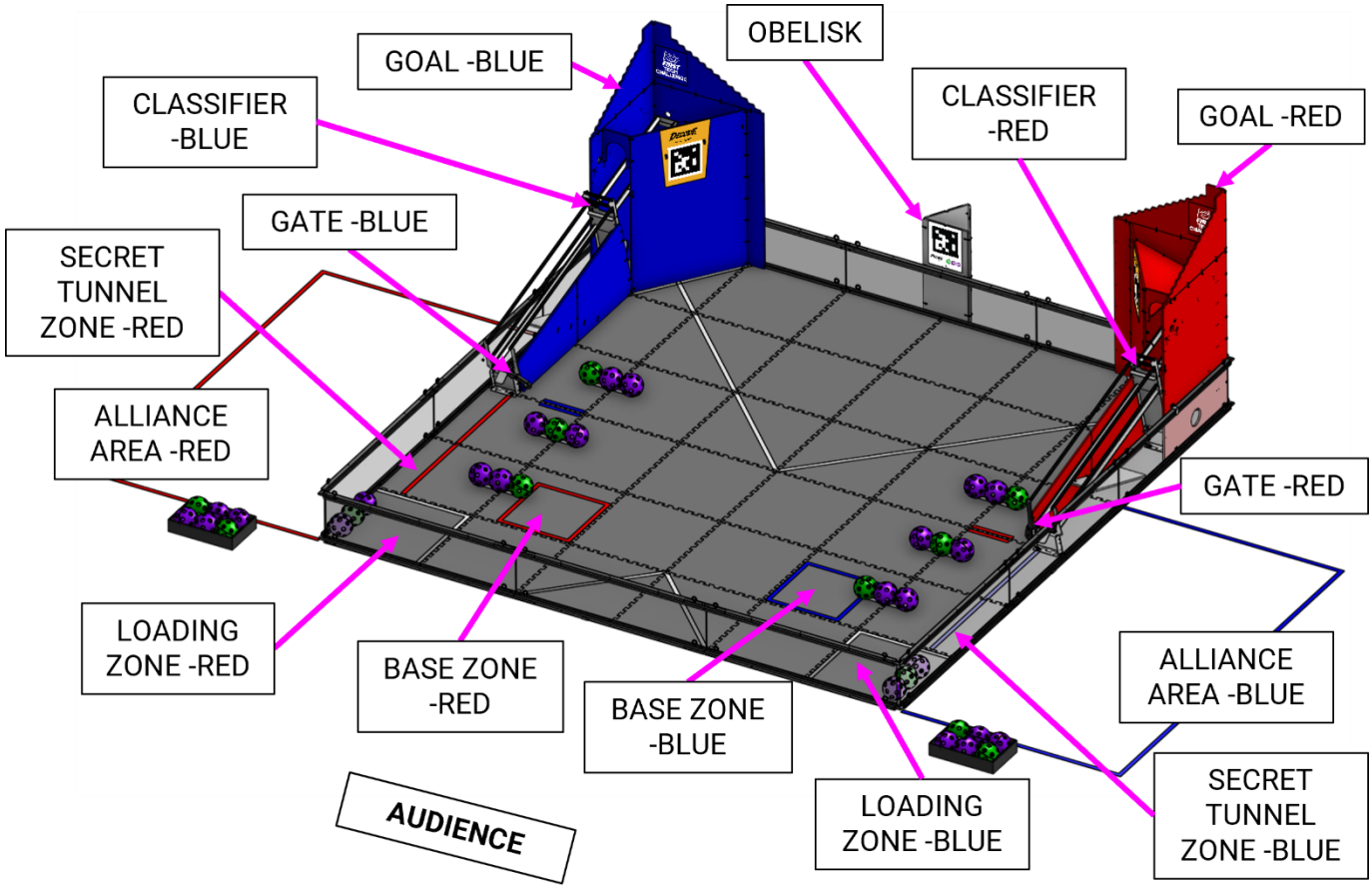
9 ARENA

The ARENA includes all elements of the game infrastructure that are required to play DECODE: the FIELD, SCORING ELEMENTS, queue area, team media area, and all equipment needed for event management.

Figure 9-1 DECODE (queue area, FIELD display, and optional media area not pictured)



9.1 Dimensions and Accuracy

The specifications for the DECODE FIELD can be retrieved from a few locations:

- The 3D CAD model is the official representation of the DECODE FIELD and how it is constructed. Measurements may be taken from this model with a general tolerance of +/- 1 in. (+/- 2.5 cm).
- Illustrations included in the Competition Manual are for a general visual understanding of the DECODE ARENA, and any dimensions included are nominal. Unless specifically noted, all these dimensions carry a tolerance of +/- 1 in. (+/- 2.5 cm).
- The Event FIELD Setup Guide includes instructions on how to build the FIELD, and along with showing the ways construction type will influence the field tolerances, it also includes many of the key dimensions which are listed in the Official FIELD Drawings.
- The FIELD Acceptance Checklist includes the controlled dimensions (with relevant tolerances) which will be regularly inspected by event staff.
- The FIELD Mitigation Guide provides FIELD STAFF recommended mitigation measures for issues with the field during an event.

The complete list of DECODE FIELD resources are posted on the Playing FIELD Resources page on the *FIRST* website.

> The ARENA is modular and is assembled, used, disassembled, and transported many times during the competition season. It undergoes wear and tear. The ARENA is designed to withstand rigorous play and frequent reassembly. Every effort is made to ensure that ARENAS are consistent from event to event.
>
> However, ARENAS are assembled in different venues by different event staff and volunteers, and some small variations occur. In addition, every region faces unique challenges which may impact the exact implementation of the ARENA, and as such the ARENA specifications are designed to accurately reflect the variations which may be present in official play, while still ensuring consistency of critical items. Contact your local support to request more information.
>
> Successful teams will design ROBOTS that are insensitive to these variations.

9.2 FIELD

Each FIELD for DECODE is an approximately 144 in. by 144 in. (365.75 cm by 365.75 cm) area bounded by the inside surface of the walls of the FIELD perimeter. The flooring surface of the FIELD is made of 36 interlocking soft foam TILES which are each approximately 24 in. by 24 in. by 0.59 in. (60.95 cm by 60.95 cm by 1.50 cm) nominally sized.

The FIELD is populated with and surrounded by the following FIELD elements:

- 1 CLASSIFIER per ALLIANCE which consists of a SQUARE, a RAMP, and a GATE
- 1 GOAL per ALLIANCE
- 1 OBELISK

Official events use the full DECODE FIELD manufactured and sold by AndyMark (am-5400_Full) or officially licensed equivalent.

The surface of the FIELD is *FIRST* Tech Challenge Field Soft Tiles (am-2499) or equivalent.

The primary version of the FIELD perimeter is the *FIRST* Tech Challenge Perimeter Kit (am-0481) sold by AndyMark. All illustrations in this manual show the am-0481 version of the FIELD design. Other versions of the FIELD perimeter of similar functionality may also be used in competitions.

Some events including the *FIRST* Championship (see section 15.2 Game Modification) will place the FIELDS on platforms or risers such that the FIELD is raised while the ALLIANCE AREAS remain at ground level.

The FIELD variant used at an event will be determined by the local Program Delivery Partner and all competition FIELDS at the same event must comply with Section 9.1 Dimensions and Accuracy and be consistent with each other per T204.

