Washington-only event
ROBOTICS CHALLENGE - HIGH SCHOOL

OVERVIEW

Students will design, build, test and demonstrate a remote controlled robot and necessary accessories in order to carry out a specific challenge. This event is not platform-specific.

ELIGIBILITY

Open to Washington TSA middle school chapters. Three (3) teams per chapter – Team of Two (2) minimum to Four (4) maximum.

ATTIRE

TSA competition attire is required.

PREPARATION

A. Teams are required to submit an Engineering Journal in PDF format on a USB flash drive for evaluation.
B. Judges will use contest rubrics to determine results.

TIME LIMITS

A. Entries must be started and completed during the current school year.
B. Each team selects a demonstration time during check-in. Teams should try to avoid conflicts with other events when selecting their demonstration time.
C. Each team is allowed three (3) minutes of preparation time.
D. Each team has three (3) minutes to demonstrate its solution to the problem.

REGULATIONS AND REQUIREMENTS

Students will work to develop their leadership and 21st century skills in the process of preparing for and participating in this Washington TSA competitive event. The development and application of those skills must be evident in their submission, demonstration, and/or communication pertaining to the entry.

Competitors in this event cannot move onto the National TSA conference in this event, as it is state-only.

PROCEDURE

A. Only registered team members are permitted to check in, prepare and demonstrate the entry. Conference ID Badge is required.
B. **REGIONAL CONFERENCE** – Design Challenge will be determined by the state conference coordinator and specifications will be provided to contestants at least two months prior to the Regional Conference.
C. **STATE CONFERENCE** – Design Challenge will be determined by the state conference coordinator and specifications will be the same for Regional and State Competitions.
D. All robots, controllers, batteries, accessories and engineering journals on a USB flash drive will be collected at a time and place indicated in the conference program.
E. When the demonstration begins, the testing area is accessible only to judges and the team currently competing.
F. All other contestants must be outside the 10' x 10' perimeter testing area.
G. A spectator area will be set up for viewing.
H. Preparation time (maximum of 3 minutes) is used to install batteries and perform a system check, NOT for practice or modifications.
I. Each team is allowed three (3) minutes to demonstrate the robot.
J. The clock starts at the judge's signal.
K. Each Team is given one (1) opportunity to demonstrate the robot. Elapsed time will be recorded to determine the place winners in event of a tie.
L. Teams whose robot fails to begin at the signal may be given a second chance to start again at the discretion of the event coordinator.

REGULATIONS

A. Course – Specifications for the Course/Challenge for each year will be made available on the WTSA website.

B. Robot – The entry may only consist of the robot, batteries, controllers and Engineering Journal on a USB flash drive.
C. Robots may be constructed using recycled, salvaged and commercial parts. There is no specific platform or vendor required.
D. Any robot control system may be used. Commercial kits may be used, combined, adapted and re-engineered for the design challenge. Examples include, but are not limited to: VEX, LEGO, TETRIX, Fisher/Technic, Lynxmotion, HiTech and/or Arduino.
E. Size Limit for Robot – Size Limit is defined by the competition and field requirements.
F. The robot may be controlled by one or two remote control devices.
G. One or two operators may control the robot during the competition.
H. Bonus Points - teams may obtain bonus points for:
   - Use of sensors in robot performance
   - Use of programming to alter/assist robot control
   - Ability to display results on brain or terminal

COMPETITION

Scenario: Roving the Ocean Floor

The Bethnic Rover was designed to explore the depths of the ocean floor, providing scientists with new data. Your robot should be designed to explore a section of the ocean where an aircraft recently crashed. The robot will collect data on the ocean floor environment, and attempt to recover the black box of the airplane. Listed below are the required tasks.

- Navigate the obstacles & rough terrain without disturbing any plant or animal life.
- Record the oxygen levels by stacking blocks in a tower.
- Identify the species type of crab by color.
- Measure and display on screen the location (x and y coordinates) of organisms on the ocean floor.
- Collect the black box from the airplane.
- Return to the submarine loading device.

The tasks must be completed within 3 minutes.

