1 Sheet
Outpost Shield	2009 Game Specific	GE-09014	2 Sheets
Airlock Right Side	2009 Game Specific	GE-09010	7 Sheets
Airlock Left Side	2009 Game Specific	GE-09012	7 Sheets
Fueling Port Glass Holder	2009 Game Specific	GE-09011	6 Sheets
Fueling Port Station Plastic	2009 Game Specific	GE-09022	1 Sheet
Fueling Port Upright Plastic	2009 Game Specific	GE-09039	1 Sheet
Fueling Port Rear Plastic	2009 Game Specific	GE-09023	1 Sheet
Top Rail Fueling Port	2009 Game Specific	GE-09031	1 Sheet
Players Station Bumper	2009 Game Specific	GE-09013	7 Sheets
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.*

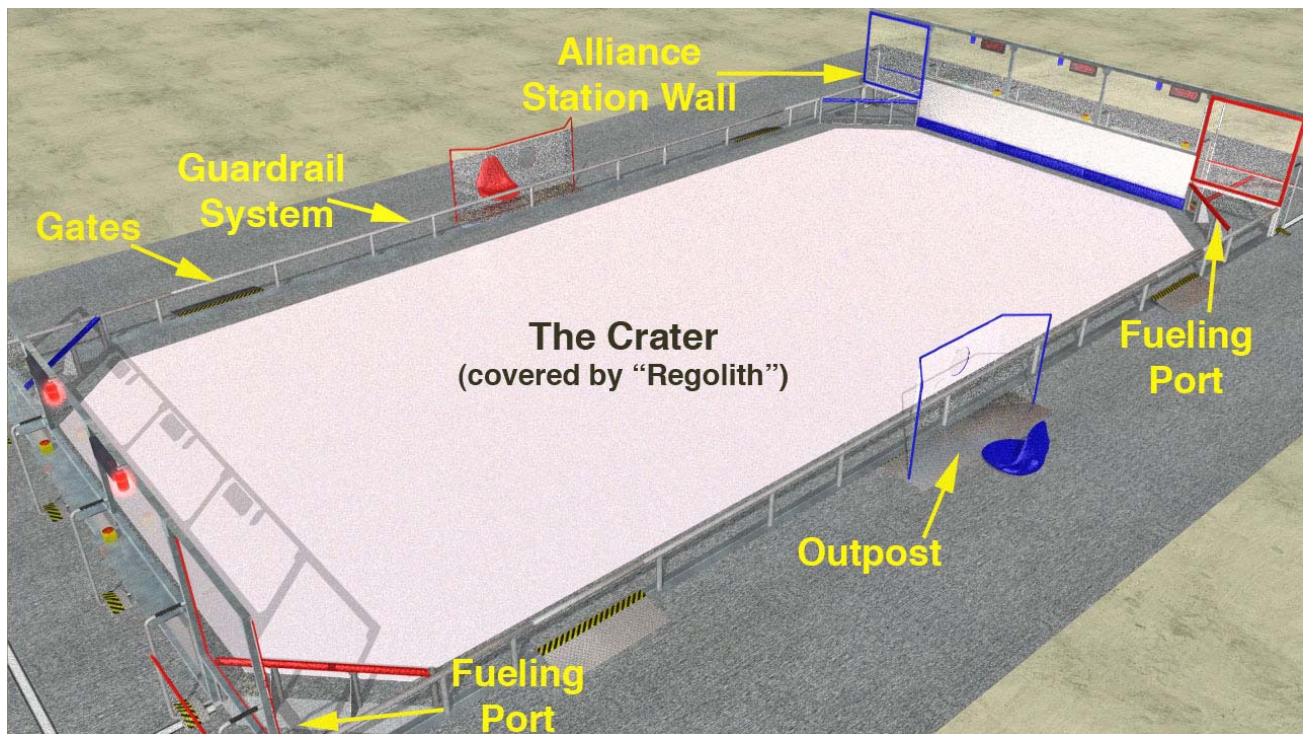
The competition ARENAS are modular constructions that are assembled, used, disassembled, and shipped many times during the competition season. They may undergo a significant amount of wear and tear. The ARENA is designed to withstand rigorous play and frequent shipping, and every effort is made to ensure 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, small some variations do occur. Fit and tolerance on large assemblies are ensured only to within 1/4 inch. Successful teams will design ROBOTS that are insensitive to these small variations.