9.3 Areas, Zones, & Markings

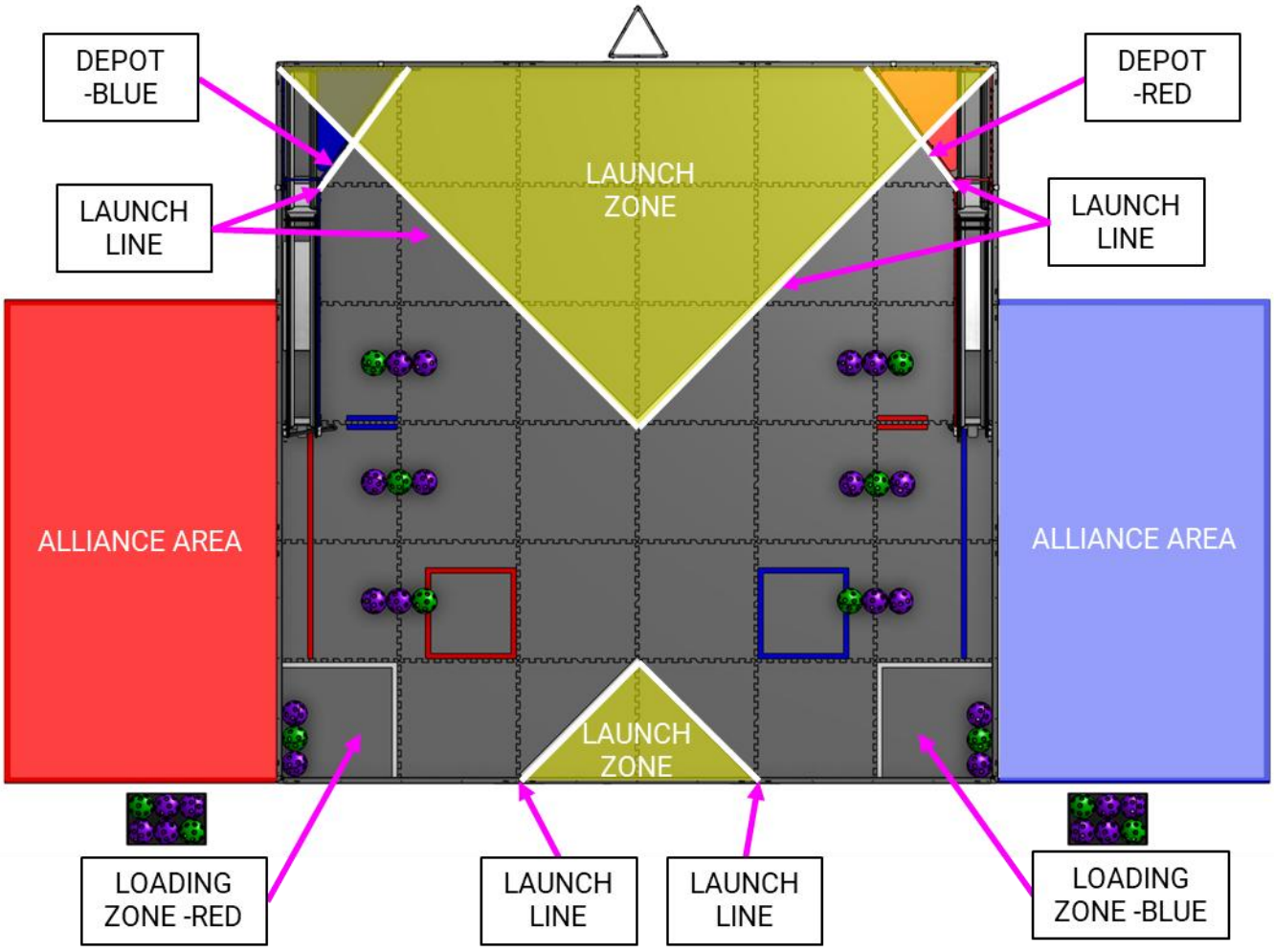
FIELD areas, zones, and markings of consequence are described below. The term “zone” is used to identify spaces within the FIELD, while the term “area” is used to describe spaces outside of the FIELD. Unless otherwise specified, the tape used to mark lines and zones throughout the FIELD is 1 in. (2.50 cm) wide 3M™ Premium Matte Cloth (Gaffers) Tape (GT1), ProGaff® Premium Professional Grade Gaffer Tape, or comparable gaffers tape in red, electric blue, and white. Areas outside the FIELD may be marked with other types or widths of tape, depending on the event.

The tape used to mark lines and zones throughout the FIELD is shown as continuous strips in all official specifications. However, events do not need to install the tape as a continuous strip:

- After applying the tape, event staff may cut the tape at the tile seams so the TILES may be removed without replacing the tape.
- Events may also apply the tape in multiple segments with gaps at the tile junctions.

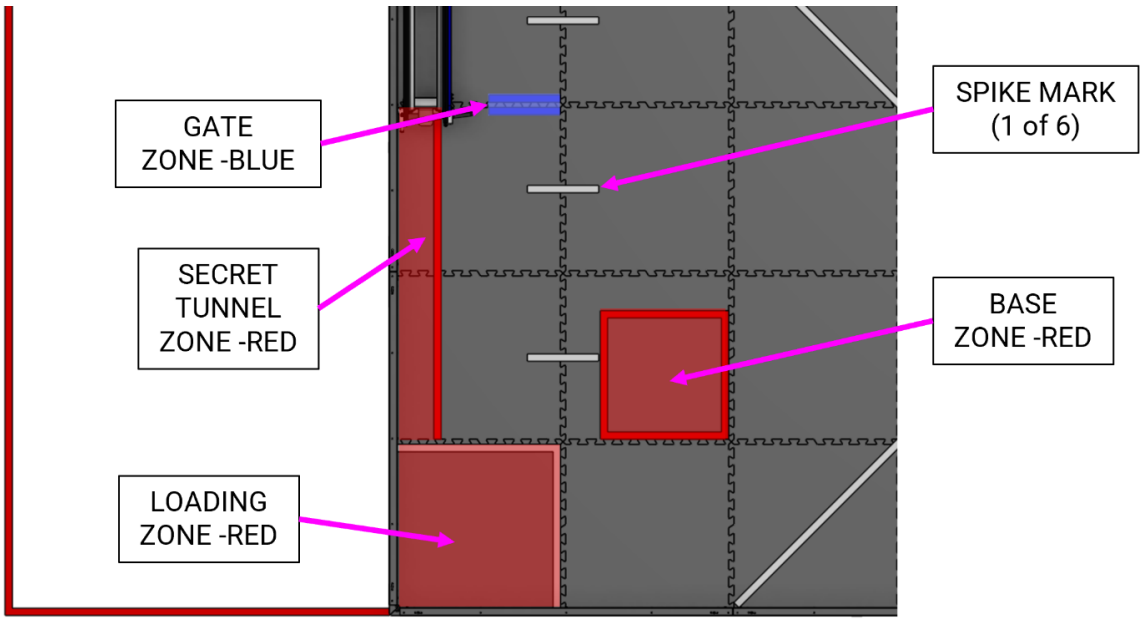
REFEREES are instructed to treat these line segments as a continuous line segment, ignoring gaps, when applying game rules.

