SKILLS ONTARIO COMPETITION
OLYMPIADES DE COMPETENCES ONTARIO

Robotics (Team of 4) - "Dueling Citadels"

Secondary / Secondaire

Contest Date

Monday, May 6 & Tuesday, May 7, 2019
Sign in starts at 7 :00 am on the contest site. *This is a two-day event.

TECHNICAL COMMITTEE CHAIR:
Bob Tone, Tech On *eh!*

- Questions for clarification of the rules can be made to bobtone@rogers.com

TECHNICAL COMMITTEE MEMBERS:

Mark Dimonte, Francis Libermann Catholic High School
Mario Blouin, École Secondaire de Hearst

Last Updated: July 2018/Plus récente mise à jour: juillet 2018

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ADDITIONAL INFORMATION

To ensure that competitors have a positive experience at the Skills Ontario Competition, a competitor and their educator should review the scope document well in advance, as well as check back to the website for updated versions of the scope up until the event.

For technical questions that are contest specific, please contact the technical chair – Bob Tone at bobtone@rogers.com or the Skills Ontario competition department at competitions@skillsontario.com .

For questions about the **registration process and eligibility,** please refer to the Competition Information Package skillsontario.com

1. DEFINITION OF TERMS REFERENCED IN THIS DOCUMENT

1.1. Tele-Operated Robot Elements are elements under the direct / active control of competitors during game play using one or two radios / game controllers held by the courtside competitors

1.2. Mobile Independent Autonomous Mobile Robot Elements are elements that at the start of a game have a competitor pressing their start button or enter on a computer keyboard as the only competitor to Independent Autonomous Mobile Robot Element communication during the entire game.

1.3. Stationary Independent Autonomous Elements are elements that have their power on at the start of games but have no direct contact with a competitor during game play. These units may interact with the team's tele-operated mobile robot with the actions of the tele-operated mobile robot triggering an active response by the Stationary Independent Autonomous Element which may be managed either by a mechanical based system (eg. A series of limit switches / no programmed elements) or a pre-programmed system (eg. Managed by an Arduino or other microprocessor) internal to the Independent Autonomous Element.

2. PURPOSE OF THE CONTEST

2.1. To create an engineering project to encourage individuals with different skill sets to form c-operative teams to design, fabricate and operate a robot.

2.2. The intent of the challenge is to have teams of students independently designing / fabricating / operating robots capable of completing the competition tasks in competition with other student-fabricated robots. Teams are not allowed to develop or implement strategies based on interfering with their opponent's ability to complete the competition task set.

2.3. Dueling Citadels Tournament Standing will be based on total number of Game Wins and Losses in all games played by each team.

3. SKILLS AND KNOWLEDGE TO BE TESTED

- Drafting
- Mechanics
- Electronics
- Computer Programming
- Metalwork
- Woodworking
- Communications

4. EQUIPMENT AND MATERIALS

SUPPLIED BY THE SKILLS ONTARIO TECHNICAL COMMITTEE

- One worktable with access to a 120V (min. 100W) power outlet per team
- For the Tele-operated component: Exclusive Use Playing Fields for each Team's Game and Evaluated Robot Experiences
- For the Autonomous Component: Exclusive Use Playing Fields for each Team's Game and Evaluated Robot Experiences
- A portable Grinder and portable Jig Saw for use in the Safe Material Removal Work Space

SUPPLIED BY THE COMPETITORS

Competitors must bring the following items at a minimum:

- Résumé for Job Interview Component
- Refillable water bottle
- Teams are responsible to provide their **OWN components** used to create their 2019 Skills Ontario Robotics Competition Built In-Advance at School Tele-operation and Autonomous Robots. (see additional info on page 11 and 14)
- As always, teams can use whatever components they wish, obtained from sources of their own choosing, when creating their Tele-operation or Autonomous Robot Solutions.
- Teams are permitted to use the platform of their choice for their Autonomous component (LEGO, VEX, Raspberry Pi, etc.)

For the Tele-operated Component:

- Easily accessible fuses on their robot
- Easily accessible kill switch(es) on their robot
- Robot accessories including batteries, controller(s), battery charger, spare parts
- Table top robot stand
- Tool box including the various tools required to modify and repair robots on-site
- Safety equipment including mandatory eye protection
- Power Bar / extension cord
- Completed Pre-inspection Checklist
- Robot Wiring Diagram

For the Autonomous Component:

- Lap Top Computer
- Microcontroller for Autonomous Task
- Microprocessor / Software (LEGO, VEX, Raspberry Pi. Etc.)

Teams will not be permitted to contact anyone outside the contest area or access files not saved to the desktop of the computer. Teams caught corresponding with those outside the contest area electronically or in person may be disqualified.

Media devices, such as cell phones, smart phones, mp3 players, or PDAs are **not** permitted on the contest site.

5. SAFETY

Safety is a priority at the Skills Ontario Competition. Prior to attending the Skills Ontario Competition, students should be familiar and competent in the use of the tools and equipment listed above as well as what safety precautions will be observed. At the discretion of the judges and technical chair, any competitor can be removed from the competition site for not having the proper safety equipment and / or not acting in a safe manner.

- It is mandatory for all competitors to wear CSA approved eyewear (including side shields for prescription eyewear) when doing any material removal fabrication work on the robots.
- Competitors must wear safety glasses in the court area during Citadel Hill Games
- Competitors will not be permitted to compete until they have the needed safety equipment.
- Competition judges will have final authority on matters of safety.
- Competitors must show competence in the use of tools and / or equipment outlined in this scope and can be removed at the discretion of the judges and technical chair if He / She does not display tool and / or equipment competency.

6. CONTEST STATUS

- This contest is offered as an official team of 4 contest at the Skills Ontario Competition.
- This contest is offered as a team of 2 contest at the Skills Canada National Competition (SCNC2019 Halifax).

IMPORTANT: Given the National Robotics Competition involves **Teams of TWO** Competitors, immediately following the Closing Ceremony on May 8th , the teacher of the Ontario Gold Medal Team of 4 will be **required to identify which two of their competitors will advance** to SCNC in Halifax on May 27-30, 2019.

NOTE: 2019 is NOT a qualifying year for WorldSkills.

7. RULES, REGULATIONS AND ELIGIBILITY

Please be sure to review all eligibility criteria in the complete Competitor Information Package, available online at skillsontario.com .

ELIGIBILITY CRITERIA:

Secondary Students must:

- Be 21 years of age or younger as of December 31st in the competition year (2019)
- Compete in only one contest at the Skills Ontario Competition.
- Students competing at a Qualifying Competition who do not advance in their designated contest area are not permitted to then register for a different contest at the Skills Ontario Competition.
- Possess a Canadian citizenship or landed immigrant status and be a resident of Ontario.

OTHER RULES AND REGULATIONS:

Prior to attending the Skills Ontario Competition all competitors need to be aware of the following:

- Translators or other assistants (e.g. hearing impaired) are permitted in the contest site **only if this request was made during the registration process and approved in advance by the Skills Ontario office.**
- During the contest, no one will have access to the contest site except the Technical Committee Members, Judges, Skills Ontario Staff and Competitors. Spectators, including teacher / advisors, will be provided a viewing area if possible.
- If there is any discrepancy between the English and French information in the scope, the English will be taken as the correct information.

Immediate disqualification may occur at the discretion of the technical chair if a competitor displays any of the following:

- Acts inappropriately
- Shows disregard for the safety of themselves or those around them
- Breaks the established rules and regulations including:
    - Uses equipment or material that is not permitted
    - Dishonest conducted (cheating, plagiarism)
    - Speaks with those outside the contest area
    - Arrives to the contest site area late

Sign-in for all contests will happen on the contest site the morning of the competition. Registration must take place prior to the deadline of March 29, 2019.

7.1. CLOTHING REQUIREMENTS:

- Competitors are to be dressed in a clean and appropriate manner.
- Competitors are not permitted to wear clothing with logos or printing.
  Note: The exception to this rule is the logo of the school, school board, college or MAESD District that the competitor is representing.
- ONLY the logo of the institution under which the space is registered can be visible.
- Corporate logos are not permitted on a competitor's clothing.

7.2. MEALS:

PLEASE NOTE: If the competitor has specific dietary needs/restrictions or tastes it is recommended they bring a lunch/snacks with them.

Skills Ontario will provide a basic lunch and a beverage for registered competitors. A vegetarian option will be made available **ONLY if selected** when completing the competitor registration form in the online system. No alternative meals will be provided.

Please bring a refillable water bottle for use throughout the day. If the competitor is part of a contest of a physical nature, it is highly recommended they bring additional snacks.

ANY FOOD BROUGHT TO THE VENUE MUST BE NUT FREE. ANY NUT PRODUCTS FOUND ON SITE WILL BE REMOVED.

8. SKILLS ONTARIO COMPETITION AGENDA

Monday, May 6TH – Tele-operated Tournament Play and Autonomous Tournament Play	
7:00am – 7:30am	Sign-in at the contest site
7:30am – 7:45am	Orientation
7:45am – 9:00am	On-court practice time (for both Tele-operated and Autonomous Components), Inspection for Tele-Operated Robots and Job Interviews
9:00am – 12:00 Noon	Tele-Operated and Autonomous Tournament Games will be hosted simultaneously
12:00 Noon – 1:00pm	Lunch
1:00pm – 4:00pm	Tele-Operated and Autonomous Tournament Games will be hosted simultaneously
* 4:00pm – 4:30pm	*Open Courts for teams to practice
To ensure all teams receive an equal number of games, this practice time may be reduced. All teams must be off the court and out of the pit area **by 4:30pm**. Both Tele-operated and Autonomous Robots must remain in the Pit Area overnight.	

Tuesday, May 7TH – Tele-operated Tournament and Playoff Play / Autonomous Tournament Play	
7:00am – 8:30am	Practice Time on Court
8:30am – 12:00 Noon	Tele-Operated and Autonomous Tournament Games will be hosted simultaneously
12:00 Noon – 1:00pm	Lunch
1:00pm – 4:00pm	Tele-Operated Playoffs and Autonomous Tournament Games
4:00pm – 4:30pm	Competition Space Shut Down

A more detailed schedule of what times each team will compete will be released each morning of the competition. Although it will not be intentionally scheduled this way, teams may be required to compete on both the Autonomous and Tele-operated courts at the same time.

Wednesday, May 8TH – Closing Ceremony	
9:00am – 11:30am	Closing Ceremony
12:00pm – 1:00pm	Team Ontario Meeting

9. JUDGING CRITERIA

9.1. Teleoperated Robot Tournament and Playoffs = 65%
9.2. Autonomous Robot Tournament = 30%
9.3. Job Interview / Resume = 5%
9.4. There are three components to the 2019 Robotics Contest

- Job Interview / Resume – please see the Job Interview / Resume section
- Teleoperated Robot Component – This is the traditional contest that has been seen over the past at the Skills Ontario Competition. It is permitted to have both teleoperated and autonomous elements used in this component.
- Autonomous Component – Teams will build a second separate Robot to be tested on a different court and which will be 100% Autonomous.

9.5. **Judging Criteria: Total 100 Marks**

9.6. **Teleoperated Dueling Citadels Tournament Play** **35 Marks**

- Highest Scoring Teleoperated Dueling Citadels Tournament Team = 35 Marks
- All Other Teams awarded Teleoperated Dueling Citadels Tournament Marks based on the following formula:
  - (35) (Individual Team Total Score / Highest Team Total Score)
- The TOP 16 Teams based on Final Dueling Citadels Tournament Play Results advance to the Teleoperated Dueling Citadels Playoffs

9.7. **Teleoperated Dueling Citadels Playoff Play =** **30 Marks**

- 6 marks per Ladder 'A' Bracket Playoff Game Win
- 4 marks per Ladder 'B' Bracket Playoff Game Win

9.8. **100% Autonomous Tournament Results =** **30 Marks**

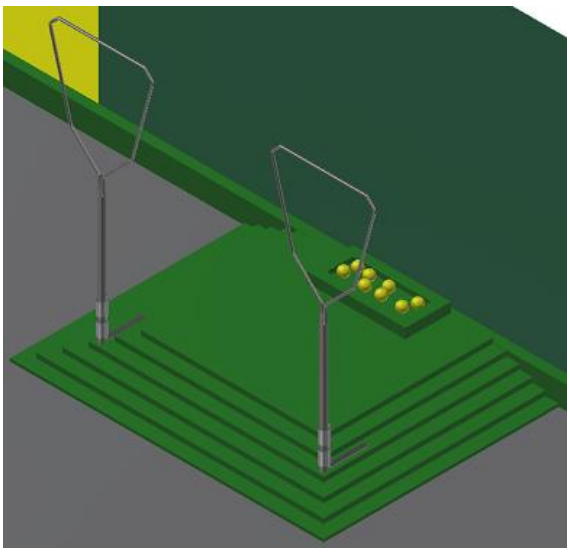
- Highest Scoring 100% Autonomous Tournament Team = 30 Marks
- All Other Teams awarded Autonomous Tournament Marks based on the following formula:
  - (30) (Individual Team Total Score / Highest Team Total Score) so if you scored half the points compared to the winning Team you will get 12.5 Marks.
- There will be NO Playoffs in the Autonomous Competition. Final standing will be based on the total points scored in ALL Task Runs of a Team over the two competition days.

9.9. **Job Interview / Resume =** **5 Marks**

To assist competitors in preparing for their eventual job searches these is a 'Job Interview' incorporated into this contest. It is expected that the competitors will arrive with a **RÉSUMÉ** and be prepared for interview questions and discussion. Performance in the interview accounts for 5% of the Team's overall mark.

10. THE DUELING CITADELS TELEOPERATION GAME OVERVIEW

The core game situation requires a Robot or Robots to deliver Soft Golf Balls into their Opponent's Stationary and Mobile Nets.