## 6.2 THE ARENA

*Note: The official Lunacy ARENA description, layout, dimensions and parts list are contained in the "FE-00030 - 2009 Arena Layout and Marking" Drawing. Diagrams and dimensions below are for illustrative purposes only.*

### 6.2.1 The CRATER

The playing field for *Lunacy* is a 27-foot by 54-foot carpeted area, bounded by two Alliance Station Walls and a Guardrail System. This field is known as the "CRATER." The majority of the CRATER is covered by a 24-foot by 50-foot surface known as the "REGOLITH." The REGOLITH is made of "Glasliner FRP™" gel-coated, fiberglass-reinforced, polymer material. This forms a tough, rigid surface that has been specifically selected to have a low coefficient of friction with the acetal-treaded ROVER WHEELS used by the ROBOTS.



The Alliance Station Wall is 6-1/2 feet high, 27 feet wide, and centered on the ends of the CRATER. The center portion of the wall is composed of a three-foot high base of diamond plate aluminum topped with a 3-1/2-foot high transparent acrylic panel. The bottom eight inches of this section is

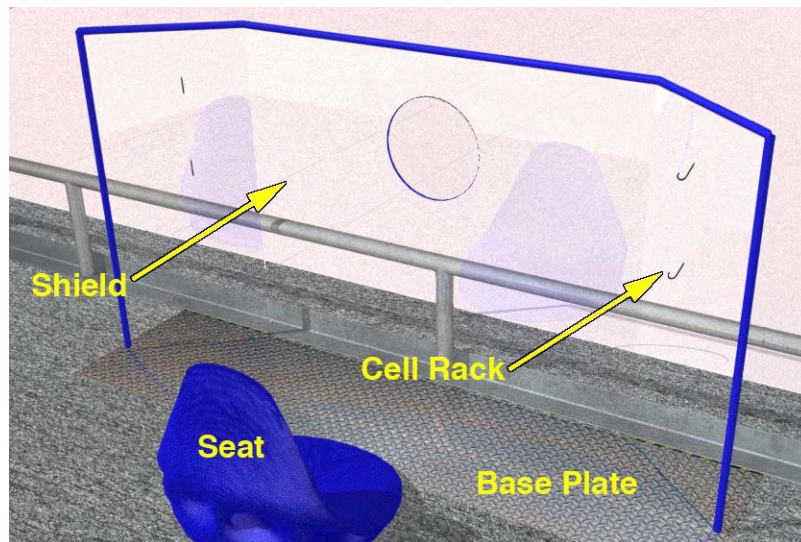
protected by a strip of bumpers, similar to the STANDARD BUMPERS on the ROBOTS. The bumpers are colored red or blue, to correspond to the BASE where they are located.

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 CRATER during a match. The Guardrail System defines the borders of the CRATER, except where it is bounded by the Alliance Station Wall.

Four gates in the Guardrail System allow easy access to the CRATER for placement and removal of ROBOTS. The gates are four feet wide and are located in each quadrant of the CRATER. The gates are closed and shielded during game play.