Figure 9-2 ALLIANCE AREA, LAUNCH LINES, and LAUNCH ZONE



- ALLIANCE AREA: a 96 in. (243.85 cm) wide by 54 in. (137.15 cm) deep by infinitely tall volume formed by placing ALLIANCE colored tape onto the flooring surface outside of the FIELD. The ALLIANCE AREA includes the taped lines (Figure 9-2).
- DEPOT: the white tape approximately 30 in. (76.20 cm) long which spans the entire length of the GOAL front face and is located at the base of the GOAL. The DEPOT tape is a LAUNCH LINE (Figure 9-2).
- LAUNCH LINE: the white tape which bounds 2 triangular LAUNCH ZONES, as well as 2 segments of white tape located at the base of the GOAL.(Figure 9-2).
- LAUNCH ZONE: infinitely tall triangular volumes bounded by LAUNCH LINES and the FIELD perimeter. There are 2 LAUNCH ZONES: the LAUNCH ZONE on the audience side of the FIELD spans a section 2 TILES wide and 1 TILE deep and the LAUNCH ZONE on the GOAL side of the FIELD spans a section 6 TILES wide by 3 TILES deep. The LAUNCH ZONES include the tape that defines the LAUNCH LINES (Figure 9-2).

Figure 9-3: SECRET TUNNEL, GATE ZONE, LOADING ZONE, and SPIKE MARKS (shown with ARTIFACTS removed)



- BASE ZONE: an 18 in. +/- 0.125 in. (45.70 cm +/- 0.30 cm) wide by 18 in. +/- 0.125 in. (45.70 cm +/- 0.30 cm) deep infinitely tall volume bounded by ALLIANCE colored tape. The BASE ZONE is an ALLIANCE specific zone belonging to the matching color ALLIANCE. The BASE ZONE includes the tape lines (Figure 9-3).
- GATE ZONE: a 2.75 in. (7.00 cm) wide by 10 in. (25.40 cm) long infinitely tall volume bounded by 2 parallel 10 in. (25.40 cm) long ALLIANCE colored tape segments adjacent to each GATE. The GATE ZONE includes the tape lines (Figure 9-3).
- LOADING ZONE: an approximately 23 in. (58.40 cm) wide by 23 in. (58.40 cm) deep infinitely tall volume bounded by white tape and the adjoining FIELD perimeters. The LOADING ZONE includes the tape lines (Figure 9-3). The LOADING ZONE is an ALLIANCE specific zone belonging to the ALLIANCE with the adjacent ALLIANCE AREA.
- SECRET TUNNEL ZONE: an approximately 46.5 in. (118.10 cm) long by approximately 6.125 in. (15.55 cm) wide infinitely tall volume bounded by ALLIANCE colored tape, the GOAL assembly, the

LOADING ZONE, and the adjoining FIELD perimeter. The SECRET TUNNEL ZONE includes the ALLIANCE colored tape lines and excludes the white tape (Figure 9-3). The SECRET TUNNEL ZONE is an ALLIANCE specific zone belonging to the matching color ALLIANCE.

- SPIKE MARK: 1 of 6 white tape marks 10 in. (25.40 cm) long used to identify the placement of 3 ARTIFACTS before the MATCH (Figure 9-3).

9.4 TILE Coordinates

TILE coordinates are used to assist with FIELD setup. Figure 9-4 defines the intersections of each of the TILES on the FIELD where the TILE tabs interlock. Figure 9-5 defines the grid coordinate system for each of the TILES.

Figure 9-4: TILE tab-line locations

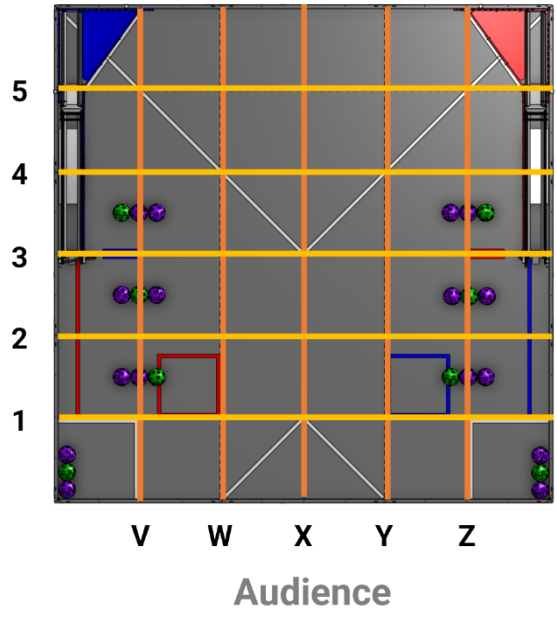
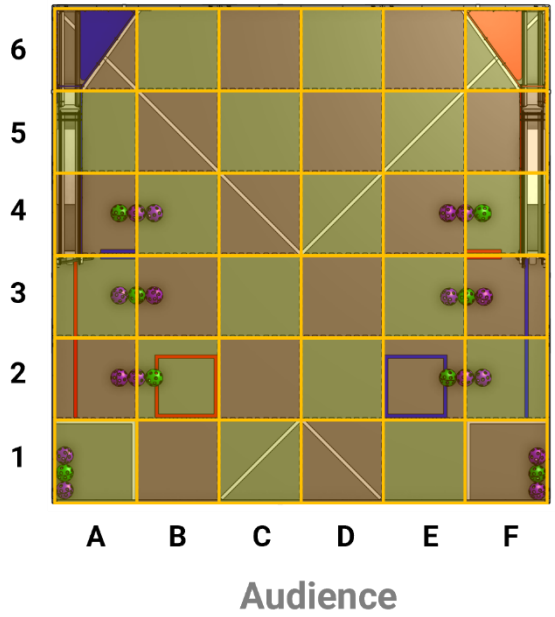


Figure 9-5: TILE locations

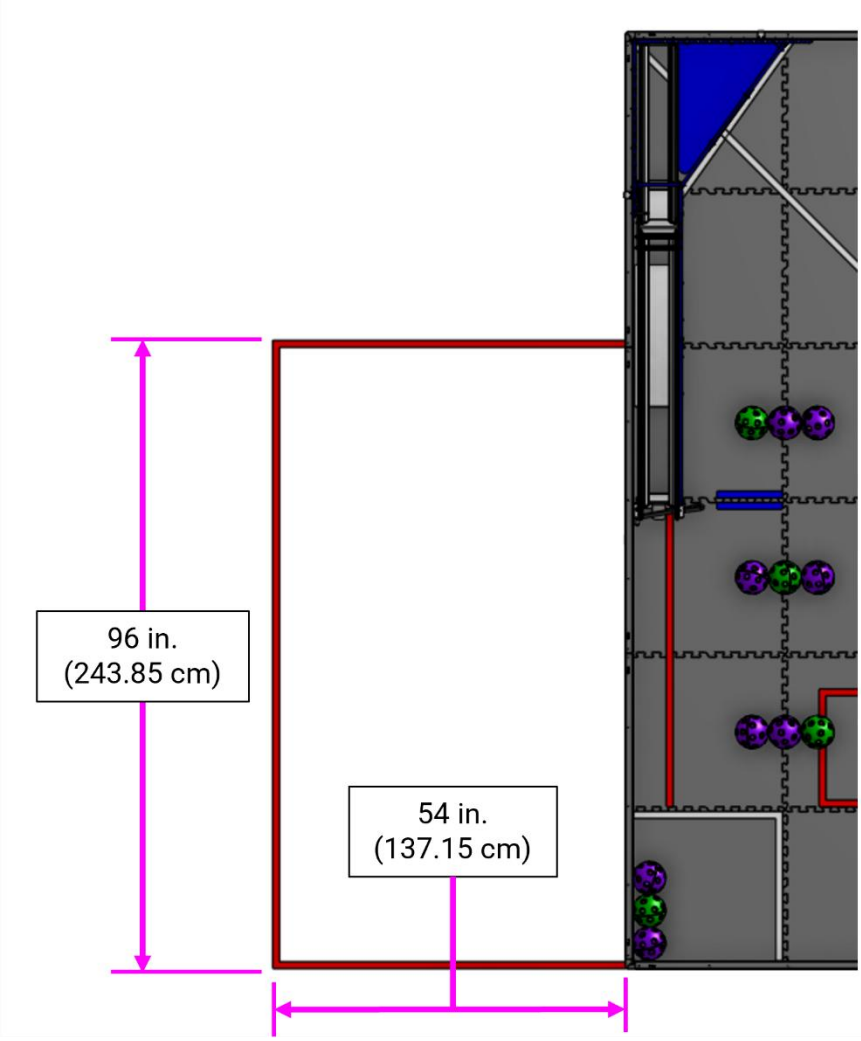


9.5 ALLIANCE AREA

An ALLIANCE AREA is the designated red or blue ALLIANCE AREA adjacent to the FIELD where the DRIVE TEAMS stage themselves during a MATCH. The FIELD is oriented such that the red ALLIANCE AREA is located on the left from the primary audience viewing direction.