- Stationary Nets positioned at the Front Corners of their Opponent's Citadel Hill, and,

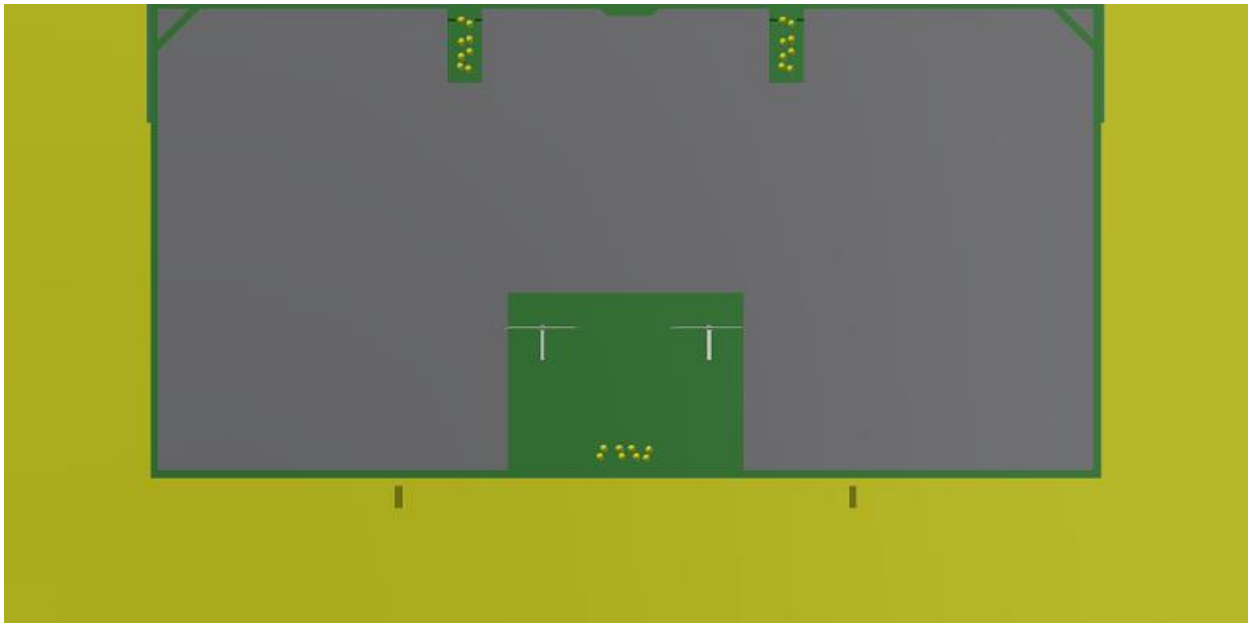
- Free Rotating Nets mounted on the back of their Opponent's Robot.
- Fully / physically blocking the "nets" is not be in the spirit of the game and is not allowed.

Teams have use of Thirty Soft Practice Golf Balls:

(a) Each Team's Robot Entry starts the game in possession of Six Soft Practice Golf Balls
(b) An additional 24 Soft Practice Golf Balls are available to teams in three boxes positioned in their exclusive use court space
a. 8 Soft Practice Golf Balls in each of 2 boxes in Fixed Positions on the court floor along the Center Wall, and,
b. 8 Soft Practice Golf Balls in a box positioned on top of their own Citadel Hill.
(c) Teams can NOT reposition the On the Court Floor Ball Boxes during game play.
(d) The On Top of Citadel Hill Ball Box will be fixed in place
(e) Robots MUST be on top of their own team's Citadel Hill when they are retrieving balls from the On Top of their Citadel Hill Ball Box.

NOTE: Teams are responsible for:

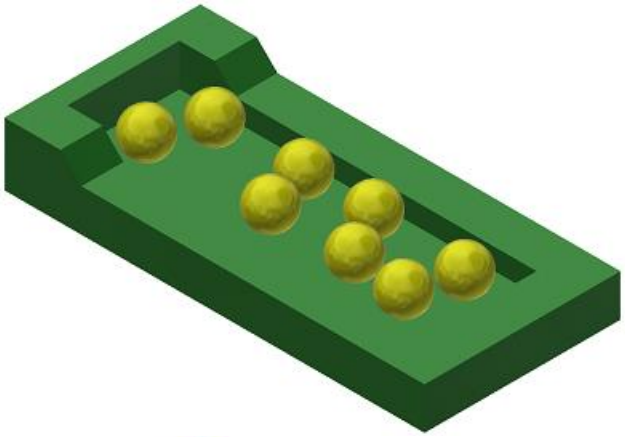
- **PROVIDING THEIR OWN GAME BALLS**
- Maintaining the condition of their game set of Soft Practice Golf Balls throughout the two days of competition play
- Teams MUST create unique markings on their set of game Soft Practice Golf Balls using permanent markers to enable these balls to be identified in the court area.



11. EACH TEAM'S EXCLUSIVE USE AREA

- Each Team's Exclusive Use Area is approximately 8 by 16 feet.
- Teams have Exclusive Use of a 30 in. wide passageway along three sides of their assigned court area.
- Both Team Members can be active in and move throughout this entire team passageway space during game play.
- It is a Team Responsibility to define the tasks assigned to each competitor.
- If a Team has a Two Robot Entry, then:
  a) Both competitors can be Robot Drivers
  b) Both competitors can also be Spotters for their partner driver
- If a Team has a One Robot Entry, then:
  - One competitor can be the Robot Driver and One competitor can be a Spotter for their partner driver

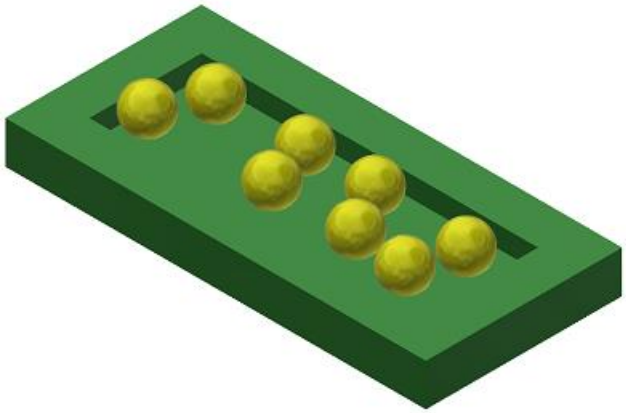
12. DUELING CITADELS PERFORMANCE ENVIRONMENT (COURT) FEATURES



- Two Court Floor Ball Boxes 15 by 7 by 0.75 in along three sides.

- Court Floor Boxes are fixed in place along the Center Wall

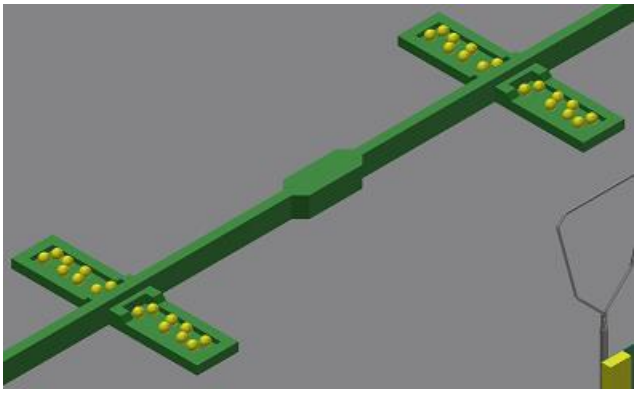
- There are EIGHT Soft Practice Golf Balls in each Court Floor Box at the start of the game.



- One Citadel Hill Ball Box 15 by 7 by 0.75 in.

- Citadel Hill Ball Boxes ARE fixed in place and CANNOT be moved by robots during game play

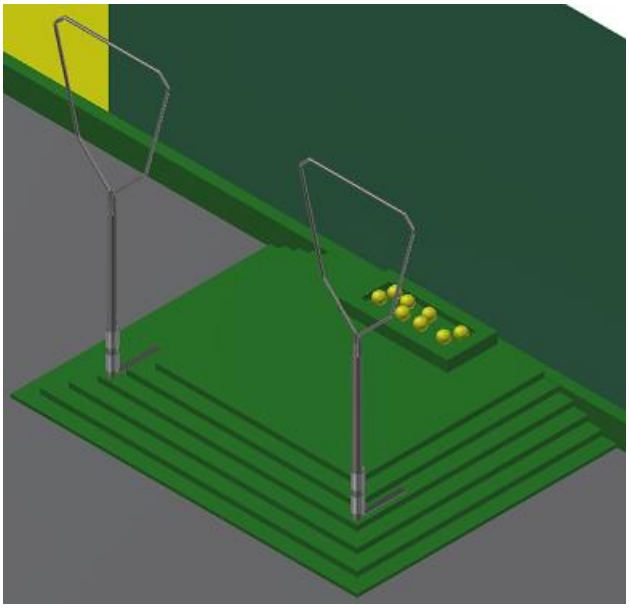
- There are EIGHT Soft Practice Golf Balls in each Citadel Hill Box at the start of the game



- Each Center Wall Ball Box is 15 by 7 by 0.75 in.

- Both Center Wall Ball Boxes ARE fixed in place and CANNOT be moved by robots during game play

- There are EIGHT Soft Practice Golf Balls in each Center Wall Ball Box at the start of the game



- The Citadel Hill Base is 36 by 48 in.

- The Top of the Citadel Hill is 26 by 28 in. and is 4.5 in. above the court floor

- There are Five Steps leading to the Top of the Citadel Hill and each of these steps has a 2 in. Run and a 0.75 in. Rise

- Tall Fish Nets are positioned in holes at the Right and Left Front Corners of the fourth step There is a 4 by 8 ft. by 0.125 in. Hardboard Wall along the back of the hill

Citadel Hill Nets:

Lucky Strike LS Econ Boat Net

Canadian Tire

Product # 78-4053-6, $15.99

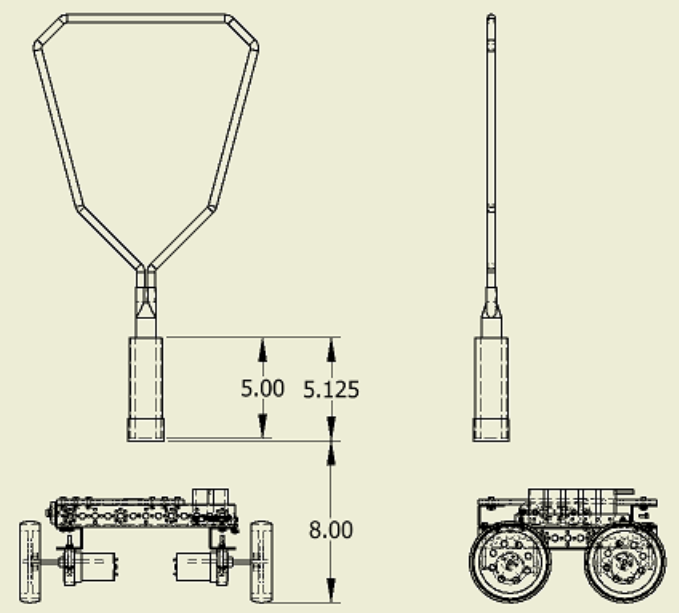
On the Robot Nets:

Lucky Strike Economy Trout Net

Canadian Tire

Product # 178-2010-2, $9.99

NOTE: Competitors are required to remove the String Loop attached to the Trout Nets **BEFORE** installing these nets on their robot.



Teams mount a Trout Net on their robot.

- In a 5 inch 1.5 Dia. Vertical Abs Pipe that has an End Cap closing the bottom of the pipe
- The Net Holder must be positioned at the Mid-point along the back side of the robot
- The Bottom of the Net Holder must be 8 inches above the court floor
- The Net must be able to rotate freely through 360 degrees **at all times** while it is in the net holder
- The Net Holder and the structural supports required to hold it in place **WILL NOT** be included when calculating a Robot's Overall Size

Note: Competitors will participate in **BOTH** the Teleoperation Dueling Citadels Game and the Built On-site Autonomous Robot Tasks concurrently during **BOTH** Competition Days.

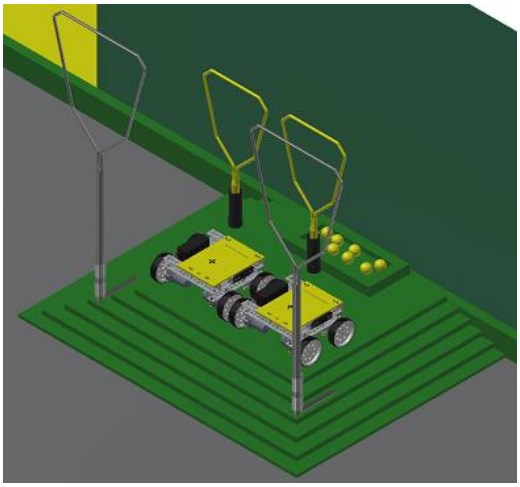
13. TELEOPERATION DUELING CITADELS GAME DESCRIPTION

13.1. Games will involve Two Teams at a time.
13.2. Both Competitors are allowed unrestricted movement around 3 sides of their Team's Assigned Court Area.
13.3. Teams can utilize a Maximum of 2 Teleoperated Robots
13.4. Teams may also have one Independent Autonomous Element as part of their entry (which must fit into the overall size limitation at the beginning of the game.)
13.5. Teams will be in possession of SIX Soft Practice Golf Balls at the start of a Game (e.g. if two robots…3 balls in each).
13.6. Each Team's robot CAN be in possession of an Unrestricted number of Soft Practice Golf Balls at any time once a game starts.
13.7. Robots CAN shoot into **ANY** net from anywhere in their exclusive use space.
13.8. Teams can incorporate defensive or offensive strategies. However, Teams may **NOT** assert control over balls in their opponent's exclusive use space. For example: A robot may **NOT** reach into the competitor's space to physically take possession of or move balls in your opponent's area.
13.9. Teams can not intentionally remove balls from the playing area (shooting balls at nets where the ball misses the net and goes out of the area does not constitute intentional removal of balls).
13.10. Teams intentionally removing balls from the court area will be penalized with a 3-point loss per ball.
13.11. Mobile nets MUST be able to move freely in a 360 degree rotation at ALL Times during game play.

