

2018 Border Challenge Robotics Competition

<https://borderchallenge.weebly.com/>

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Section 1 – Introduction

With all the technological advances in law enforcement society still experiences crime. Originally used to reduce casualties related to explosive ordinance disposal (EOD), robots have been available for bomb disposal since the early 1970s. Like most technology, the costs and size associated with robotics has decreased paving the way for expansion into other military and law enforcement applications. Thanks to the 1033 Program and procurement by individual agencies, robots are increasingly common in domestic law enforcement today.

The skills learned from designing, engineering, building, and testing a robot combined with teamwork, problem solving, and competition mirror the problem-solving approach students of today need to solve new challenges of tomorrow in all industries including law enforcement.

This competition is designed to mesh the fields of robotics and domestic law enforcement to have students apply both technical and tactical expertise in combating crime and saving life.

Section 2 – The Robot

Robot Overview

Robots **must** be constructed with VEX Robotics EDR or IQ kits and parts. Which can be found here: <https://www.vexrobotics.com> Prior to the start of competition, the robot must pass an inspection. Only one robot will be allowed to compete per team.

Robot Rules

1. The robot must be remotely operated by a VEX joystick.
2. Robots can be constructed with any VEX robot construction kits and materials
3. Robots cannot interfere with or be designed to defeat competition elements.
4. Robot can be no larger than 20" width x 20" length x 20" height and will be measured at the start of the competition by a competition judge.
5. Teams must bring the robot to the field prepared to compete.
6. At the start of competition, the robot will be placed in the designated starting area (Command Post) for measurement.
7. Once placed in starting position and after measurement a robot can no longer be modified by any team member or "touched" by human hands until the competition round has completed, or the robot has become immobilized, at which time the round will end automatically, and no time bonus will be counted.
8. Robots may expand beyond the given dimensions after the time has started for the competition round.
9. Judges have discretion and final decision that robot is constructed and prepared to compete fairly.

Section 3 – The Competition

Competition Overview

This competition will encompass elements of an emergency and or disaster situation that law enforcement officials can benefit from the assistance of a robot.

For 2018 these elements include: A hostage situation, a barricaded suspect, and a bomb threat.

Competition Teams

Teams can consist of no more than 4 students per team.

Invited schools may enter no more than 4 teams per school.

Each team must be registered, and entry fees paid by the competition payment due date.

Fee is \$50 per team.

Competition Objectives

There are **five objectives** that ***the robot must complete***.

Objective 1 must be completed first, objectives 2 through 4, can be completed in any order. The

***Note:** Items will be on the floor but may be picked up and “handed” to the robot, or “placed” on the robot; however, if an item is dropped it can no longer be touched by human hands or the robot and will be considered field debris.

Objective 5 is ongoing throughout the competition round.

Aside from collaborating to prepare for the competition: A team interview is the **team objective** that ***the team must complete*** on the day of competition.

Robot Objectives

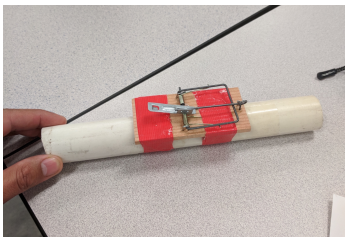
- 1. Establish communication with the hostages**, the scenario supposes that hostages have been held captive for quite some time and no contact has been made with the suspect. After many hours, a hostage is seen through a window and signals for a phone. Communication will try to be established between the hostages and law enforcement. ***The robot must deliver a cellular phone to the designated hostage holding area from the command post and return to post.*** (See ***Note** above under section Competition Objectives)

Objective 1 must be completed first, remaining objectives (2-5) can be completed in any order.

- 2. Deliver aid to the hostages**, after establishing communication with the hostages, it is determined that:

- a. One of the hostages is wounded. **The robot must deliver a small first aid kit to the hostage from the command post.** (See *Note above under section Competition Objectives)
 - b. One of the hostages is diabetic and in need medication. **The robot must deliver medication to the hostage from the command post.** (See *Note above under section Competition Objectives)
 - c. One of the hostages is dehydrated and in need of hydration. **The robot must deliver a water bottle to the hostage from the command post.** (See *Note above under section Competition Objectives)
- 3. Perform recognizance and clear the area for SWAT**, Further intel gathered from the robot and hostages indicates that the suspect has placed a pressure activated explosive device. Locate the explosive device and remove it from the box safely without detonation. **The robot must remove a blanket covering a box, reach into the box, and remove the explosive from the box, then complete objective 4. (EOD)**
- 4. Explosive Ordinance Disposal (EOD)** **The robot must safely dispose of the explosive by placing it within a bomb disposal box. The explosive is a “Pressure Activated Pipe Bomb” See images below.**

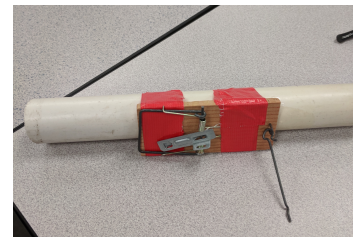
For the purpose of this challenge detonation occurs when and if the mouse trap hold-down bar is released and the spring and hammer are activated.