## 6.2.2 OUTPOSTS

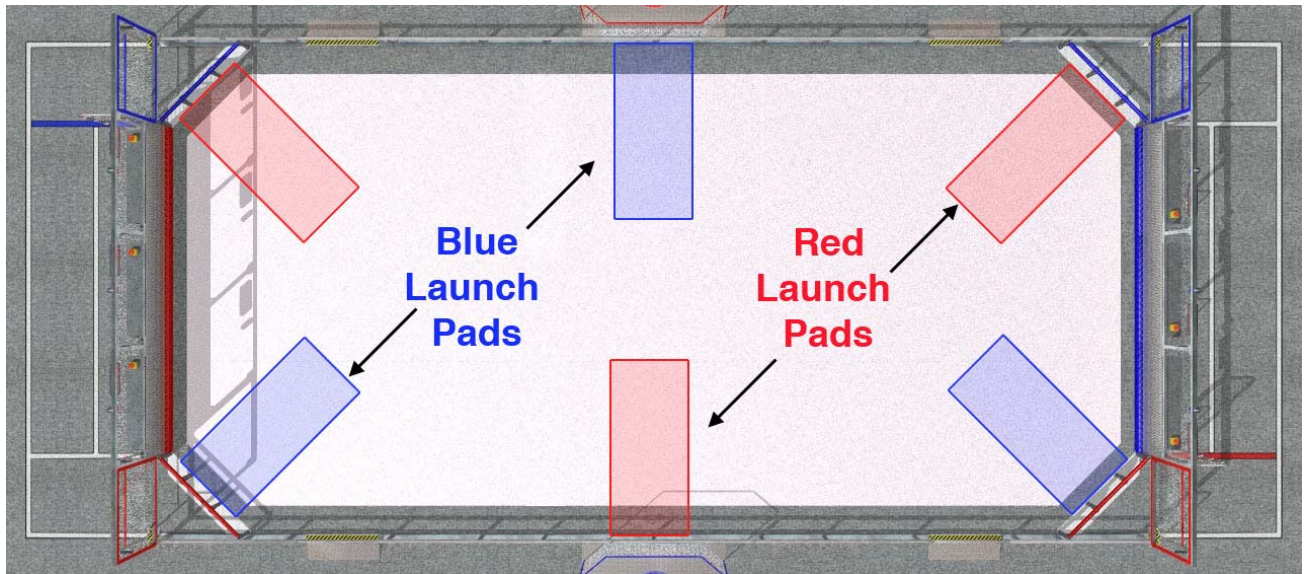
The OUTPOSTS are located on the centerline of the CRATER, immediately outside the guardrail. Each of the two OUTPOSTS is assigned to a corresponding ALLIANCE, red or blue. One PAYLOAD SPECIALIST for each ALLIANCE sits at the OUTPOST. The OUTPOST is constructed of a shield, a base plate, and a seat. The shield is made of 1/4-inch polycarbonate, and is 48 inches tall, and 96 inches wide. The shield is intended to protect the PAYLOAD SPECIALIST from accidental incursions into the OUTPOST by any ROBOT parts that may exit from the CRATER. A set of hooks, known as the CELL RACK, is attached to the inside of the shield. The CELL RACK is used to store EMPTY CELLS during the match. There is an opening in the shield through which the PAYLOAD SPECIALIST may pass GAME PIECES to ROBOTS. The seat includes a “seat belt” restraint that holds the PAYLOAD SPECIALIST in position behind the shield. The base plate is 3/4-inch thick plywood to which the shield and seat are attached.



## 6.2.3 LAUNCH PADS

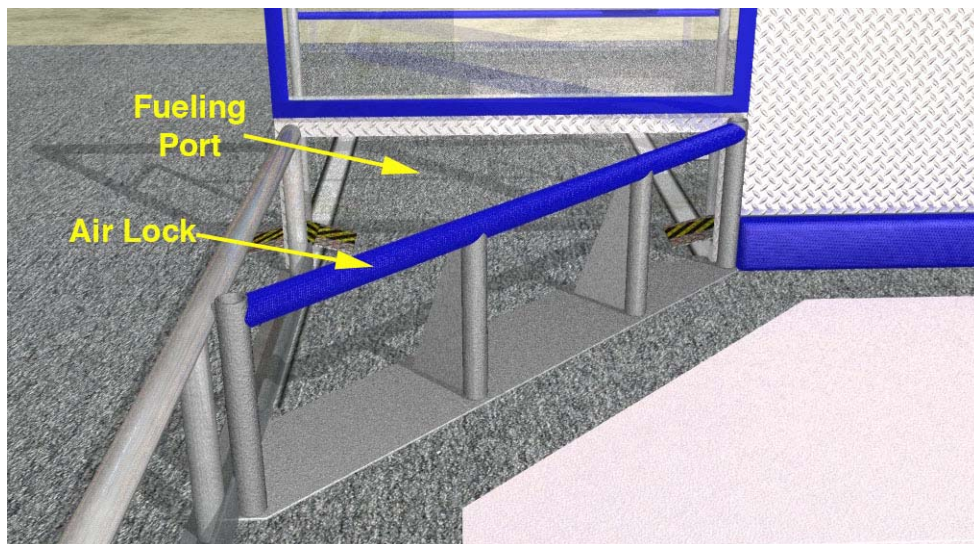
Three 48-inch by 96-inch LAUNCH PADS are marked on the CRATER floor for each ALLIANCE. The LAUNCH PADS indicate the areas in which the ROBOTS and TRAILERS must be positioned