14. SCORING SUMMARY

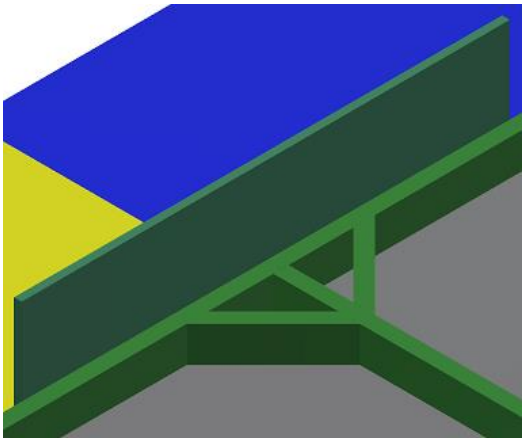
14.1. Scoring will be done at the end of each 3-minute game.
14.2. Teams MUST score a Minimum of ONE point as a direct result of their robot's actions to be declared a game winner.
14.3. 3 points will be awarded for each ball in the opponent's 'Mobile / On the Robot' net(s).
14.4. 2 points will be awarded for balls in the opponent's 'On the Citadel' nets.
14.5. 1 Point will be awarded, FOR YOUR OPPONENT, for each ball that your robot is holding at the end of the game.
14.6. 1 point will be awarded for each ball that lies on the floor of the OPPONENT'S COURT SPACE
14.7. Zero points will be awarded for each ball that is in the ammo boxes.
14.8. 10 Points will be awarded IF ALL Robot(s) in a Team's entry that are carrying a Trout Net, have travelled down OFF their Citadel Hill during game play and have returned to the Top of their Citadel Hill before the end of the game buzzer.

15. START OF THE GAME ROBOT POSITION



- A Team's Entire Entry **MUST** be positioned **ON TOP** of their Home **Citadel Hill** at the Start of each Game.

- The outer edges of the Citadel Hill Top Plate establish a set of Perimeter Vertical Planes that No Part of a robot can be breaking at the start of a game.



- Balls that land inside the Triangular Spaces formed by the center wall and the center wall's braces are considered 'Out of Play' and have Zero Point Value.

16. PIT AREA AND COURT ACCESS

16.1. A Pit Area is provided so that students may make repairs and improvements to their robots between games. (Note: Teachers are not permitted in the pit area once the competition has started).
16.2. Teams MUST bring their Robots into the skill area at Orientation. Teams are NOT allowed to remove their robots from the skill area during the over-night periods between Orientation Day, Competition Day 1, and Competition Day 2 of the contest.
16.3. Laptops may be removed overnight by competitors.

17. TOURNAMENT PLAY

17.1. Competitors must wear Safety Glasses when they are in the Teleoperation Court Area.
17.2. Dueling Citadels Game Tournament will be based on an 'Unseeded Tournament Format'.
17.3. Dueling Citadels Tournament Standing will be based on total number of Game Wins and Losses in all games played by each team.
17.4. Teams will play in an equal number of Tournament Games.
17.5. Teams will participate in an equal number of games against each opponent Team.
17.6. Tournament games will last 3 minutes
17.7. The amount of time between games will be determined by the number of participants. This information will be provided to teams at the start of the tournament.
17.8. Between tournament games, battery changes and repairs to robots may be completed at the team's assigned Pit Area Worktable.
17.9. During game play, referees will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.
17.10. Damaging the court area is prohibited. If a robot's design causes damage to the court elements, then it will not be allowed to compete until it can operate without causing damage. Games missed due to this situation will be forfeited.

NOTE: Damage is considered to be BREAKING court components. Robots bumping into court components and causing them to shift position without breaking any court element will NOT be considered to be damaging the court. It is expected that all court components will be fixed firmly in place so that the court is a Neutral Factor in the competition.

17.11. Games will start on time. Teams are responsible to know when their games are scheduled. Teams arriving late will be allowed to use the remainder of the time in the game. Competitors cannot enter onto the court surface or make adjustments to their robot during a game.
17.12. If a robot is mal-functioning and represents a hazard to participants, other robots or itself in the opinion of the Referee, then, the referee may authorize the shutting off of the robot during a game. Disabled robots or parts of robots not generating any safety concerns will be left on the court until the game time expires.
17.13. It is a Team Decision what roles team members will fill. Drivers are the competitors holding the robot controller and asserting direct control over a Tele-operated robot.

17.14. The Spotter would be the competitor providing navigational guidance to the driver.
17.15. Competitors may change roles while a game is in progress.
17.16. Competitors (Driver/s and/or Spotters) can move freely in their Assigned Courtside Team Area throughout the game.
17.17. Competitors may **not** enter an opponent team's Assigned Courtside Team Area at any time during game play.
17.18. At the start of a game, robots are expected to be in their Designated on top of their Citadel Hill Starting Positions.
17.19. Robots arriving AFTER a game has started will be allowed to enter the game in their designated on top of their Citadel Hill Starting Positions and use the Time remaining in the 3 minute game.
17.20. Robots must not leave the contest court at any time during a game.
17.21. It will be a referee's ruling that decides if an 'End of the Game Shot' took place before or after the game-ending buzzer sounded and whether a robot is located completely on the top of its' Citadel Hill when the game-ending buzzer sounds.
17.22. If a Soft Practice Golf Ball lands out of the court, it may not be retrieved and will be out of limits of play.

Scoring will take place after the End of the Game Buzzer

18. COURT LAYOUT

18.1. Please note: Although great pains will be made to keep the court in compliance with the drawings, some inaccuracies in construction may occur. **Please make your robot designs allowing for a possible ½ inch tolerance.**
18.2. The primary court items that have a direct bearing on robot design are:

- The open court surface will consist of the good side of Plywood Sheets **OR** the facility floor **OR** the smooth side of Masonite Sheeting.
- The Citadel Hill Steps are unpainted Plywood

Detailed court information has been included in the Appendix Section of this document.

19. THE ROBOT RESTRICTIONS

19.1. All elements of a team's entry, both autonomous and tele-operated Robots must **pass** a pre-competition inspection for compliance with the safety and design rules before they will be allowed to participate in tournament games.
19.2. Robots must remain in compliance with these rules throughout the competition.
19.3. If teams fall out of compliance with these rules then they will not be permitted to compete and will forfeit all of their scheduled games until they have corrected the non-compliance problem.

20. START OF THE GAME ROBOT STATUS

20.1. When a robot's main power is turned on prior to the start of a game the robot must be in an overall 'Idle State' and the following conditions must exist:

- Robots must be stationary
- Robots must be in their designated On Top of their Citadel Hill Starting Location.
- If Team Entries involve multiple Robots / Mechanisms then all of them must be placed in the designated starting location and must be positioned to not exceed the allowed total 4 cubic feet volume per Team.
- All systems may be ON.
- Air System Circuits may be fully charged to 100 PSI and their compressors can be ON.

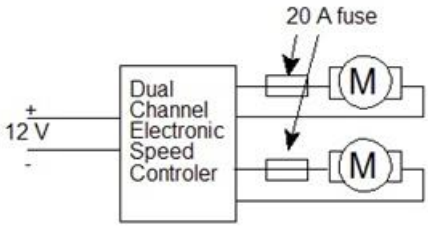
21. OVERALL TEAM ROBOT ENTRY SIZE

21.1. Complete Team Entries must not exceed an overall size of **4 cubic feet** (6,912 cubic inches) at the start of each game.
21.2. Team Entries may expand to a larger size once a game has started.
21.3. Overall Team Entry Size will be calculated using the maximum single dimension in each category (Length / Width / Height) of the Complete Team Entry not average dimensions.
21.4. This overall size maximum will allow Team Entries to be any variation / combination of elements that does not exceed **6,912 cubic inches**, using the following formula: Volume = Length x Width x Height

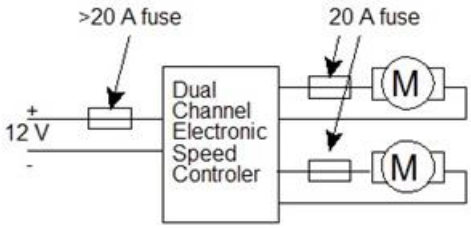
22. POWER SOURCES / MANAGEMENT

22.1. The total voltage in any individual circuit cannot exceed 24 volts
22.2. The maximum continuous power rating allowed in any circuit branch is 240 W, which will be limited by voltage and fuse selection. A larger main fuse can be used to provide protection for motor controllers. To calculate power in any given circuit, use the following formula: Power (Watts) = Voltage (Volts) x Current (Amps).

***Acceptable* Circuit Protection: (ESC is NOT protected by fuse)**



***Recommended* Circuit Protection: (ESC *IS* protected by fuse)**



22.3. Teams are reminded that it is the purpose of a fuse to protect the students themselves and the equipment in their circuits. Teams must develop circuit diagrams and calculate the appropriate values for all circuits on their robot. Teams must submit a wiring diagram of their robot's circuits.
22.4. Each current branch path from the battery must include either an **in-line fuse, resettable fuse, circuit breaker** or be connected to a dedicated fuse in a rack.
22.5. Batteries must be complete sealed commercial battery packs.
22.6. All robots must be able to be turned off with a single motion.
22.7. Robot Controller receivers may be in an independent circuit.

23. Non-Electrical (Battery) Energy Sources

23.1. Pressure based energy sources (air or other) may be pre-charged to a maximum of 100-PSI pressure in their reservoirs (cylinders) at the start of each game.
23.2. Air pressure systems using Competitor-made or modified air pressure hardware are **NOT** permitted.
23.3. All pressurized tanks on robots must have a pressure gauge to indicate the stored pressure and a form of automatic overpressure safety relief system.
23.4. The pressure tanks and related gauges / controls must be shielded from damage due to collisions or flying target objects.
23.5. The stored pressure in the tank must not exceed a maximum of 100 PSI at any time.
23.6. Tension-based energy sources (elastics, springs or other) may be in either a relaxed at rest state or in a tense / compressed state at the start of each game.

24. RECOMMENDED ROBOT CONTROLLERS

24.1. It is recommended (not required) that all teams use 2.4 GHz “non-crystal” control systems on Tele-operated Robots.
24.2. Teams are allowed the use of an unlimited amount of channels, but only two separate tele-operated robots. Teams assume full responsibility if any interference is to occur with their respective communication systems that could render the robot(s) useless.
24.3. Tele-operated Robots may not transmit audio/visual information to off the robot devices. (Ex: Having a camera transmit images real time to a computer near the driver, etc.)

25. PIT AREA

25.1. Competitors MUST wear safety glasses when doing fabrication work involving material removal processes (grinding / cutting).
25.2. Only registered competitors are permitted in the contest space.
25.3. Designated teacher/industry team advisors are permitted in the pit area **only** to inspect the worktable setup of their team prior to the start of the tournament.
25.4. Designated teacher/industry team advisors are **not** allowed in the pit area during tournament play.
25.5. Teachers and industry advisors are not permitted to handle tools or robot parts. Students must affect all repairs and modifications on their robot.
25.6. Teams will be provided with a pit area workspace on a standard project table.
It is required that teams fabricate a **tabletop stand** for holding their robot(s) in the pit area. This stand or these stands should hold the robot(s) securely and be capable of preventing the robot(s) from driving on or off the table in the case of either deliberate motor testing during repairs or due to random, unexpected motor activity.

26. OVERALL COURT DESCRIPTION:

26.1. The Court Playing Surface will be a 16’ by 16’ square.
26.2. Individual Exclusive Use Team Spaces are 8’ by 16’ rectangles.
26.3. The Perimeter Court Walls will be made using 2 by 4 inch planks.
26.4. This wall will as a result be approximately 3.5 inches tall.
26.5. The court surface may vary between melamine, concrete, hardboard, or plywood.