Active Explosive
Hold-down bar set



Side View



Detonated Explosive
Hold-down bar released

- 5. Mobility** **The robot must traverse various indoor/outdoor terrain (debris, rubble, gravel, dirt/sand, grass, etc.)**

Competition Elements

Any item dropped by the robot becomes field debris.

Competition elements may be similar in size, dimension, and weight to the items listed below.

(Items may be substituted with a similar item):

- A smart phone similar to a Samsung Galaxy Note or Apple iPhone Plus

- A small first aid kit (approx. 1.75 x 6.00 x 5.50 Inches)
- Medications in a sealed sandwich size zipper bag
- A 16.9oz water bottle
- A small newborn receiving blanket
- A box similar to a shoe box
- Fake explosives
- Bomb disposal box
- Various obstacles and debris, i.e. ceiling tile, sheetrock, rubble, gravel, dirt, sand.

Competition Rounds

A round is 5 minutes in length.

Teams will have 5 minutes to complete as many objectives as possible.

Robot will be placed in starting point for inspection and measurement.

Judge will confirm with driver that he or she is ready.

5 minutes will be set on the timer, on go – driver may begin the robot competition round.

Each team will have only **one** round to complete the competition objectives and be scored.

Team Robot Objectives will be scored by the scoring rubric at the end of the round, based on the robot performance.

Bonus points can be added to the score based upon time remaining, when the driver has indicated they are complete or the robot has become immobilized and call “time”.

Time remaining will then be recorded.

In the event of a tie, a second round of robot competition objectives will occur, and the combined highest score will break the tie.

Team Objective

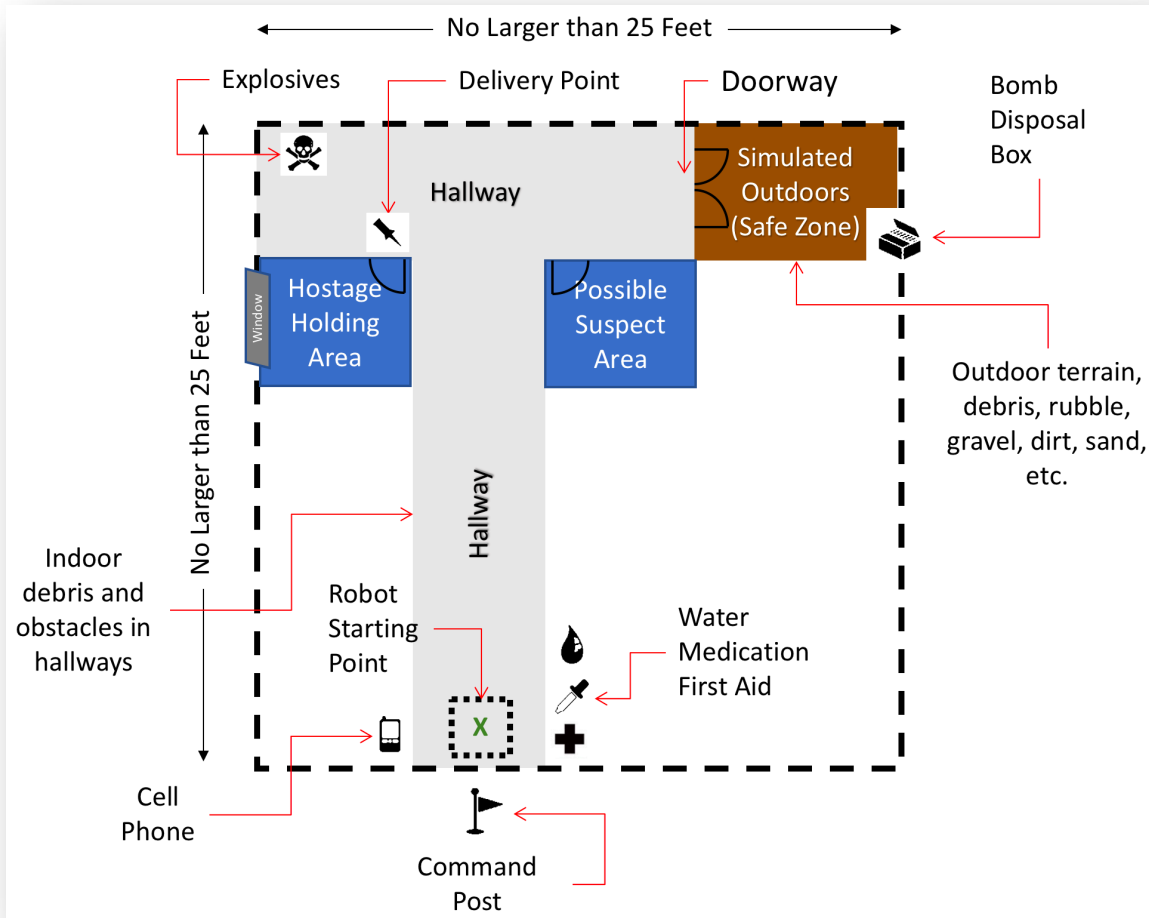
Positive, respectful, and ethical conduct of all students and adults associated with a team is an important to competition. Judges will consider all team conduct by students and/or adults when determining award recognition.