Short tables, stands, or stools may be provided by the event which will sit near the FIELD perimeter inside the ALLIANCE AREA. These tables are provided for teams to place their OPERATOR CONSOLES. If provided by the event, these tables may not be removed or rearranged by the teams without permission from the Head REFEREE, FIELD Supervisor, or FTA.

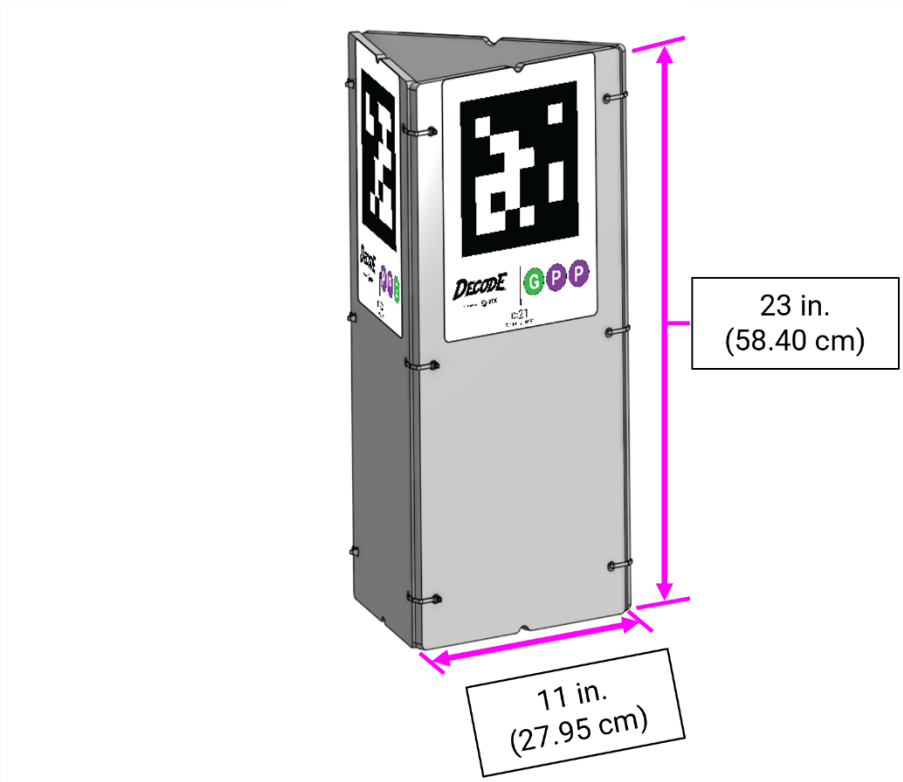
Figure 9-6: ALLIANCE AREA



9.6 OBELISK

The OBELISK is an equilateral triangular prism (we know, real obelisks have 4 sides) which is positioned with 1 of the rectangular faces centered on the GOAL-side of the FIELD, just outside of the FIELD perimeter. The OBELISK is 23 in. (58.40 cm) tall and each rectangular face is 11 in. (27.95 cm) wide (Figure 9-7).

Figure 9-7: OBELISK dimensions



Each of the 3 rectangular faces of the OBELISK has an AprilTag (see section 9.10 AprilTags) which corresponds to a different MOTIF. A MOTIF is a series of ARTIFACT colors, comprised of 2 purple (P) and 1 green (G), in a unique order. There are 3 MOTIFS in DECODE (GPP, PGP, PPG).

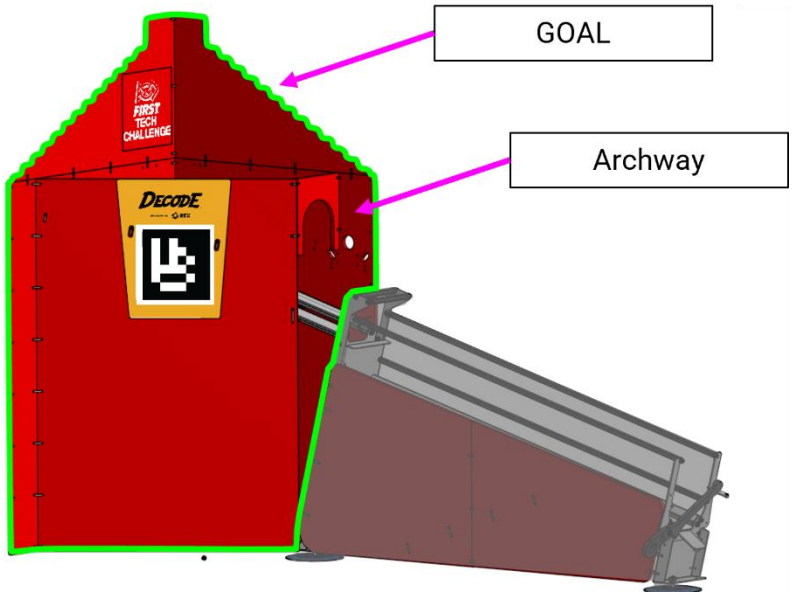
The OBELISK orientation is randomized by the FIELD STAFF using the event management software after DRIVE TEAMS have set-up for the MATCH (G304). The event management software will determine which face of the OBELISK should face towards the FIELD and the FIELD STAFF will put it in place. The location of the OBELISK will be approximately centered along the outside edge of the FIELD perimeter with the face containing the AprilTag approximately parallel to and contacting the FIELD perimeter wall.

The location of the OBELISK is not intended to be deterministic relative to the field coordinate system and should not be used for navigation.