27. Pre-inspection for Compliance with Safety and Design Rules

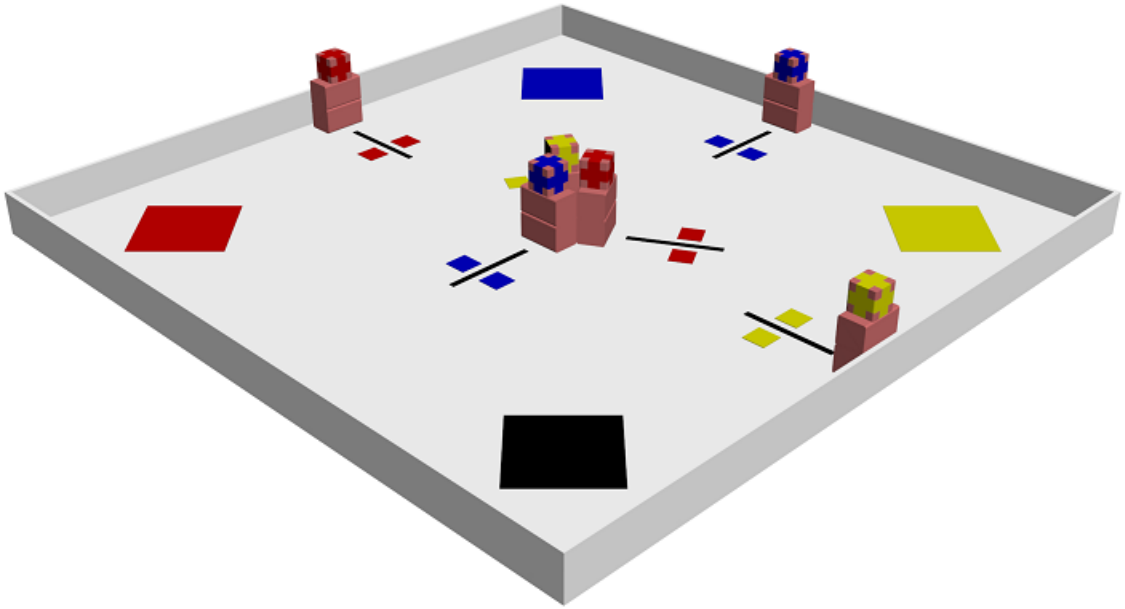
- ❑ Mandatory Wiring Diagram provided.
- ❑ Table Top Robot Stand
- ❑ Overall volume ≤ 4 ft^3 or 6,912 in^3
- ❑ No explosives/combustibles
- ❑ No lasers
- ❑ No Arial Robots
- ❑ All batteries are sealed commercial batteries in good physical condition
- ❑ Batteries wired in series should be the same amp hour rating (ex. both 1500 mAh) and batteries in parallel are of same voltage (ex. both 12 volts).
- ❑ Batteries securely mounted
- ❑ Total voltage in any individual circuit does not exceed 24V
- ❑ No circuit **branch** exceeds 240W (Voltage x Fuse Current Rating, easily accessible)
- ❑ All circuits have a fuse or breaker (breakers must have **DC rating**) and all Fuses / Breakers must be readily accessible.
- ❑ Mandatory Pressure System Circuit Diagram provided.
- ❑ No Competitor-made or modified air pressure hardware being used.
- ❑ Only commercially manufactured Pressure Tanks (cylinders) can be used.
- ❑ Pressure indicator
- ❑ Pressure in tanks does not exceed 100 psi
- ❑ Over-pressure safety valve
- ❑ Pressure tanks and related gauges and controls are shielded from damage due to collisions
- ❑ **Robot is able to be turned off with a single motion**. Radio receivers / Logic circuits may be independent of the kill switch.
- ❑ Control unit to support operator to robot communication are being used.
- ❑ Demonstration of robot functionality

Additional concerns:

Robot Evaluator Signature

Team Representative Signature

Color Correct Delivery



Performance Environment Layout Option One

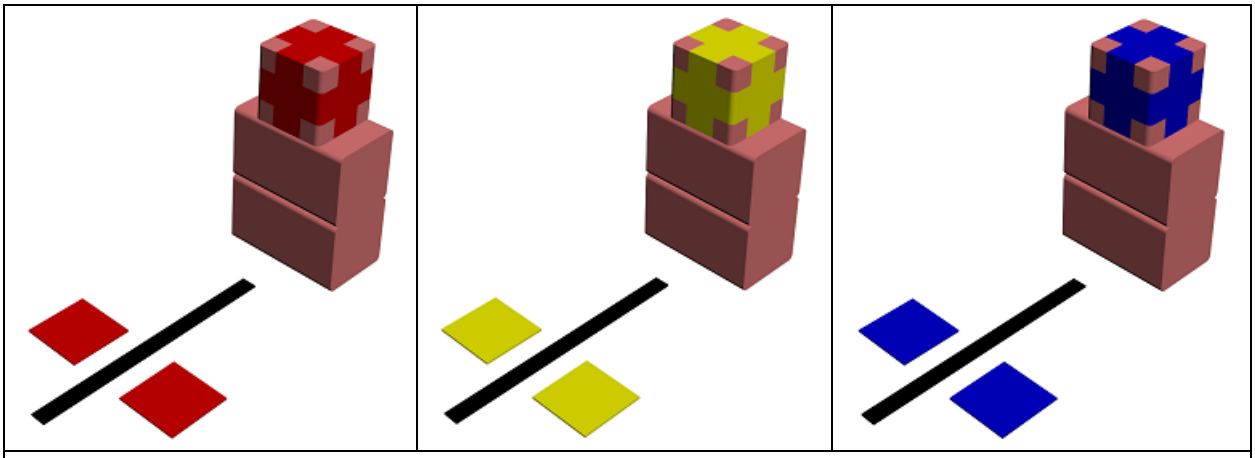
1. Autonomous Robot Performance Requirements

- Start on the Black Square
- Locate each of the Six Target Blocks, 2 with Red Tape Stripes, 2 with Yellow Tape Stripes and 2 with Blue Tape Stripes
- Take possession of each Target Block (one at a time)
- Deliver each Target Block onto the Destination Pad (a Red, Yellow or Blue 12 by 12 in. colored Bristol board sheet) that matches the color of the stripes on the Target Block.

2. Target Block Start of the game positions

- All Target Blocks will be positioned On Top of a pair of 6.0 by 3.5 by 3.5 in. Blocks
- Black Tape Lines that are 12 by 0.75 in. will lead to the Center Of both the Target Blocks and the larger blocks they are sitting on.
- A Pattern of 1.5 in. Wide / Colored Tape Lines are positioned on each Target Block to identify the color of the Target Block on each Stand

3. Target Block Identification

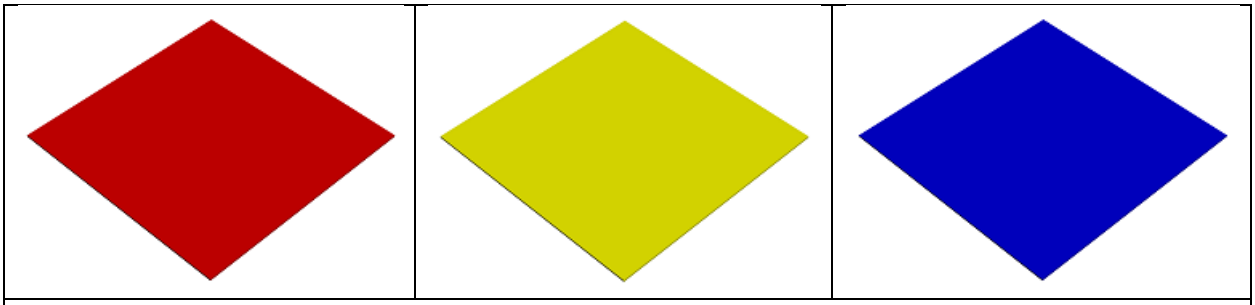


A 12 by 0.75 in. Black Tape Line is Perpendicular to the Mid-point of each Stand and the Target Block sitting on the Stand.

A Pair of 3 in. Colored Bristol Board Squares are positioned on both sides of the Black Tape Line, 3 inches from the end of the 12 in. Black Tape Line and 1 in. away from the edge of the Black Tape.

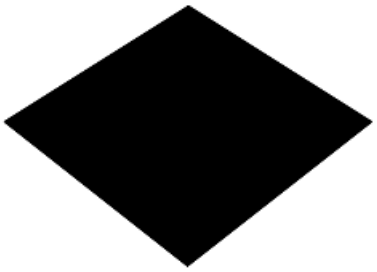
The 3.5 by 3.5 in. Target Blocks have two 1.5 in. wide Colored Tape Bands to identify them as being the Red, Yellow or Blue Target Block. These colored bands are formed using Red, Blue and Yellow colored 0.75 in. electrical tape.

4. Target Block Destination Squares



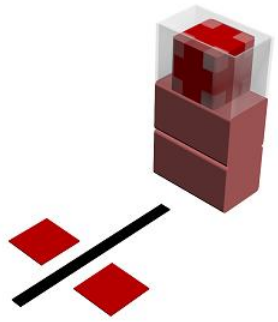
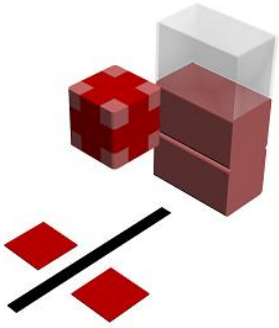
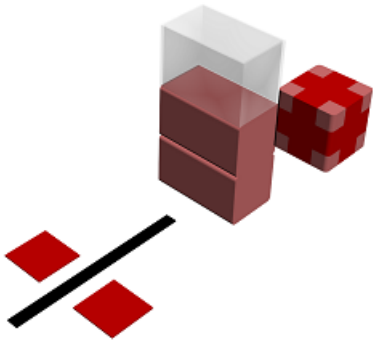
The Target Block Destination Locations are defined by 12 Inch Red, Yellow and Blue Bristol Board squares fixed in position of the Performance Environment Floor.

5. Robot Starting Position



- A 12 by 12 Inch Black Bristol Board Square fixed in position on the Performance Environment Floor identifies the Robot's Start of an Evaluated Task Run Position.
- Robots are expected to be Centered on the Black Square, BUT they can overhang the perimeter of the Black Square if the Robot's Overall Footprint is greater than 12 by 12 inches. The Maximum Allowed Overhang is 2 inches on all sides of the Black Square making 16 by 16 inches the Maximum Robot Footprint for a Team's entry.

6. Scoring Pattern related to Taking Possession of Target Blocks

<table>
<tr>
<td>  </td>
<td>  </td>
<td>  </td>
</tr>
<tr>
<td>• The Four sides of the Target Block Stands form a Column of Vertical Four Planes</td>
<td colspan="2">• TWO Points will be awarded when a Robot has Taken Possession of a Target Block,
• Moved the Target Block to a position Outside the Vertical Planes Column, and,
• Is Holding the Target Block clear of the floor.</td>
</tr>
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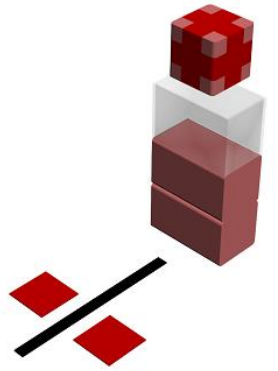
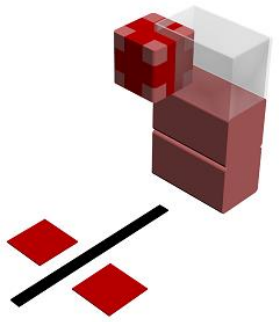
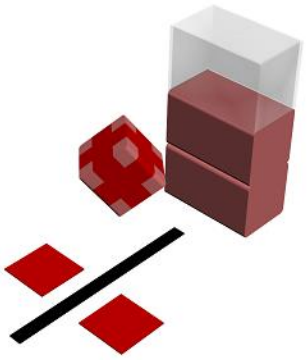
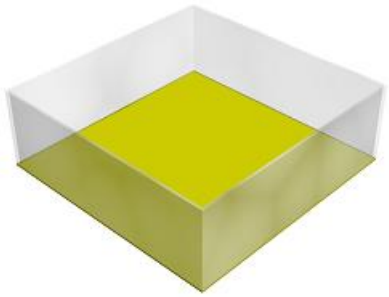
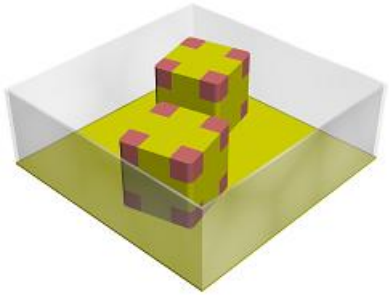
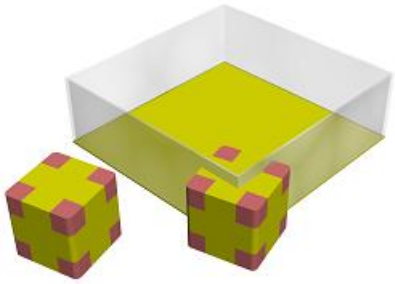
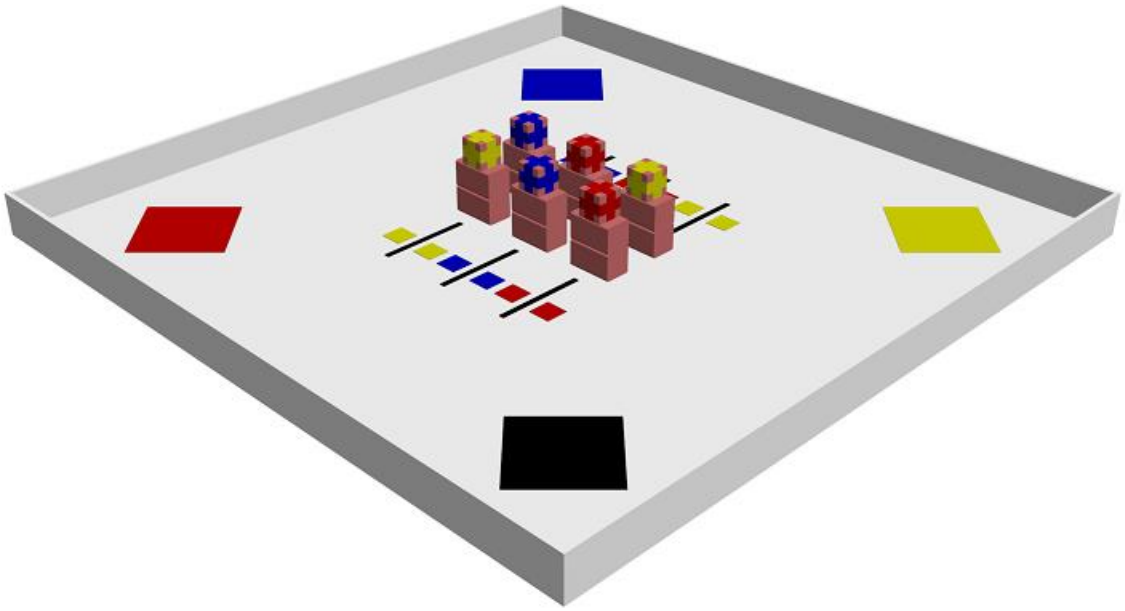
<td>  </td>
<td>  </td>
<td>  </td>
</tr>
<tr>
<td colspan="3">• Zero Points will be awarded if ANY Portion of the Target Block is Inside the Planes Column even if the Target Block is being held clear of the Top of the Stand.
• Zero Points will be awarded if a Target Block is simply Knocked OFF the Stand onto the floor.</td>
</tr>
</table>