before the start of the match. The LAUNCH PADS locations are shown in the drawing below (note that the LAUNCH PAD locations are emphasized in this drawing for the purposes of illustration - the actual location markings will be less intrusive and will not detract from the visual appearance of the CRATER). For precise dimensions and locations of the LAUNCH PADS, please refer to the official “FE-00030 - 2009 Arena Layout and Marking” drawing.



## 6.2.4 FUELING PORTS

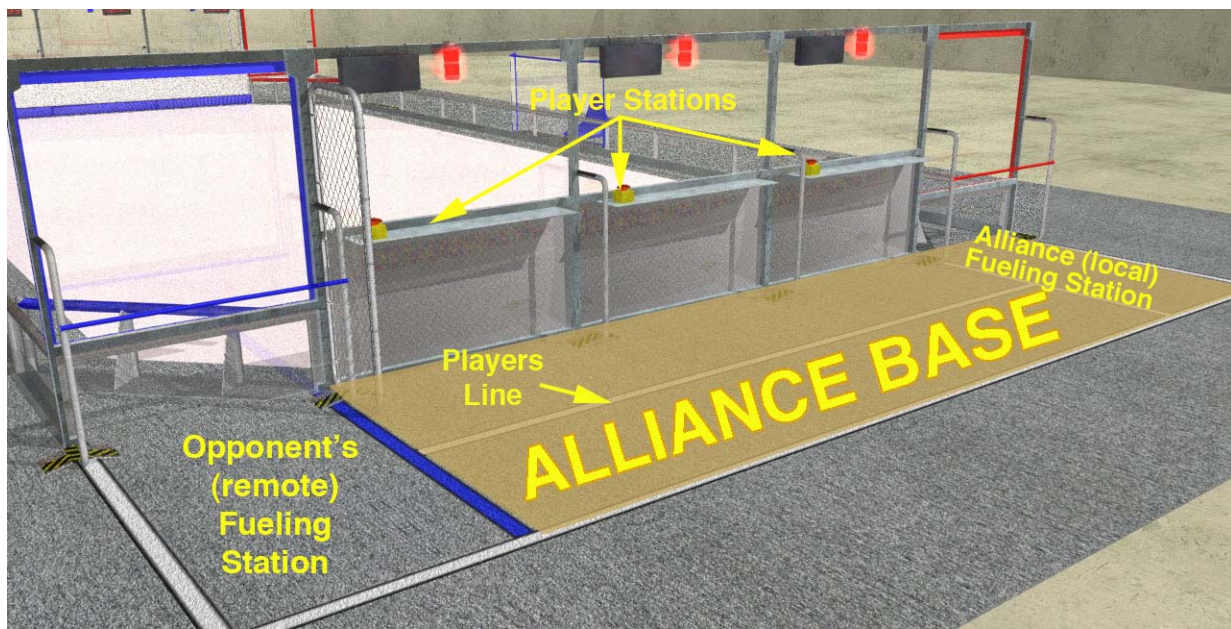
The corner between the Alliance Station Wall and the Guardrail System includes the AIR LOCK and the FUELING PORT. The FUELING PORT is a 48-inch wide by 19-inch tall opening in the Alliance Station Wall through which the GAME PICES can exit from the CRATER. Protecting this opening is the AIR LOCK, which is constructed of 1-1/2-inch diameter steel pipe, welded to a 1/4-inch base plate that is attached to the carpet. The AIR LOCK is oriented at a 35-degree angle between the Guardrail System and the Alliance Station Wall. The purpose of the AIR LOCK is to prevent ROBOTS, in whole or in part, from passing through the FUELING PORT and contacting any team members. It also helps prevent ROBOTS from getting trapped in the corners of the CRATER.