9.7 GOAL

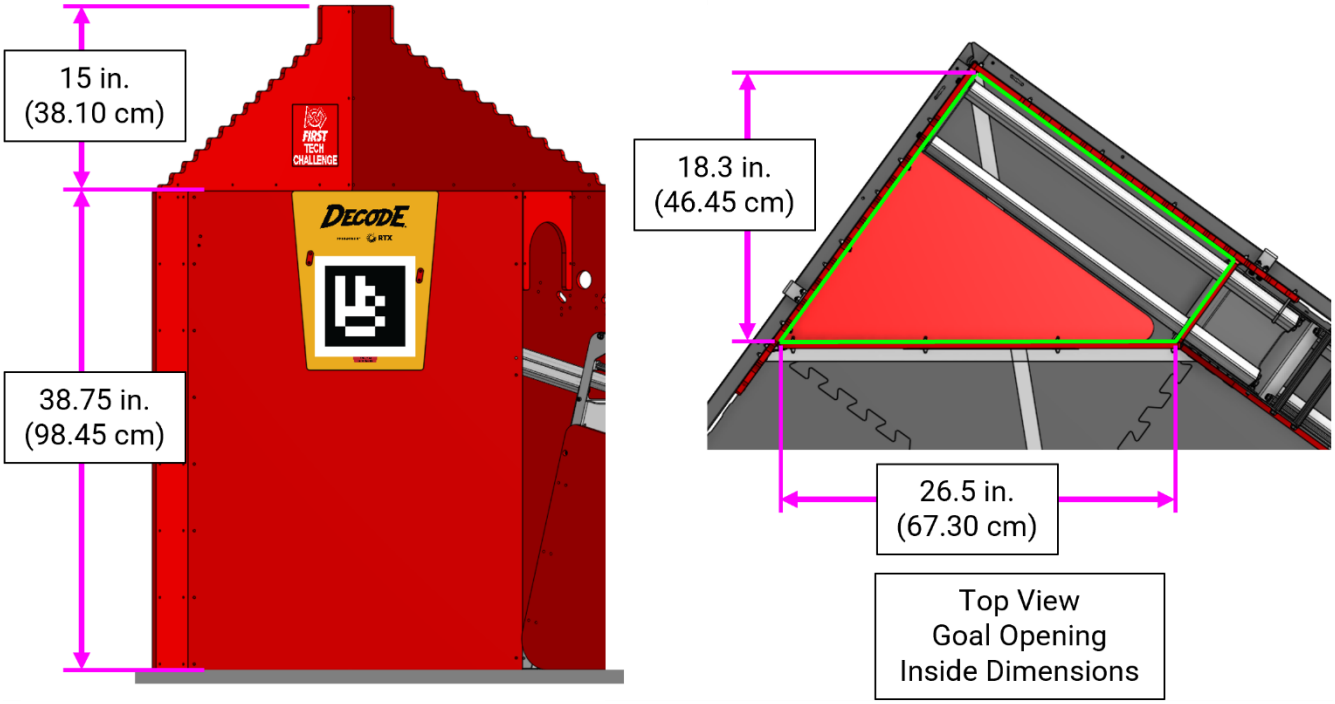
The GOAL is an approximately 27 in. (68.60 cm) by 27 in. (68.60 cm) by 54 in. (137.15 cm) tall structure primarily composed of 0.39 in. (1.00 cm) thick polypropylene corrugated plastic sheet. The GOAL is a 3-sided structure with a horizontal triangular shaped opening at the top. On the side where the CLASSIFIER connects to the GOAL there is an exit archway (Figure 9-8).

Figure 9-8: GOAL with Archway exit



The opening of the GOAL is approximately 26.5 in. (67.30 cm) wide and 18.3 in. (46.45 cm) deep. The top lip of the GOAL is 38.75 in. (98.45 cm) from the surface of the TILE. The maximum height of the backboard with the *FIRST* Tech Challenge logo is 15 in. (38.10 cm) from the open top of the GOAL (Figure 9-9).

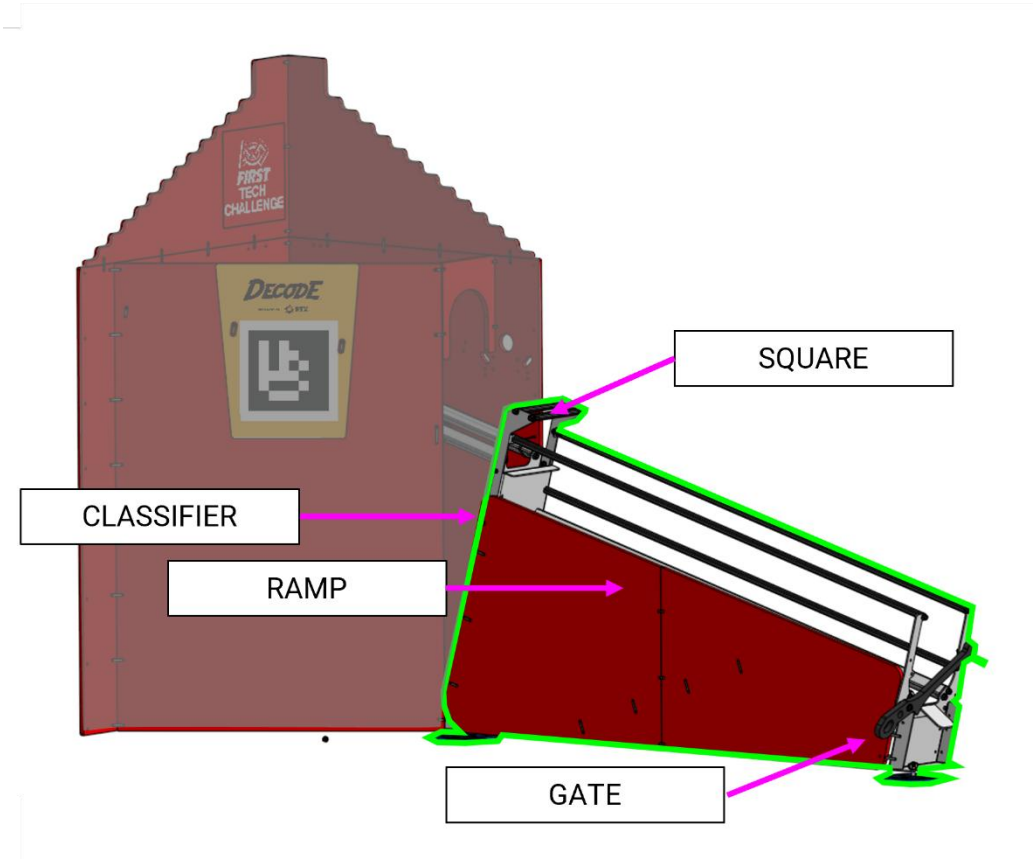
Figure 9-9: GOAL Dimensions



9.8 CLASSIFIER

The CLASSIFIER is a structure attached to the GOAL which has 3 main components: the SQUARE, RAMP, and GATE (Figure 9-10).

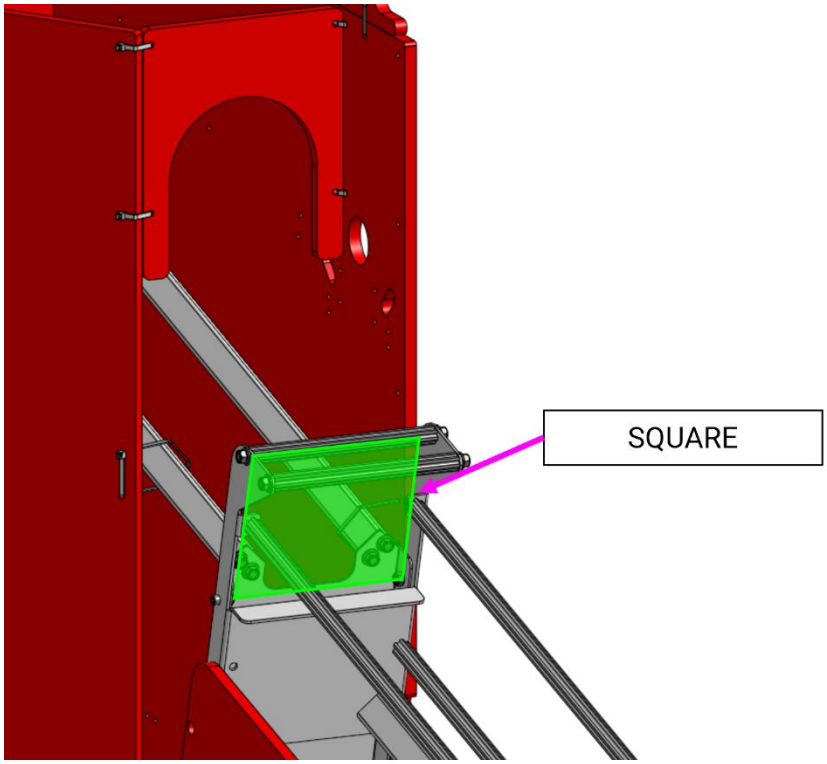
Figure 9-10: CLASSIFIER with no SCORING ELEMENTS



9.8.1 SQUARE

The SQUARE (Figure 9-11) is a location at the top of the RAMP at which ARTIFACT scoring is assessed as per 10.5 Scoring.