7. Scoring Pattern related to Delivering Target Blocks

		
• The Four sides of the Destination Squares form a Column of Vertical Four Planes	• TWO Points will be awarded for EACH Target Block Delivered ONTO the Destination Square Surface, is 100% inside the Destination Square's Vertical Planes Column and has been Fully Released by the Robot. • ZERO Points will be awarded for Target Blocks that have been delivered close to or Partially through the Destination Squares Vertical Planes. **NOTE:** Marking will be done at the end of each Ten Minute Evaluated Task Run Experience	

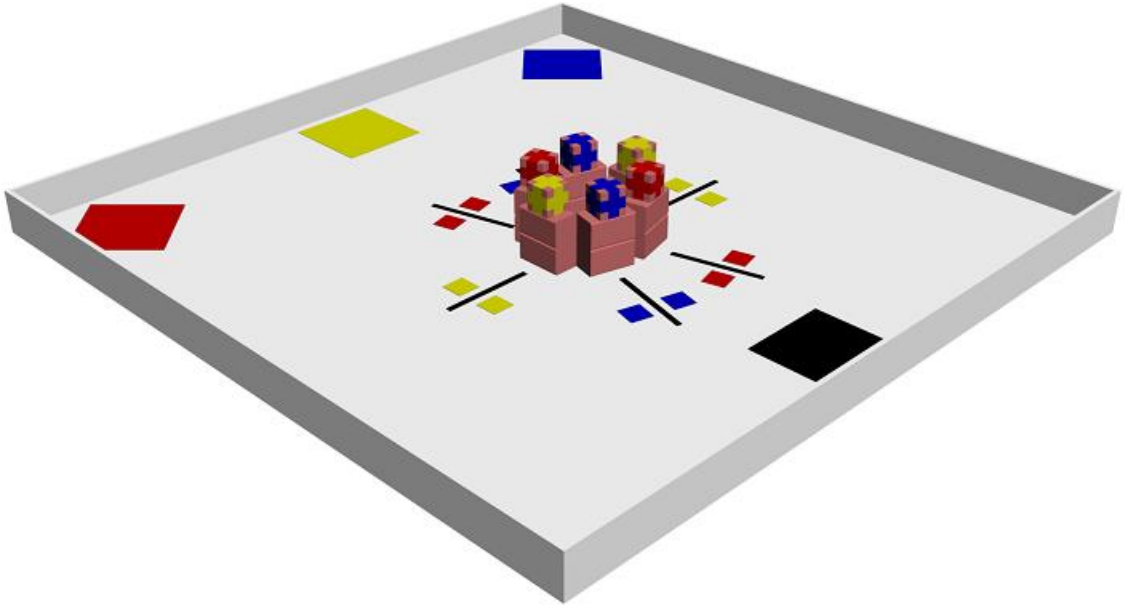
8. Performance Environment Layouts

- There are Six variations of the Performance Environment Layout presented in this document
- The Day One and Day Two Performance Layouts will be different from one another
- The Competition Performance Layouts will be selected by the Roll of a Die at 7:30 AM each competition day

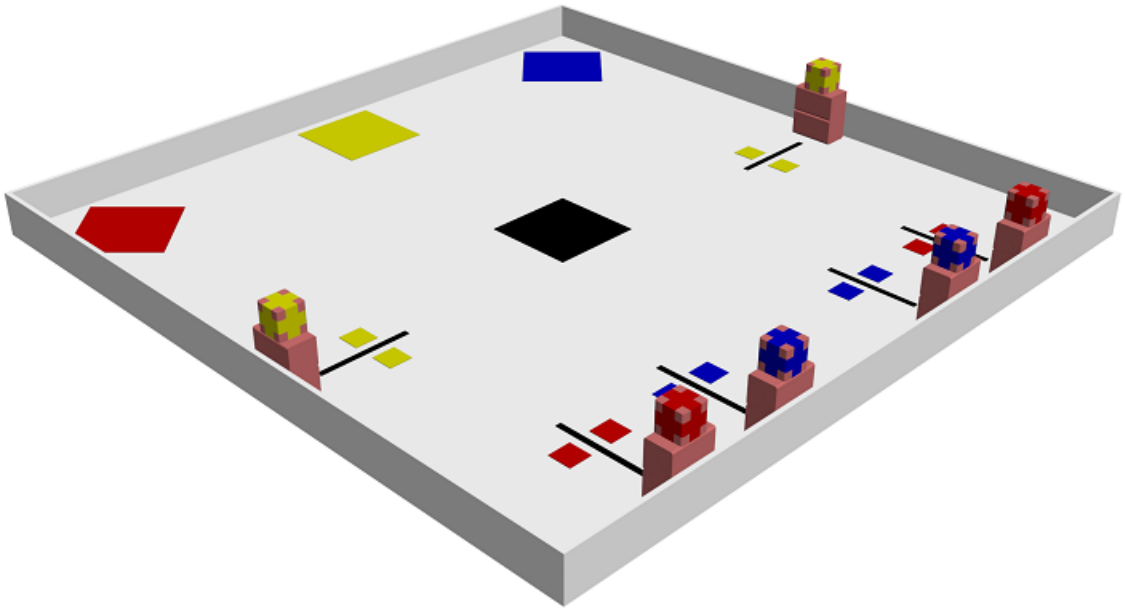


Performance Environment Layout Option Two

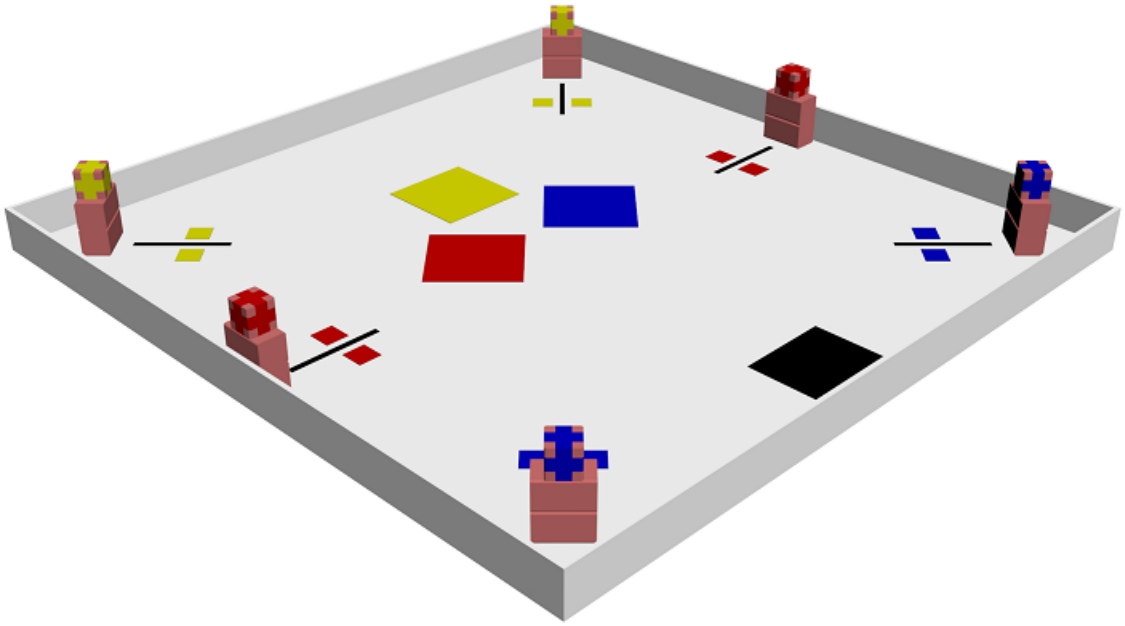
Note: The Core Autonomous Performance Environment is an 8 by 8 Ft. square with 5 In. Tall Perimeter Walls. The Floor is Smooth, White Melamine.



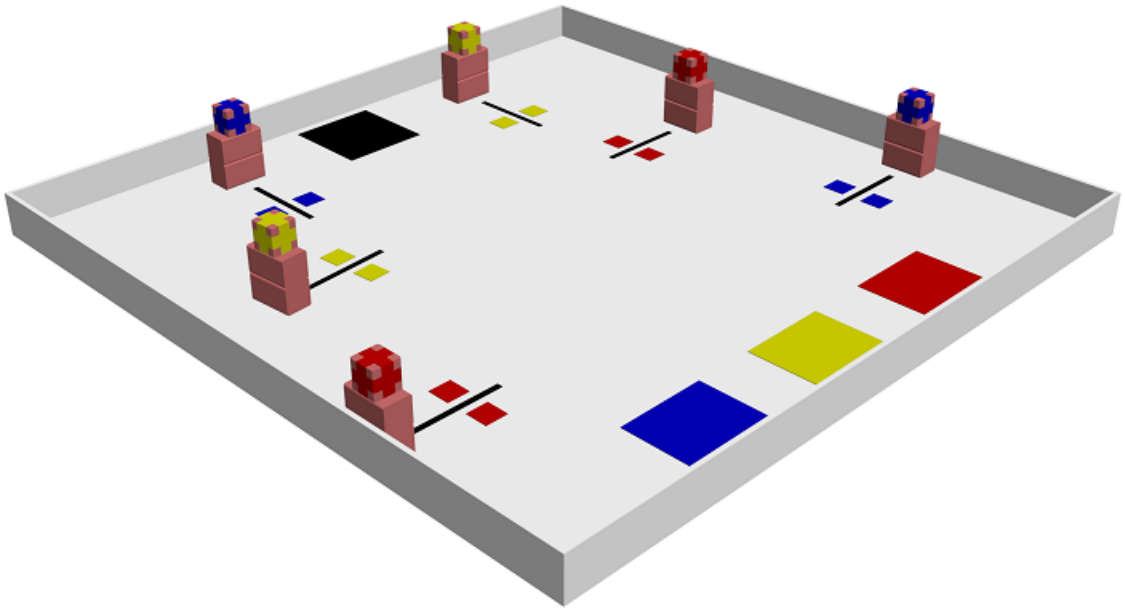
Performance Environment Layout Option Three



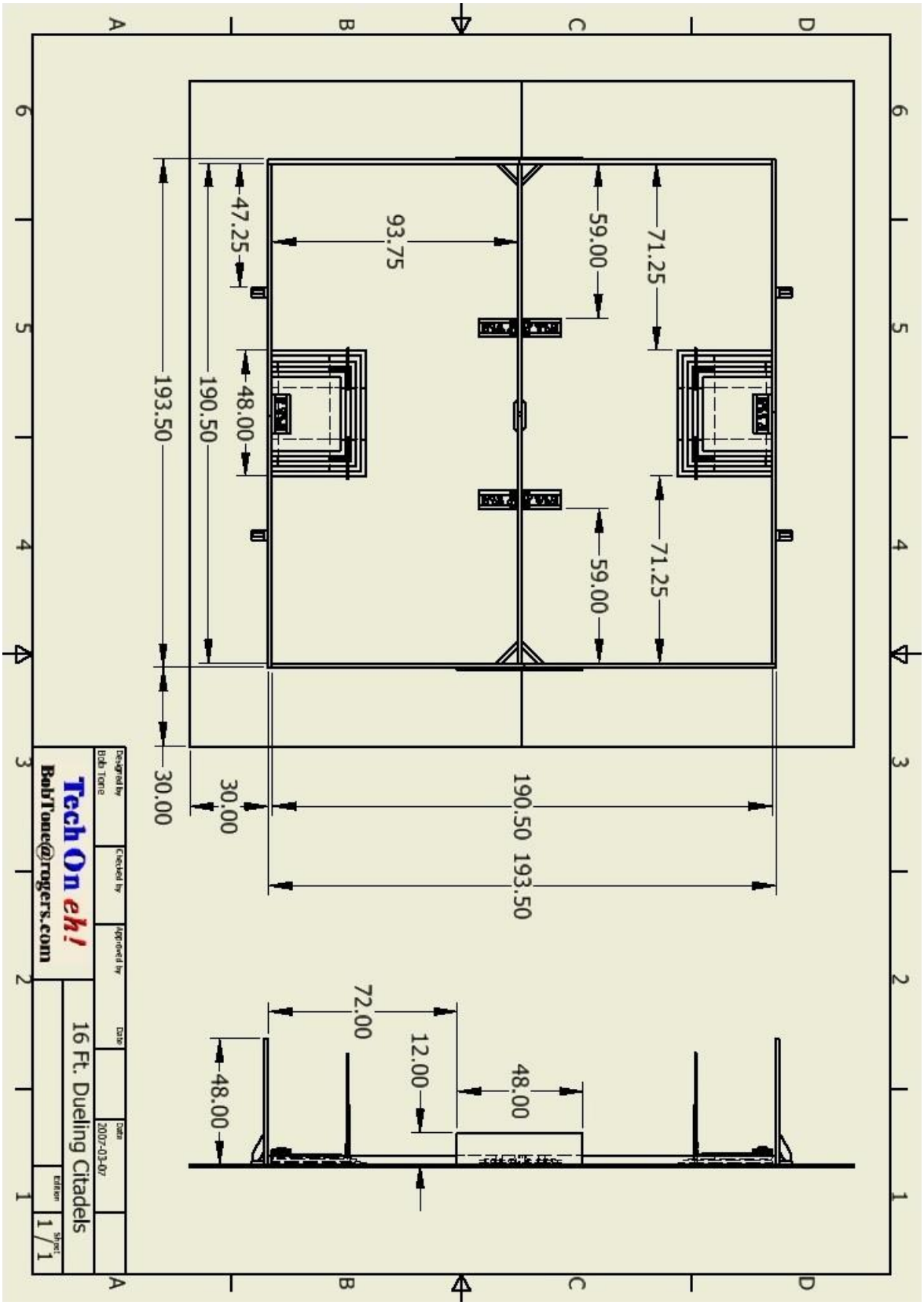
Performance Environment Layout Option Four