EVALUATION

WTSA Robotics - Engineering Journal Evaluation

A. Check the WTSA website for the current scoring rubric.
B. Must be submitted on a USB flash drive in PDF format – clearly labeled with team ID #.
C. **Engineering Journal** MUST include:
   - **Plan of Work** – may use worksheet or custom designed document: Date, Task, Time Involved, Team Member Responsible,
   - Robot description: Paragraph describing how the robot meets the challenge. Clearly explain bonus features you expect to receive points for.
   - Engineering Design Process: Problem definition, brainstorm, design, build, test, repeat.
   - **Technical Drawings** – may include: Sketches, and/or Tool Drawings, and/or CAD Drawings

WTSA Robotics - Demonstration Evaluation

A. Check the WTSA website for the current scoring rubric.
B. Deductions of 50 points off of the total possible points may be made for the following: (only once for any or all infractions):
   - Damaging the conference course
   - Arriving late to the demonstration
   - Any conduct unbecoming a TSA participant
C. Disqualification may result for the following:
   - Failing to appear at the selected demonstration time
   - Unsafe Robot Designs – decision at the discretion of the event coordinator

STEM INTEGRATION

This event aligns with the STEM (Science, Technology, Engineering, and Mathematics) educational standards.

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Setup Process (performed by judge/coordinator)

A. The 5 oxygen blocks will be scattered in the designated location (Zone 1) each time.
B. The judge will select 4 "'organisms" (from the supply of 9) and roll them on the ocean floor in Zone 2. The judge will move them so there are no organisms in Zone 1 (near blocks), and they are all approximately 12" apart. There will be a penalty for disturbing the organisms.
C. The judge will spin the dial to set the crab color. (Zone 3)

Demonstration Process

A. The robot begins in the staging/start zone. The robot may be facing any direction to begin, and the driver may touch or modify the robot any time it is in the staging zone.
B. The driver(s) MUST remain in the driver box the entire time.
C. The same robot base must be used for the entire demonstration.
D. The robot cannot cross over or touch any of the PVC pipe that defines the course parameters (penalty for touching PVC).
E. The clock will start on the signal by the event coordinator/judge.
F. The driver may choose to perform the tasks in any order.
G. Zone 1: The driver will stack the "oxygen" blocks to determine the oxygen level.
H. Zone 2: The robot must identify the location (x,y coordinate in inches) of each organism. The result must be displayed via a program on the robot or a monitor.
I. Zone 3: The robot must sense (or see) the crab color to determine the species. The driver may verbally say the color, or have the color displayed on the robot screen. The first color the driver says will be the color recorded.
J. The robot must travel over the "mountains" to reach Zone 4. They may not cross the bare PVC boundary.
K. Zone 4: The driver must turn the handle to open the airplane, and retrieve the black box.
L. The robot should return to the initial staging zone (loading submarine).
M. The clock will stop when the robot is parked in the staging zone after all tasks have been completed or the designated time (3 minutes) expires.

Scoring

Scoring and placement will be based on the sum of the scores of the official scoring rubric

Tie Breaker

In the event of a tie score, the team with the least elapsed time will receive the higher placement.