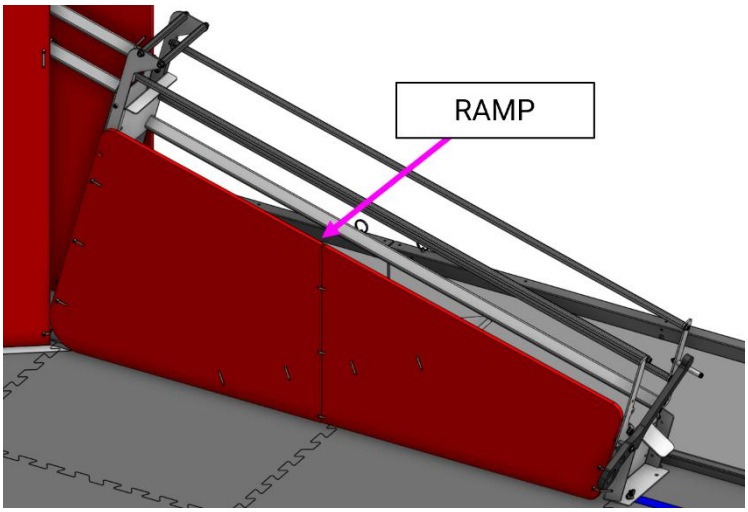
Figure 9-11: SQUARE on the RAMP



9.8.2 RAMP

The RAMP is a structure made of primarily aluminum extrusion. The RAMP can fit up to 9 CLASSIFIED ARTIFACTS before newly entered ARTIFACTS will OVERFLOW.

Figure 9-12: RAMP with no SCORING ELEMENTS



In most cases exactly 9 ARTIFACTS will fit on the RAMP as CLASSIFIED before newly entered ARTIFACTS will OVERFLOW, but sometimes ARTIFACTS LAUNCHED into the GOAL at a high velocity or with significant spin may skip over the 9th open CLASSIFIER slot and count as OVERFLOW. This is a normal FIELD operation and not an ARENA FAULT.

Figure 9-13: RAMP partially full of SCORING ELEMENTS

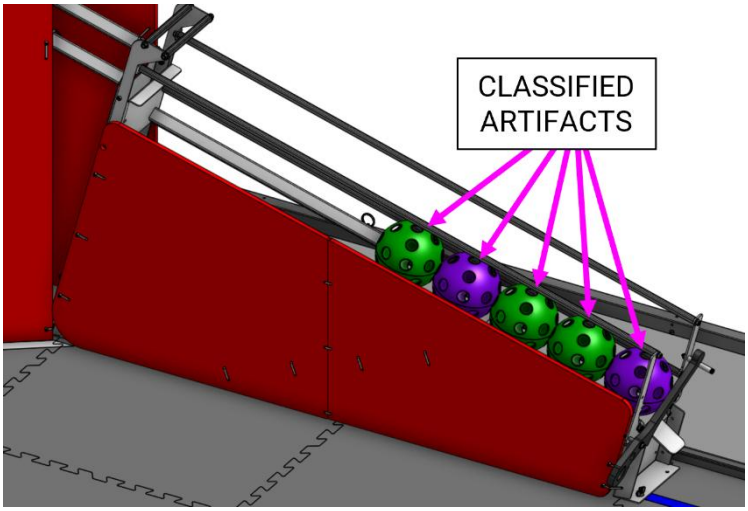
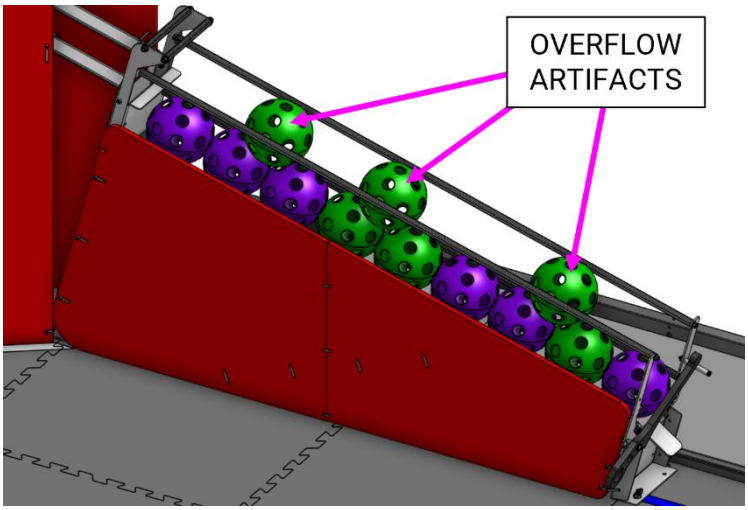


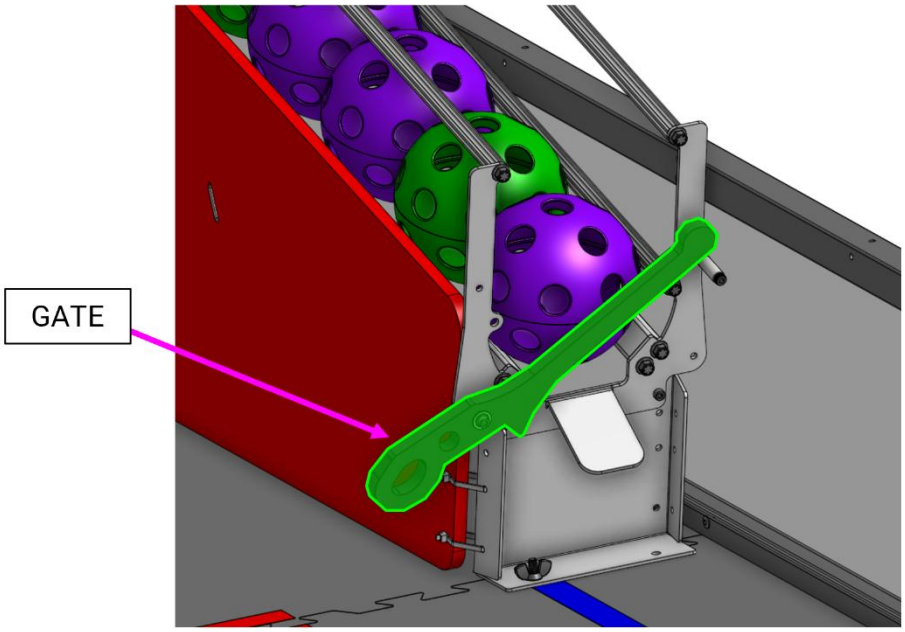
Figure 9-14: RAMP full of SCORING ELEMENTS with OVERFLOW



9.8.3 GATE

The GATE is an ALLIANCE specific FIELD element that prevents CLASSIFIED ARTIFACTS from exiting the RAMP into the opposing ALLIANCE'S SECRET TUNNEL ZONE (Figure 9-15). OVERFLOW ARTIFACTS can pass over the top of the GATE to exit the RAMP into the opposing ALLIANCE'S SECRET TUNNEL ZONE. The GATE is closed by gravity and after opening it may or may not stay open to clear all CLASSIFIED ARTIFACTS.