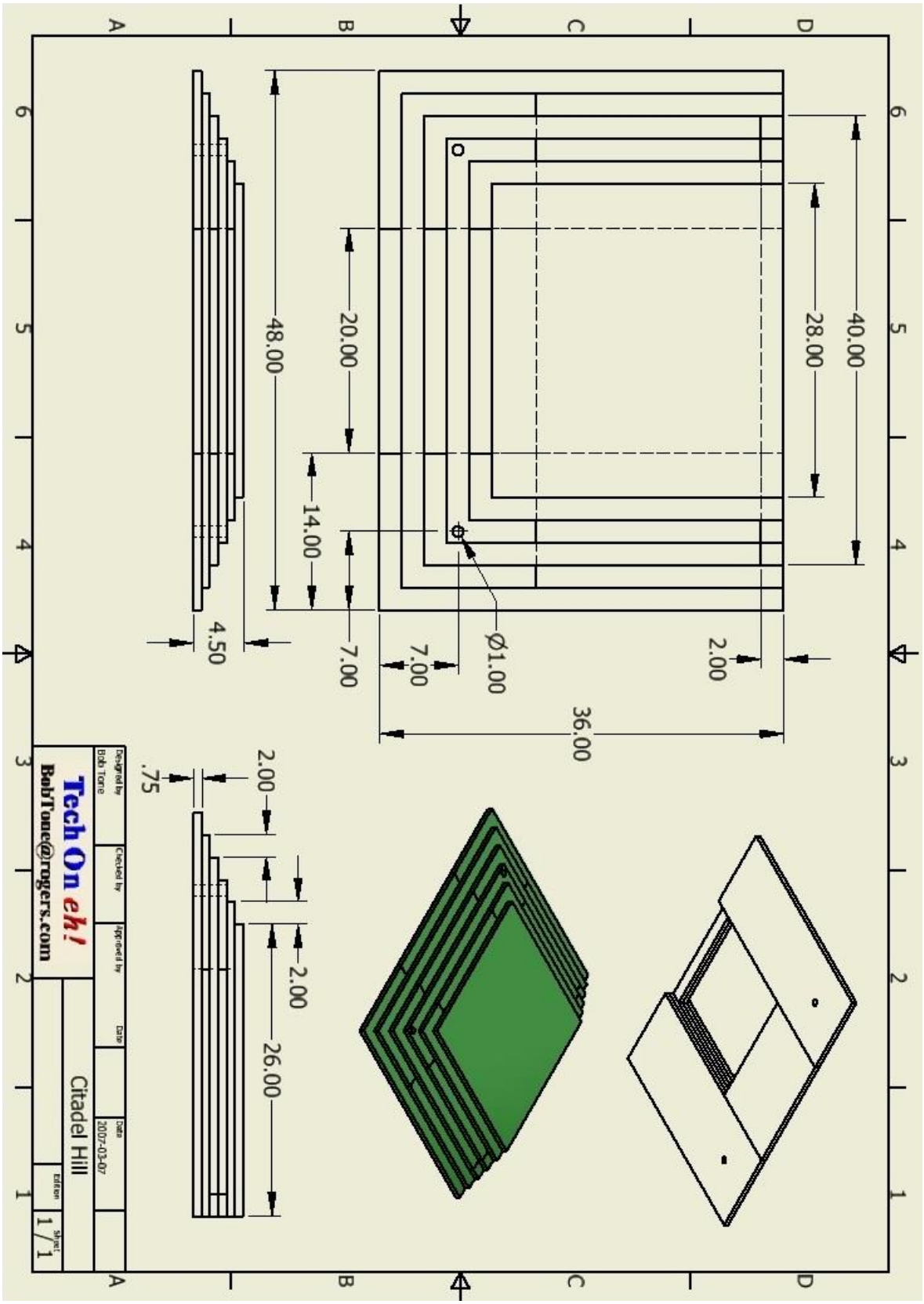


Performance Environment Layout Option Five



Performance Environment Layout Option Six


93.75
59.00
71.25
47.25
48.00
193.50
190.50
30.00
30.00
190.50
193.50
72.00
12.00
48.00
48.00
Tech On eh!
BobTonne@rogers.com
Designed by
Bob Tonne
Checked by
Approved by
Date
16 Ft. Dueling Citadels
Date
2007-03-07
Edition
Sheet
1 / 1


40.00
28.00
48.00
20.00
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7.00
4.50
Ø1.00
7.00
2.00
36.00
2.00
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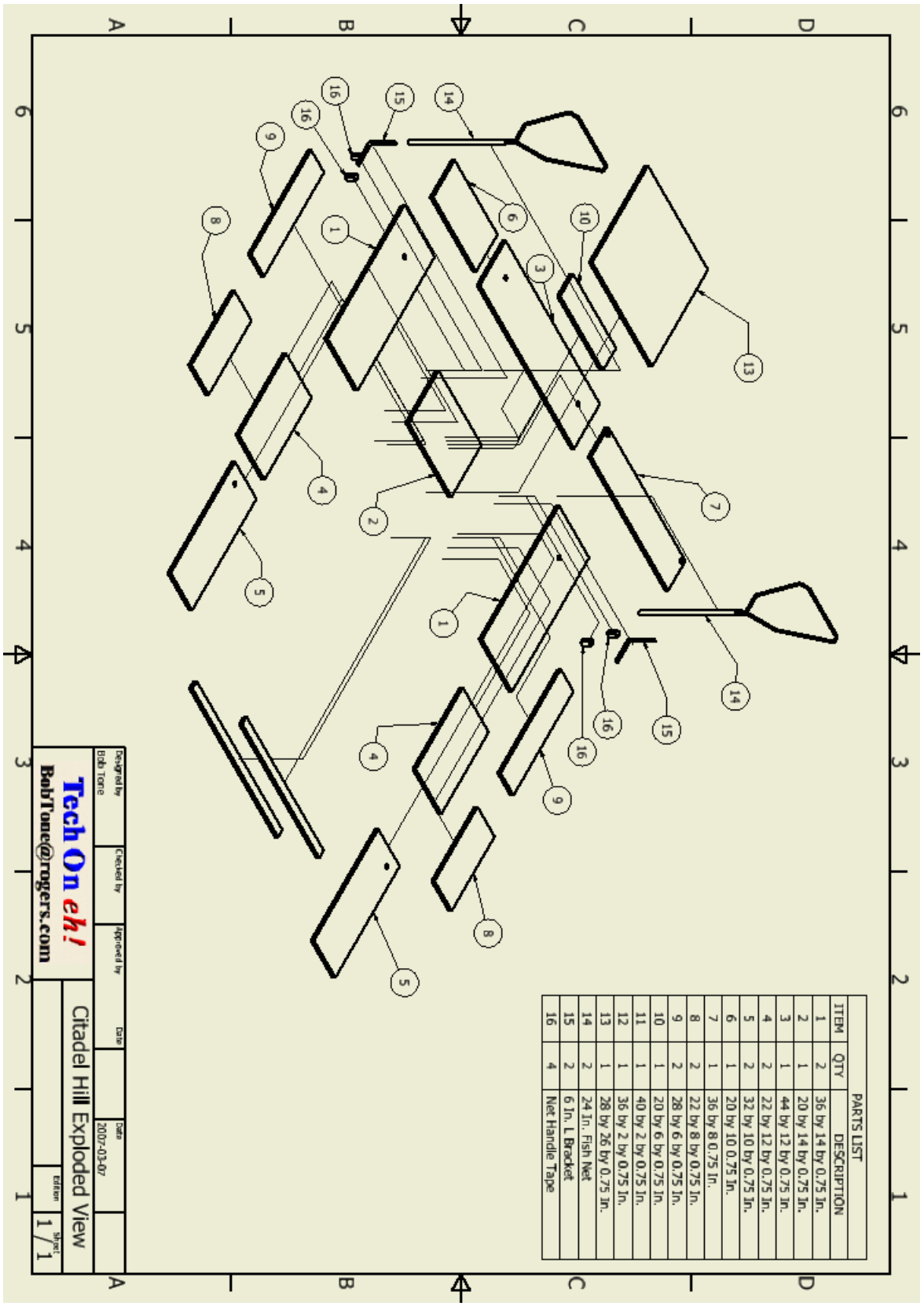
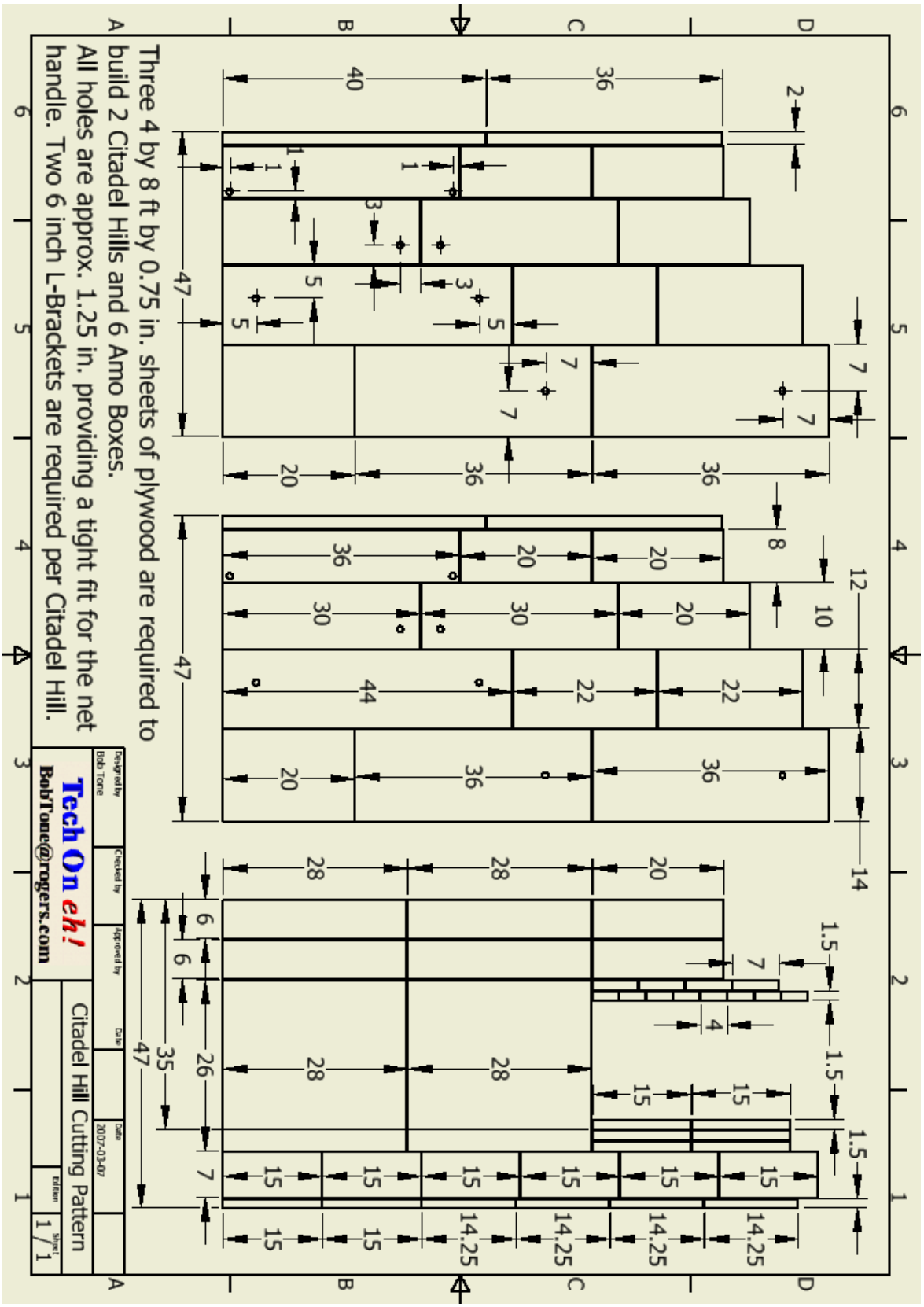
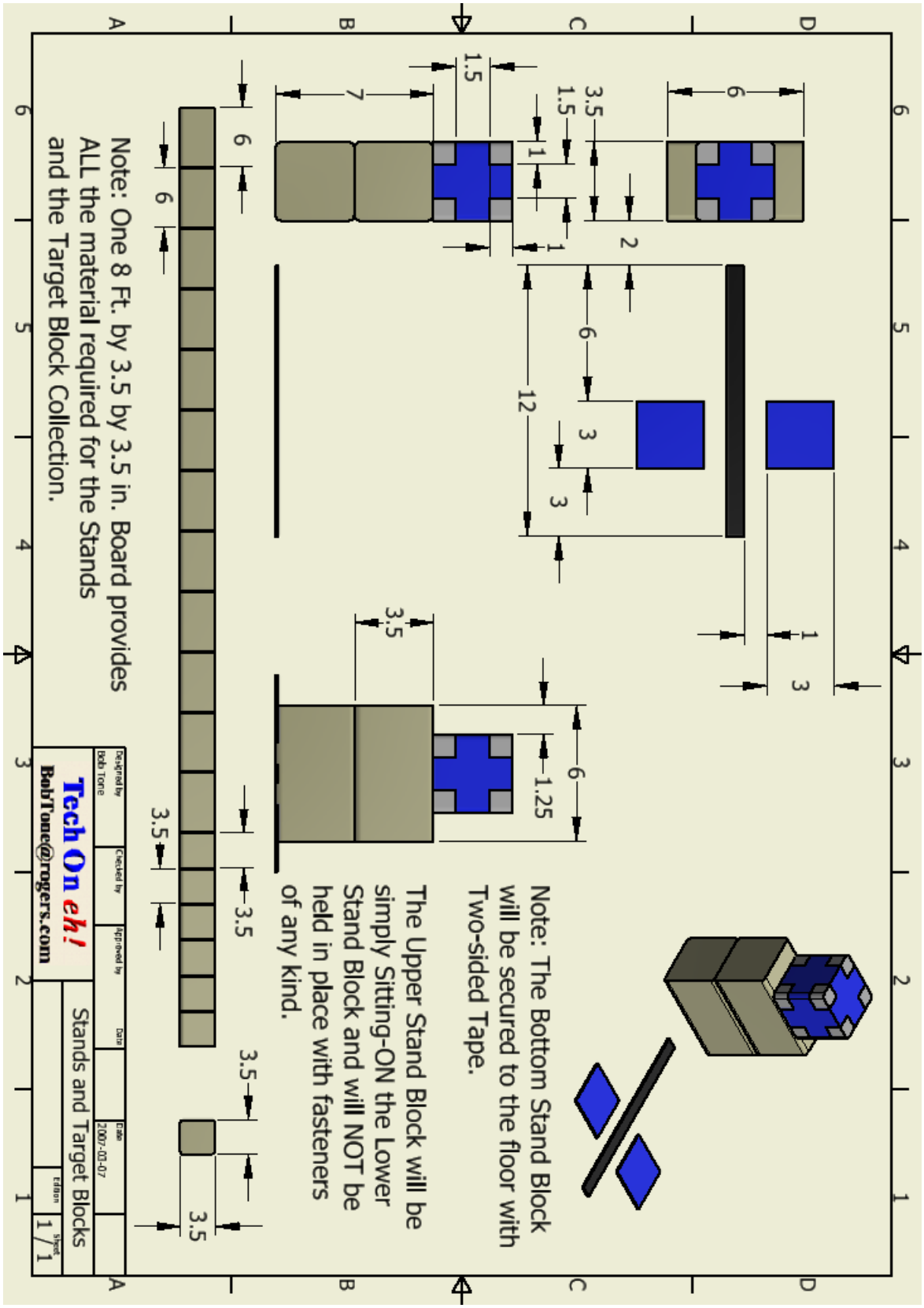
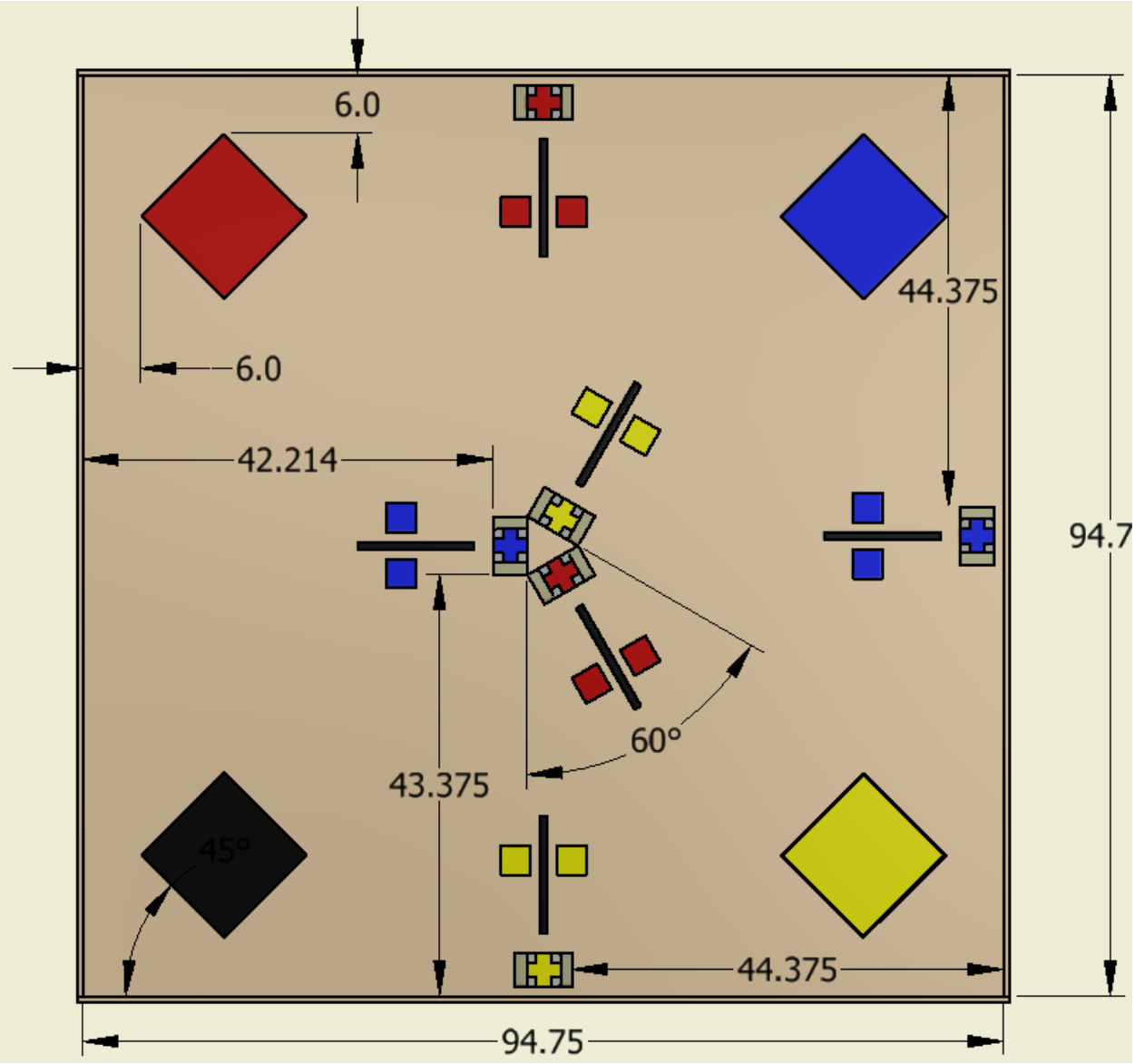
Tech On eh!
BobTonne@rogers.com
Citadel Hill
2007-03-07
1/1