## 6.2.5 ALLIANCE BASES

The ALLIANCE BASES (BASES) are located at either end of the ARENA, behind the Alliance Station Walls. The PILOTS and COMMANDER from each team stand in the BASE during the match, from where they operate their ROBOTS. Each BASE includes the 18-foot by 8-foot area behind the three identical Player Stations, and the FUELING STATION for that ALLIANCE. All boundaries for the BASE and FUELING STATIONS are marked on the carpet with gaffers tape. The tape boundaries are considered “in” the bounded areas.

Each BASE shares the Alliance Station Wall with the CRATER, and extends eight feet back from the Alliance Station Wall. The BASE is the width of the Player Stations (18 feet), plus the local FUELING STATION. The PLAYERS LINE is four feet back from the Alliance Station Wall, and extends across the width of the Player Stations. The BASE includes the area behind the PLAYERS LINE.



## 6.2.6 BASE Player Stations

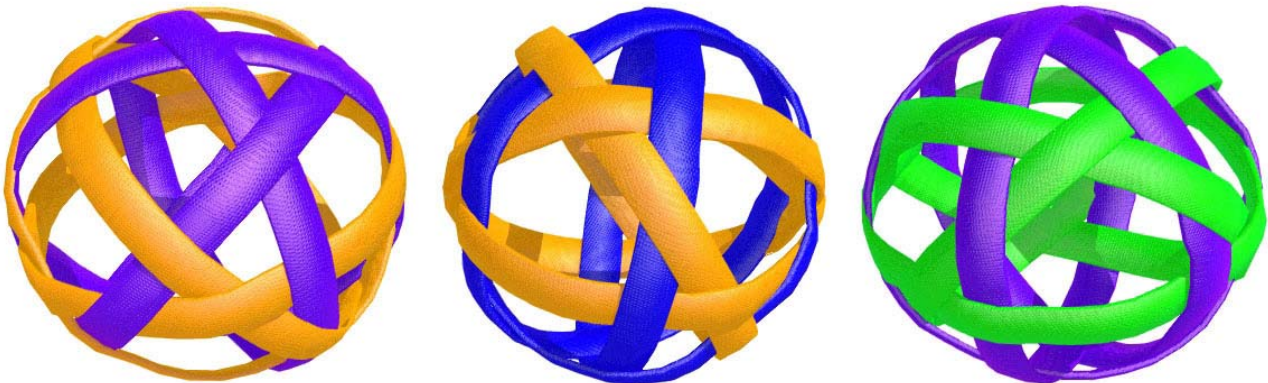
Attached to the Alliance Station Wall are three aluminum shelves to support the robot control systems of the three teams on the ALLIANCE. The support shelf measures approximately 60 inches wide by 12 inches deep. There is a 4-1/2-foot long by two-inch wide strip of Velcro tape (“loop” side) along the center of the support shelf that may be used to secure the controls for the ROBOT and the OPERATOR CONSOLE. Each setup location includes two competition cables (power and Ethernet) that attach to the Driver Station. These cables provide power for the team’s OPERATOR CONSOLE and control communications with the ROBOT. 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 Station and below the shelf.