Figure 9-15: GATE



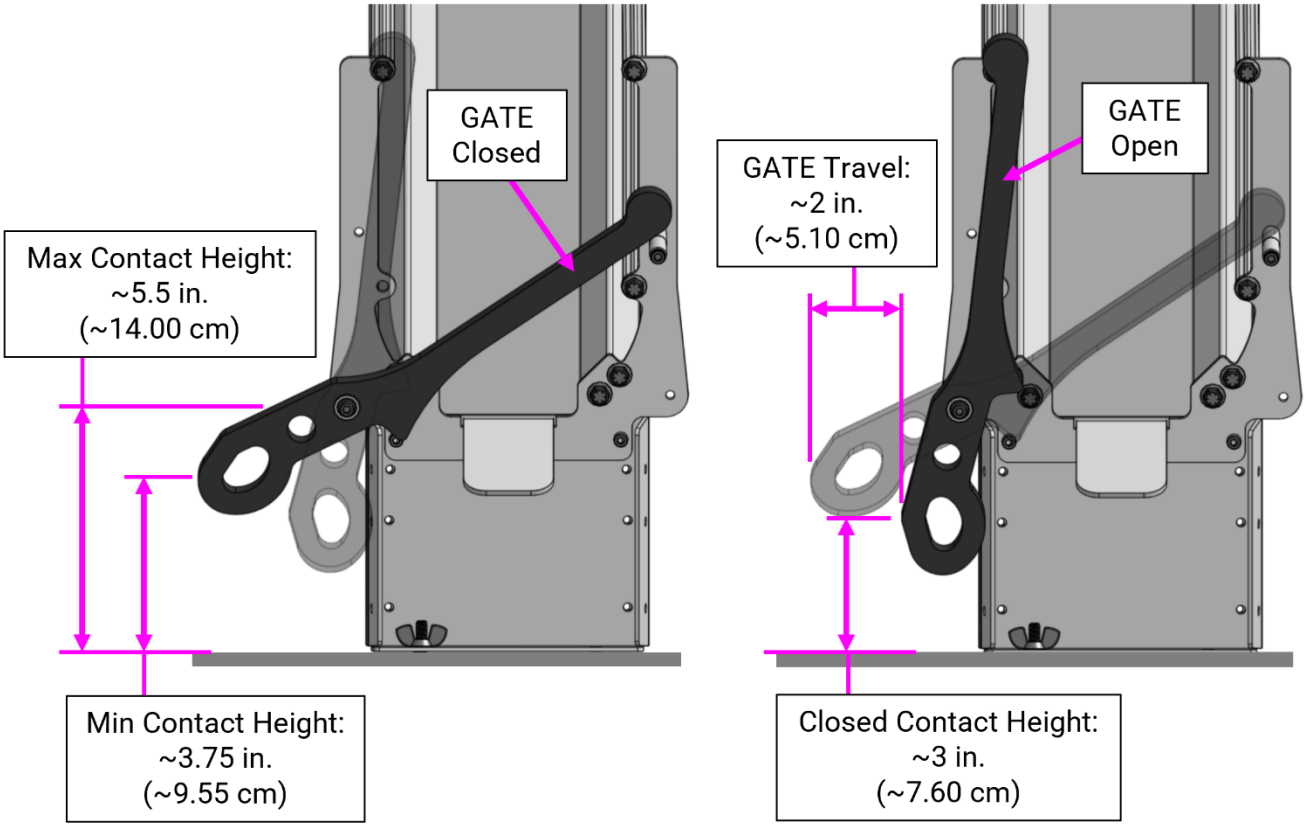
The GATE is a ROBOT-activated, push to open mechanism which will release ARTIFACTS which are CLASSIFIED on the RAMP (Figure 9-16).

> The GATE will take variable amounts of time to close. The GATE closing before all CLASSIFIED ARTIFACTS exit the RAMP is not considered an ARENA FAULT, and teams should be prepared to hold the GATE open to fully clear the RAMP. The GATE not closing immediately when released by the ROBOT (but closing eventually) is not considered an ARENA FAULT. During a MATCH, FIELD STAFF may follow steps in the Field Mitigation Guide to mitigate some FIELD issues during a MATCH. Refer to the Field Mitigation Guide for more guidance on how FIELD STAFF will respond to inconsistent FIELD behavior.

When closed, the height of the contact area of the GATE above the surface of the TILE ranges from approximately 3.75 in. (9.55 cm) to 5.5 in. (14.00 cm) and when open the contact point is approximately 3 in. (7.60 cm) above the TILES (Figure 9-16). The total horizontal displacement required to move the GATE from closed to open is approximately 2 in. (5.10 cm).

> TEAMS are encouraged to design their ROBOTS with a large vertical surface which ensures consistent contact with the GATE arm. It is particularly important that this panel extends up to the high end of the interface range approximately 5.5 in. (14.00 cm) above the TILE surface. This ensures the ROBOT cannot end up "under" the GATE arm and will help prevent ROBOTS from inadvertently damaging the FIELD.

Figure 9-16: GATE Actuation: Open & Closed



9.9 SCORING ELEMENTS

SCORING ELEMENTS are ALLIANCE neutral ARTIFACTS. ARTIFACTS are 5 in. (12.70 cm) nominal Gopher ResisDent™ polypropylene balls in purple (am-3376a_purple) and green (am-3376a_green). There are 24 purple (P) ARTIFACTS and 12 green (G) ARTIFACTS total in a DECODE MATCH.

ARTIFACTS are not perfectly spherical and may vary in size. Teams should plan for this variation when designing their ROBOTS. Based on the specifications provided by the manufacturer, ARTFACTS are specified to be 4.9 in +/- 0.25 in. (12.45 cm +/- 0.65 cm) in diameter at the mold seam.

Figure 9-17: SCORING ELEMENTS (ARTIFACTS)

9.10 AprilTags

AprilTags for DECODE are 8.125 in. (~20.65 cm) square targets from the 36h11 tag family (Figure 9-18).

AprilTags are placed on the front face of the GOAL to help aid in ROBOT navigation and targeting. The red ALLIANCE GOAL has ID 24, and the blue ALLIANCE GOAL has tag ID 20. Each marker has an identifying “TAG ID” text label (Figure 9-19).

AprilTags with the ID 21, 22, 23 are located on each rectangular face of the OBELISK, which is placed outside of the FIELD and can be used to identify the MOTIF for the MATCH.

The OBELISK AprilTag is not recommended for ROBOT navigational use as the exact placement location may vary from MATCH to MATCH.