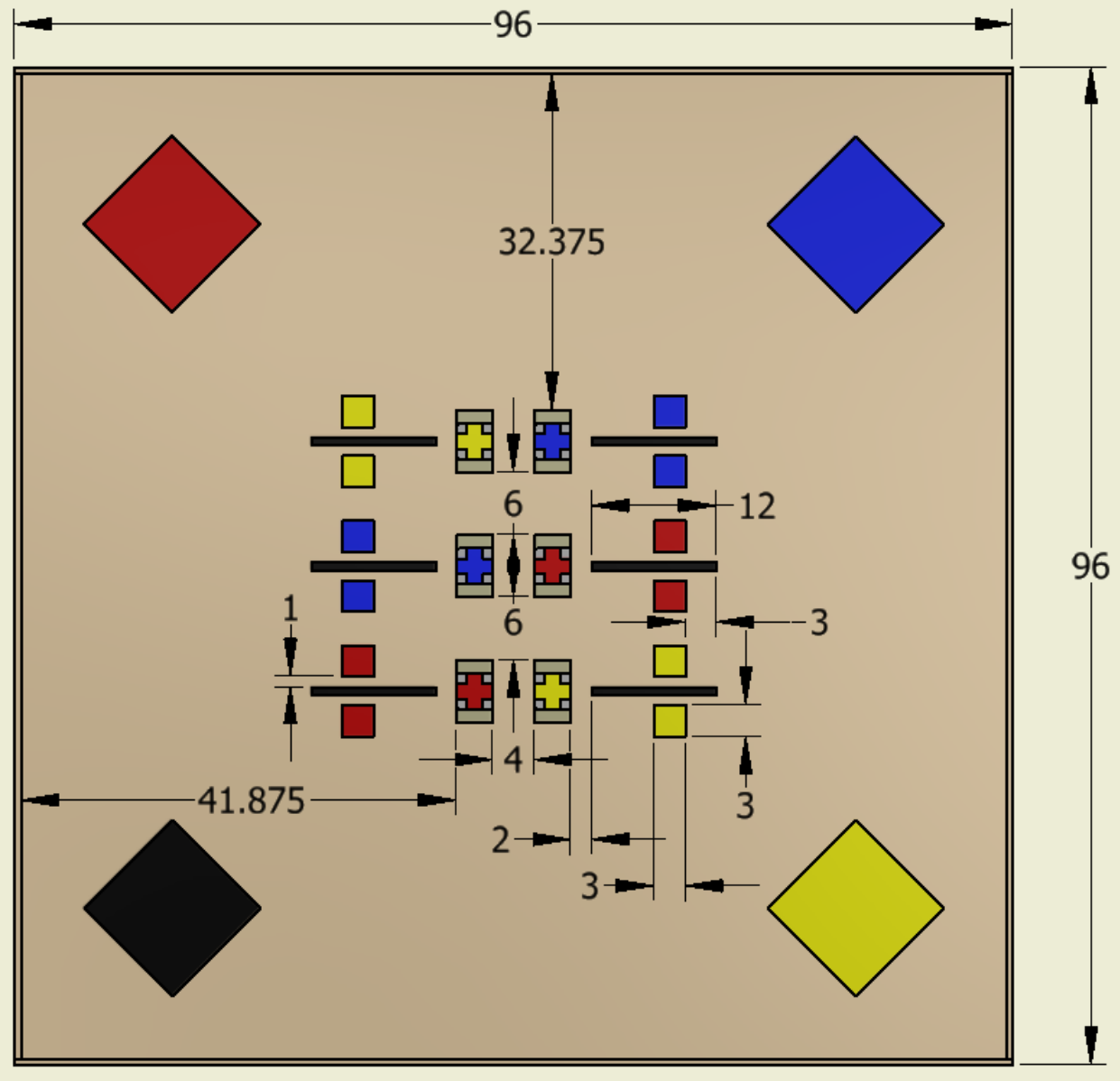

PARTS LIST
ITEM QTY DESCRIPTION
1 2 36 by 14 by 0.75 In.
2 1 20 by 14 by 0.75 In.
3 1 44 by 12 by 0.75 In.
4 2 22 by 12 by 0.75 In.
5 2 32 by 10 by 0.75 In.
6 1 20 by 10 0.75 In.
7 1 36 by 8 0.75 In.
8 2 22 by 8 by 0.75 In.
9 2 28 by 6 by 0.75 In.
10 1 20 by 6 by 0.75 In.
11 1 40 by 2 by 0.75 In.
12 1 36 by 2 by 0.75 In.
13 1 28 by 26 by 0.75 In.
14 2 24 In. Fish Net
15 2 6 In. L Bracket
16 4 Net Handle Tape
Designed by Bob Tonn
Checked by
Approved by
Date
Tech On eh!
BobTonn@rogers.com
Citadel Hill Exploded View
Date 2007-03-07
Edition
Sheet 1 / 1


Three 4 by 8 ft by 0.75 in. sheets of plywood are required to build 2 Citadel Hills and 6 Amo Boxes.
All holes are approx. 1.25 in. providing a tight fit for the net handle. Two 6 inch L-Brackets are required per Citadel Hill.
Designed by Bob Tonie
Checked by
Approved by
Date
Tech On eh!
BobTonie@rogers.com
Citadel Hill Cutting Pattern
Date 2007-03-07
Edition
Sheet 1/1

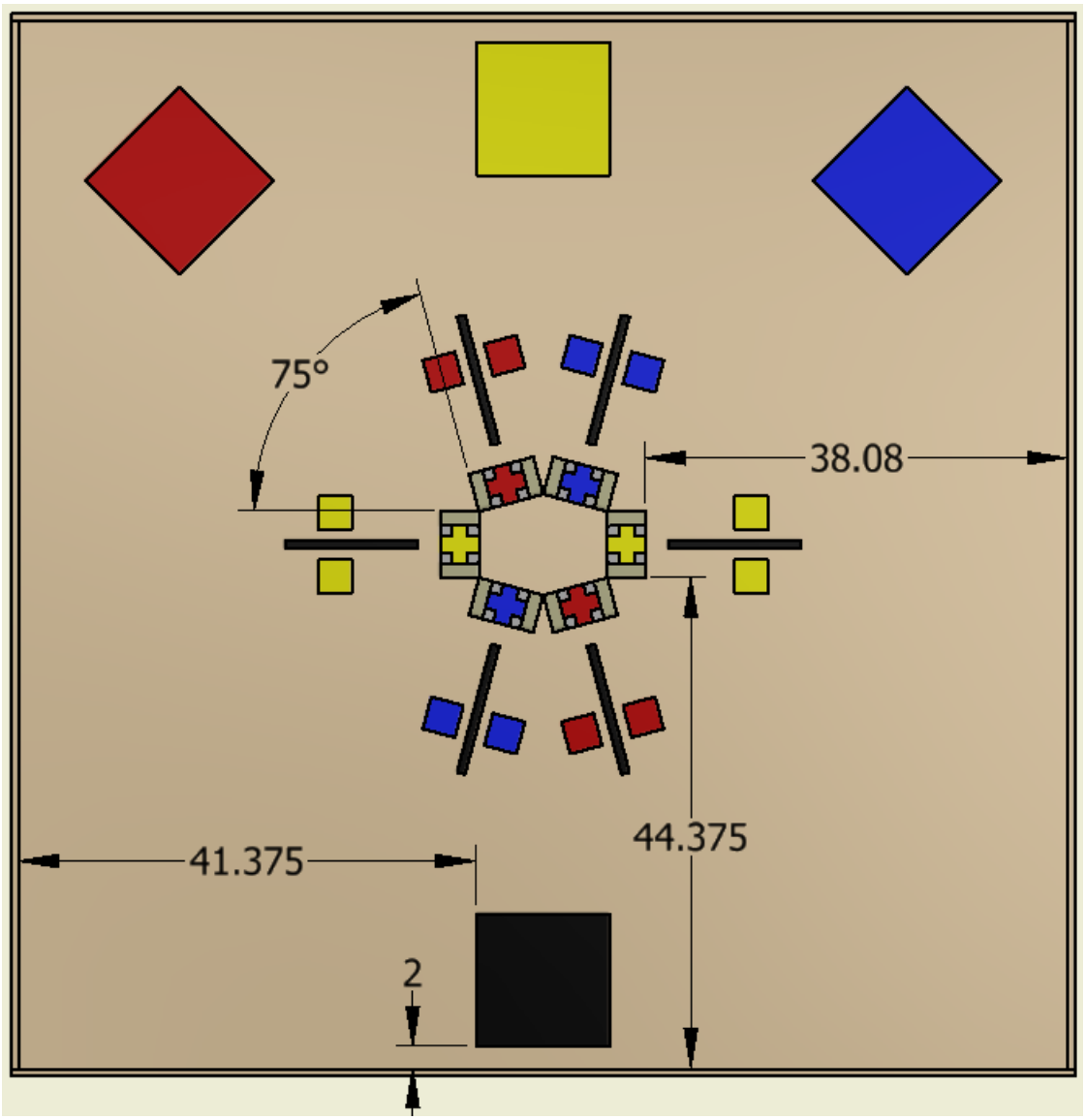

Note: One 8 Ft. by 3.5 by 3.5 in. Board provides
ALL the material required for the Stands
and the Target Block Collection.
Note: The Bottom Stand Block
will be secured to the floor with
Two-sided Tape.
The Upper Stand Block will be
simply Sitting-ON the Lower
Stand Block and will NOT be
held in place with fasteners
of any kind.
Tech On eh!
BobTonne@rogers.com
Stands and Target Blocks
2007-03-07
1 / 1