Judges will interview teams in their assigned pit areas. Teams must be available before or after they compete for an interview.

Scores will be recorded on the team objective – interview scoring sheet.

Competition Field

An open area will be used to simulate a t-shaped hallway section of a building. The command post will be at the south side of the hallway. The entire area will be marked off with cones and/or caution tape. Students may not pass the caution tape. The Competition field shall be no larger than an area of 25' by 25' in total with line of site to the robot from command post and all other areas at all times. Team members may not pass the striped area. Driver must operate robot from outside the area.



Section 4 – Scoring

Robot Objectives - Scoring Sheet

Objective	0 Points	2 Point	5 Points	10 Points	Points Possible	Points Earned
1. Communication with hostages established. (-5 points penalty if not completed first)	Cell phone did not leave command post	Cell phone left command post but did not make it to hostages or fell off robot and item became debris (-5 points from total score penalty)	Cell phone left command post and was successfully delivered to hostage delivery point	X	5 <input type="checkbox"/> Penalty <input type="checkbox"/> Penalty	
2A. Delivery of first aid to the hostages.	First aid did not leave command post	First aid left command post but did not make it to hostages or fell off robot and item became debris (-5 points from total score penalty)	First aid left command post and was successfully delivered to hostage delivery point	X	5 <input type="checkbox"/> Penalty	
2B. Delivery of medication to the hostages.	Medication did not leave command post	Medication left command post but did not make it to hostages or fell off robot and item became debris (-5 points from total score penalty)	Medication left command post and was successfully delivered to hostage delivery point	X	5 <input type="checkbox"/> Penalty	
2C. Delivery of water to the hostages	Water did not leave command post	Water left command post but did not make it to hostages or fell off robot and item became debris (-5 points from total score penalty)	Water left command post and was successfully delivered to hostage delivery point	X	5 <input type="checkbox"/> Penalty	
3. Clear the area for SWAT	No attempt to clear the area	Blanket was moved	Blanket was removed from the box completely	Attempt was made to remove the explosive	17	
4. EOD	Explosive untouched	Explosive was removed from the box completely	Explosive moved to or passed the safe zone	Explosive placed in bomb disposal box	17	
4. EOD Penalty	Robot dropped the explosive or Explosive detonated at any time during handling before being placed in bomb disposal box. No penalty if detonation occurs in bomb disposal box (-15 points from total score penalty)				<input type="checkbox"/> Penalty	
5. Mobility	Robot became immobilized at any time during competition	Robot traversed "indoor" obstacles and elements with ease	Robot traversed "outdoor" obstacles and elements with ease	Robot can travel anywhere with ease	17	
Time Bonus	Used all 5 minutes, time expired	Time remaining after all objectives completed added to final score. Rounded to nearest ¼ min. 15 seconds = .25, 30 seconds = .50 45 seconds = .75 1 min = 1			Time Remaining _____	

School: _____ Team Number: _____ Team Robot Score: _____

Judge Initials: _____ Team Captain Initials: _____

Team Objective - Interview Scoring Sheet

Criteria	1 point	3 points	5 points	Points Possible	Points Earned
Robot Design Process	Students can explain limited aspects of the robot design process.	Students can explain most aspects of the robot design process.	Students can clearly explain the robot design process.	5	
Effective Project Management	Students cannot explain how team progress was monitored and/or how students were assigned to tasks.	Students can explain how team progress was monitored and how students were assigned to tasks.	Students can explain how team progress was tracked against an overall project timeline and how students were assigned to tasks based on their skills and availability.	5	
Competition Strategy related to Robot Design	Students can only describe one strategy and design, or they cannot explain how and why the current strategy or design were selected.	Students can describe at least two strategies and designs that were considered and can explain how or why the current strategy or design were selected.	Students can describe multiple strategies and robot designs that were considered, and they can fully explain how and why the current strategy and robot design were selected for competition.	5	
Teamwork & Communication Skills	Students demonstrate limited teamwork, fluency, and courtesy. Evident one student did all or most of the work.	Students demonstrate some teamwork, fluency, and courtesy. Evident that 2-3 students did all or most of the work.	Students demonstrate high level of teamwork, fluency, and courtesy. Evident that all team members participated and completed the work cooperatively.	5	
Interview	Students rely on one or two members to answer all the questions.	Students support each other as needed to answer the Judges' questions.	All students independently answer the Judges' questions.	5	
Professionalism	Students do not present themselves in a respectful and courteous manner.	Students present their answers in a respectful and courteous manner to either the team members or the Judges.	Students present their answers in a respectful and courteous manner to the Judges and other team members, making sure each team member has a chance to contribute and waiting to speak until the other student has finished.	5	
Total Team Objective Points:				30	
Total Robot Objectives Points:				71	
+ Time Bonus (if applicable):					
-Penalties (if applicable):				-40	
Total Score:				101 + time Max Score Possible	