Figure 9-18: AprilTag Locations on the DECODE FIELD

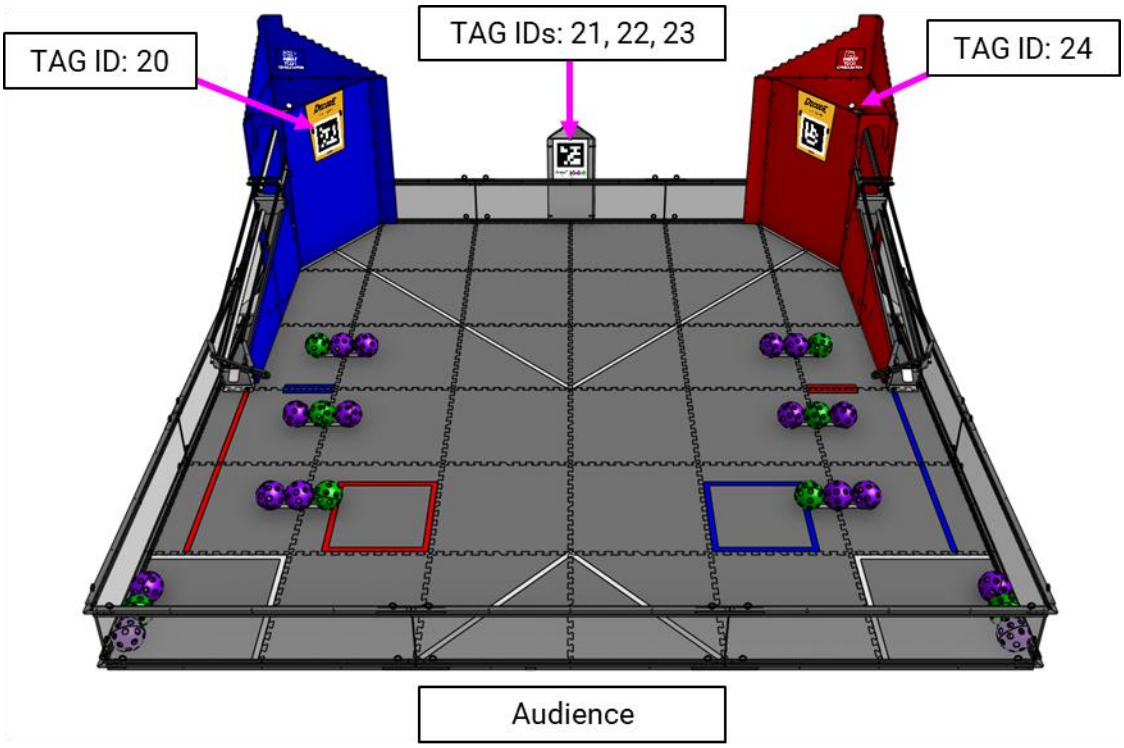
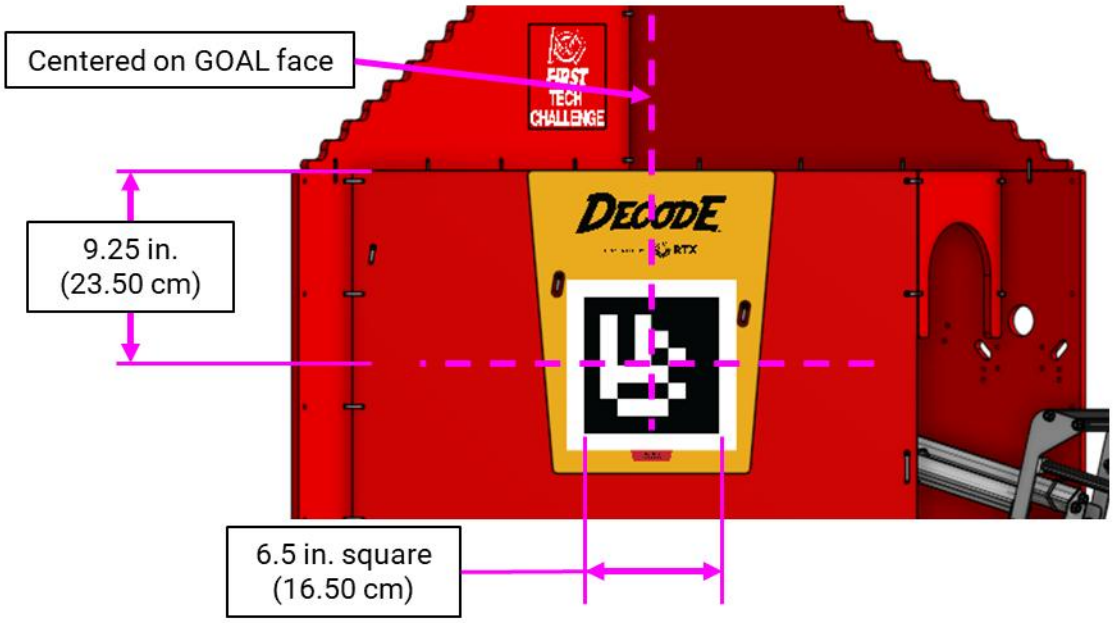


Figure 9-19: AprilTag location on the GOAL



Do not print the images from this manual for practice purposes, they are examples only and are not the same size as those used in the ARENA. Please refer to the Playing Field Resources page for printable versions of these images, including instructions on how to place the images correctly around the FIELD.

9.11 FIELD STAFF

FIELD STAFF are volunteers present in and around the ARENA that are responsible for making sure the MATCHES are cycled through efficiently, fairly, safely, and with a spirit of cooperation, *Gracious Professionalism*®, and generosity of spirit. FIELD STAFF roles are filled by volunteers from the community who prepare for the event with thorough training and certification. There are 3 FIELD-side key volunteer roles with whom teams should be familiar with and are encouraged to use as resources to make their event experience valuable.

- Head REFEREE – trains, directs, and supervises REFEREES. They oversee all scoring processes and procedures in collaboration with other FIELD STAFF. They interact with STUDENTS, volunteers, and event staff. The Head REFEREE has final authority for decisions regarding MATCH scores, FOULS, and YELLOW and RED CARD assignments.
- *FIRST* Technical Advisor (FTA) - ensures events run smoothly, safely, and in accordance with *FIRST* requirements. The FTA collaborates with *FIRST* staff, event staff, and other event volunteers in many different areas at events. The FTA focuses on all technical things related to the FIELD, ROBOTS, and game, and acts as a team advocate for all teams competing at the event.
- FIELD Supervisor - (may be the same as the FTA or Head REFEREE at smaller events) directs activity on the FIELD to ensure efficient execution of the MATCHES, pacing of the event, and smooth flow of MATCH play. FIELD Supervisors are responsible for ensuring the FIELD is intact and lead FIELD reset teams, who are responsible for resetting the FIELD after each MATCH in preparation for the subsequent MATCH.

For additional details about each of these roles, as well as other *FIRST* Tech Challenge volunteer roles, please refer to our volunteer resources.

9.12 Event Management System

The *FIRST* event management system is the software responsible for managing the MATCH scores and other event inputs. The system encompasses all FIELD electronics, including computers, displays, REFEREE and other volunteer electronic devices, wireless access point, ethernet cables, etc.

The *FIRST* event management system alerts participants to milestones in the MATCH using audio cues detailed in Table 9-1. Please note that audio cues are intended as a courtesy to participants and not intended as official MATCH markers. If there is a discrepancy between an audio cue and the visual FIELD timers, the visual FIELD timers are the authority.

Table 9-1 Audio cues

Event	Timer Value	Audio Cue
MATCH start	2:30	“Cavalry Charge”
AUTO ends	2:00	“Buzzer x 3”
AUTO to TELEOP Transition	0:07 to 0:01	“Drivers, pick up your controllers, 3-2-1”
TELEOP begins	2:00	“3 Bells”
Final 20 seconds	0:20	“Train Whistle”
MATCH end	0:00	“3-second Buzzer”
MATCH stopped	N/A	“Foghorn”