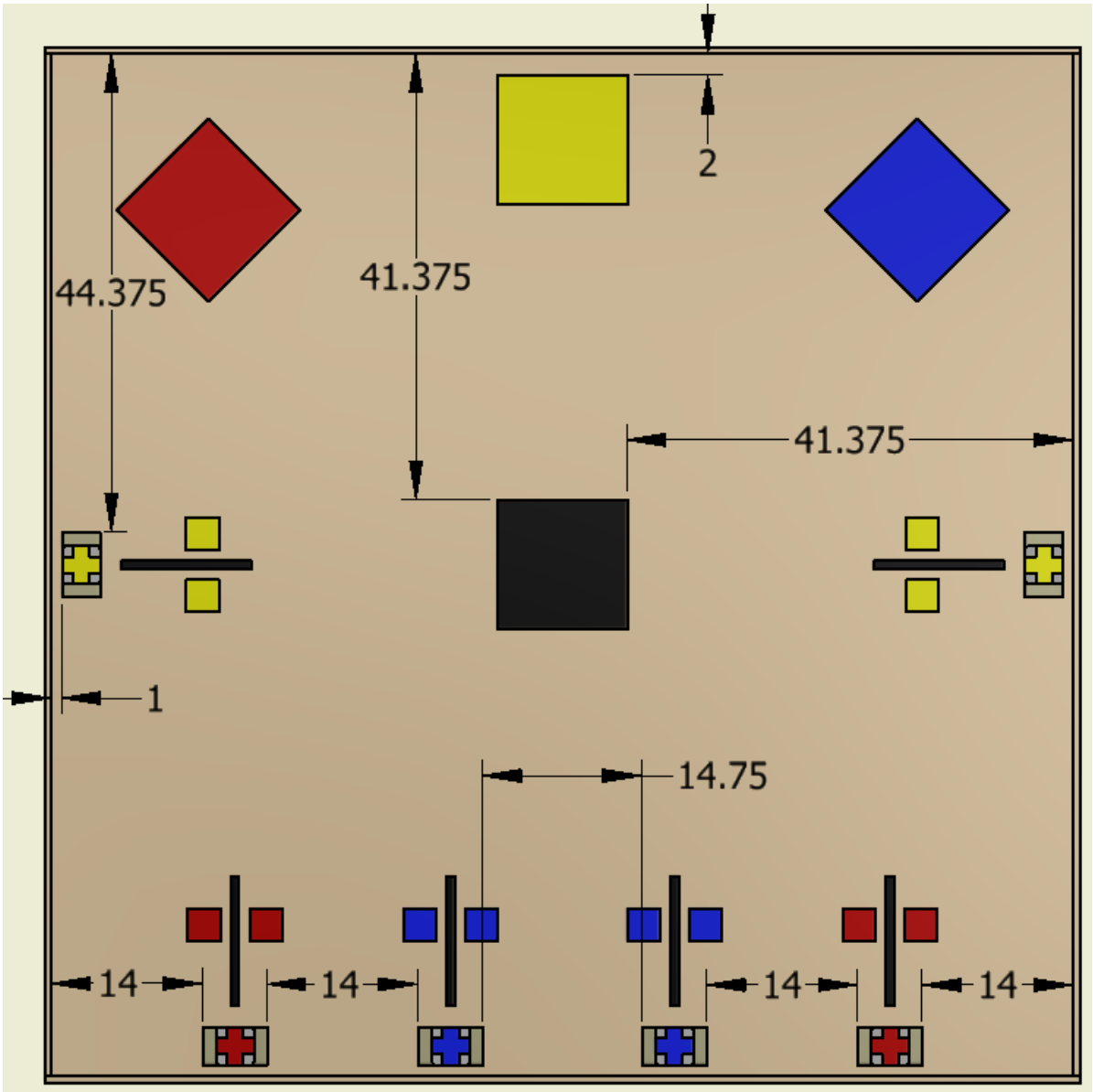
Autonomous Performance Environment Layout One Details



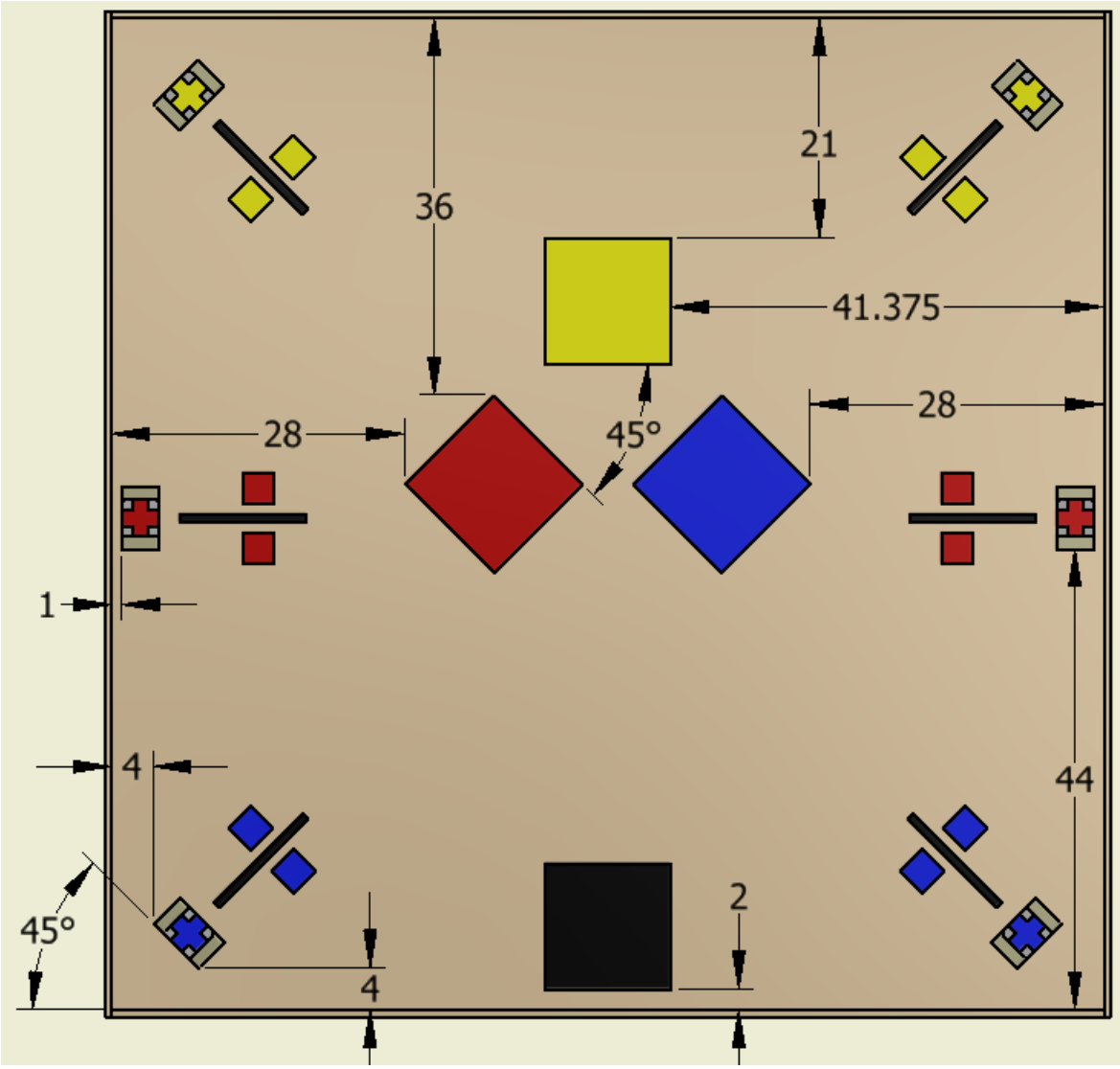
Autonomous Performance Environment Layout Two Details



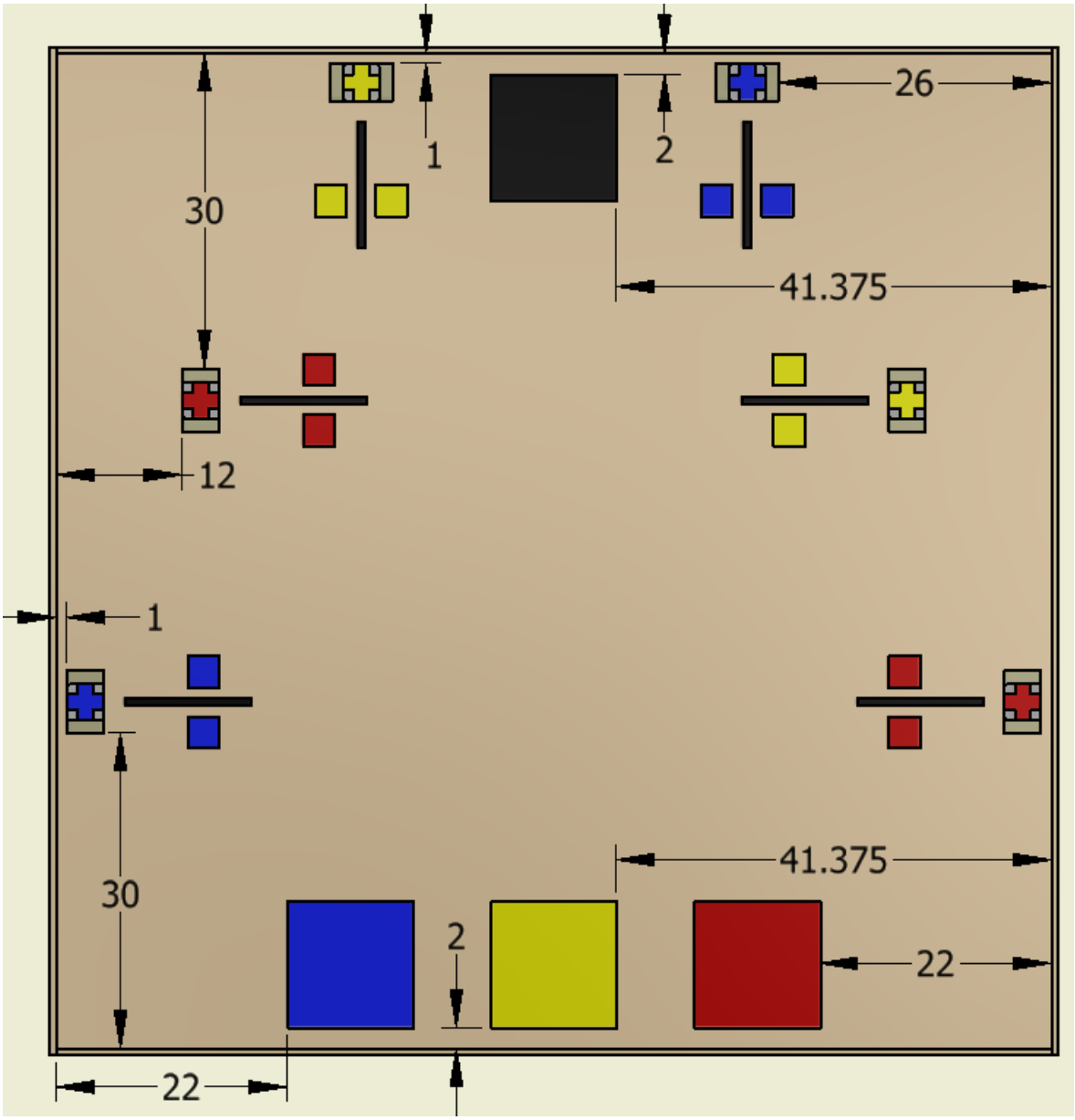
Autonomous Performance Environment Layout Three Details



Autonomous Performance Environment Layout Four Details



Autonomous Performance Environment Layout Five Details



Autonomous Performance Environment Layout Six Details