## 6.2.7 FUELING STATIONS

To either side of the Player Stations are the FUELING STATIONS. The FUELING STATIONS extend from the Alliance Station Wall back eight feet to the rear BASE line, and from the outer boundary inwards 4-1/2 feet to the edge of the Player Stations. There is one FUELING STATION for each ALLIANCE at each end of the ARENA (i.e. one “local” FUELING STATION immediately adjacent to the ALLIANCE Players Station, and one “remote” FUELING STATION at the other end of the ARENA). When standing in the BASE and facing the CRATER, the FUELING STATIONS for the ALLIANCE are to the right, and the opponent’s FUELING STATIONS are to the left. Extended-reach tongs are attached to each FUELING STATION, to be used by the PAYLOAD SPECIALIST to safely retrieve GAME PIECES from the FUELING PORT. A container is provided at each FUELING STATION to provide temporary storage of retrieved MOON ROCKS. A set of hooks, known as the CELL RACK, is attached to the inside of the Alliance Station Wall. The CELL RACK is used to store EMPTY CELLS and SUPER CELLS during the MATCH.

## 6.3 GAME PIECES

While playing *Lunacy*, ROBOTS manipulate GAME PIECES to accomplish the objectives of the game. The ROBOTS collect “MOON ROCKS” and transport “Fuel Cells.” There are two types of Fuel Cells – “EMPTY CELLS,” and “SUPER CELLS.” Each GAME PIECE is a 9-inch diameter round object, made of braided 1-inch wide strips of fabric-covered polymer. These objects are commercially available as “Orbit Balls.”



<u>Object</u>	<u>Color</u>	<u>Objects In The Arena</u>
MOON ROCKS	Orange and purple	120
EMPTY CELLS	Orange and blue	up to 8 (4 per ALLIANCE)
SUPER CELLS	Green and purple	up to 8 (4 per ALLIANCE)

## 6.4 PAYLOAD TRAILER

During each match, a two-wheeled PAYLOAD TRAILER (TRAILER) is attached to each ROBOT. The TRAILER is provided to each team as a piece of field equipment for the duration of the match.



The TRAILER is composed of a hexagonal base with an inscribed (face-to-face) diameter of 28 inches surrounded by BUMPERS (refer to Chapter 8 for a description of BUMPERS). Projecting vertically from the base are twelve 1-5/16 inch OD plastic conduit pipes. The pipes are arranged in a 25-inch diameter circle. The heights of the pipes vary linearly, from 34 inches off the floor in the back, to 42 inches off the floor in the front of the TRAILER. This arrangement allows the pipes to act as a flexible “backstop” for GAME PIECES that are thrown into the TRAILER.



A 4.2 inch diameter post projects vertically from the center of the hexagonal base. The top of this post is covered by an 8-inch diameter, 24-inch tall, two-color vision target. The vision target is located between 59 and 83 inches above the floor. It is covered with bright pink and green fabric that has been selected as a material that can be easily seen by the digital camera provided in the 2009 Kit Of Parts. The vision target can be inverted to indicate the color of the ALLIANCE to which it is assigned. When the vision target is placed on a TRAILER that belongs to the red ALLIANCE, it will be oriented so the pink half is above the green half. When placed on a TRAILER from the blue ALLIANCE, it will be inverted so the green half is above the pink half.

The TRAILER is supported by two 6-inch diameter acetal-treaded ROVER WHEELS (described in Chapter 8). These wheels are identical to those required for use on the ROBOTS. Thus, the trailer will have a similar coefficient of friction with the floor, and similar surface interaction characteristics, as the ROBOTS.

The TRAILER is attached to the ROBOT via a pin-and-clevis attachment mechanism. This mechanism has been designed so that the centerline of the tongue of the trailer is 2-13/16 inches above the floor. The tongue fits into a standard “Trailer Hitch” clevis (manufactured from materials provided in the 2009 Kit Of Parts) that is permanently mounted on each ROBOT (for more information regarding the mounting of this part, please refer to Rule <R18> in Chapter 8). A standard 1/4-inch hitch pin locks the tongue of the TRAILER in the clevis during the match.

The base and the bumpers of the TRAILER are colored either blue or red, to correspond to the ALLIANCE to which it has been assigned. The color of the TRAILER is used as the primary means of identifying to which ALLIANCE a ROBOT belongs.