RESOURCES/RECOMMENDATIONS FOR FIELD SET-UP MATERIALS

Competition Area

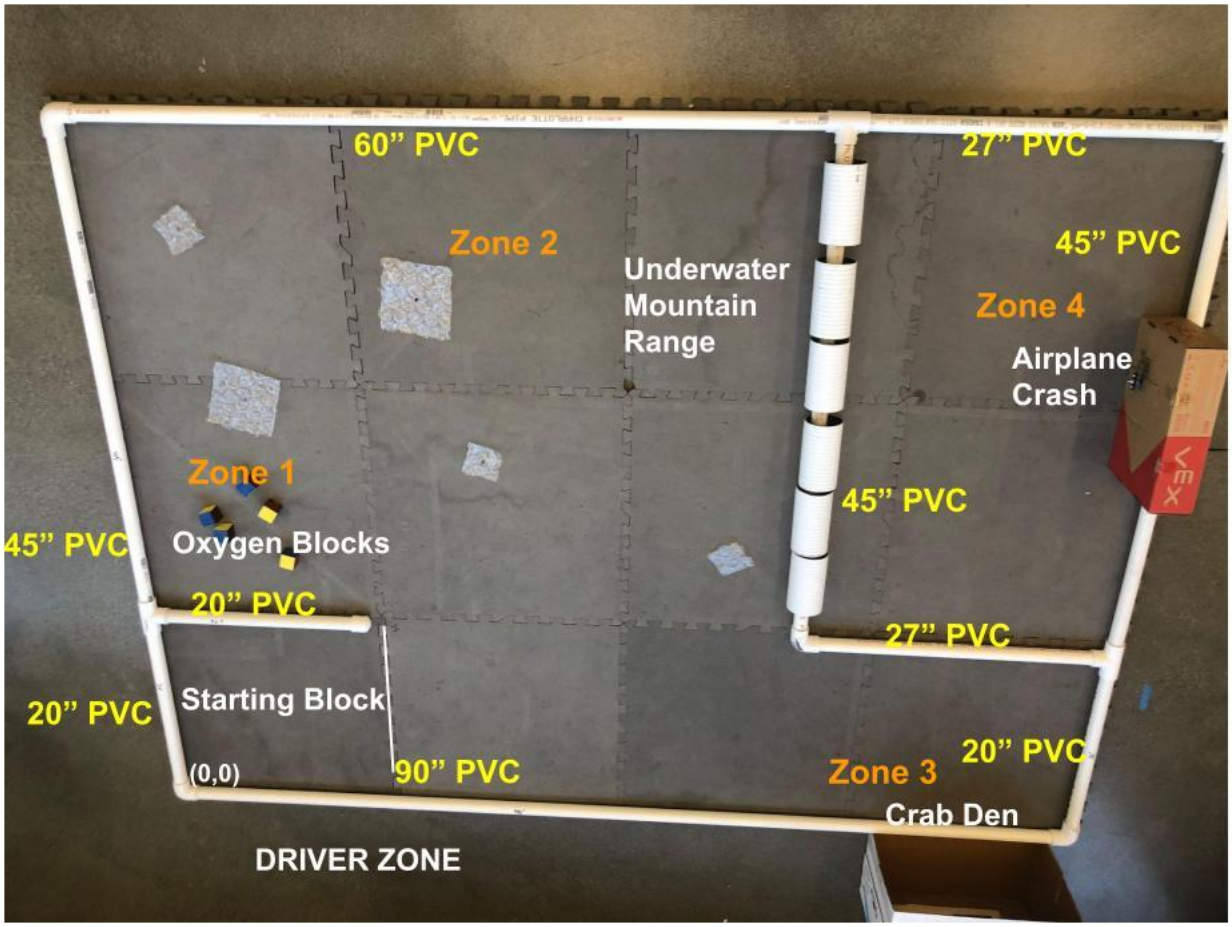
A. The competition area will be defined by using 1" Schedule 40 PVC pipe and appropriate fittings. (Couplers, "T"'s, Elbows)
B. The inside dimensions of the boundary will measure: 67" L X 90" W. (+/- 1") (12 Vex Tiles)
C. See diagram and bill of materials for details field layout.

Bill of Materials

Quantity	Size	Material	Description
3	1"ø X 20"L	Schedule 40 PVC Pipe	Zone dividers
3	1" X 1" X 1"	Schedule 40 PVC "T"	Branches
5	1" X 1"	Schedule 40 PVC 90° Elbow	Corners
3	1"ø X 45"L	Schedule 40 PVC Pipe	Zone dividers
2	1"ø X 27"L	Schedule 40 PVC Pipe	Zone dividers
1	1"ø X 90"L	Schedule 40 PVC Pipe	Outer boundary
2	1"ø X 60"L	Schedule 40 PVC Pipe	Outer boundary
12	24" x 24"	Standard Vex Tiles	Ocean Floor
2	11" x 11"	Tagboard	Crab Species
4	5" x 5"	Construction paper – 1 ea red, blue, yellow, green	Crab Species
1	Roll	Packing Tape	Crab Species
1	12" x 18" x 10"	Standard ream paper box	Crab Species
1	Small	Brad	Crab Species
6	6" segments	3" Triple wall Solid Drainpipe	Mountains
1	13 ½" x 9" x 3 ¼"	Thick Cardboard Box	Airplane
2	6" or greater	Zip ties	Airplane
1	2 ¼ x 2 ¼ x 1 ¼ "	Heavy Weight – Vex Motor	Airplane
1	2' x 2' of large bubble wrap	Cut into 3 4" x 4", 3 6" x 6", and 3 3" x 3" squares.	Organisms
5	1 ½ " x 1 ½ " x 1 ½"	Blocks - painted any color. Cut from 1.5" square trim wood – actual size is slightly smaller.	Oxygen Level Indicators
1	3"	Shaft	Airplane Handle
2	2 x 5 hole	Flat plates – Actual handle inside and out	Airplane Handle
2	2 x 3 hole	Flat plates – Against cardboard	Airplane Handle
2	Ea	Lockplates against flat plates	Airplane Handle
4	3/8"	Screws + 4 kepts nuts	Airplane Handle
2		Spacers – ½ " on outside and 1/8" on inside	Airplane Handle
1		1 post hexnut retainer with bearing	Airplane Handle

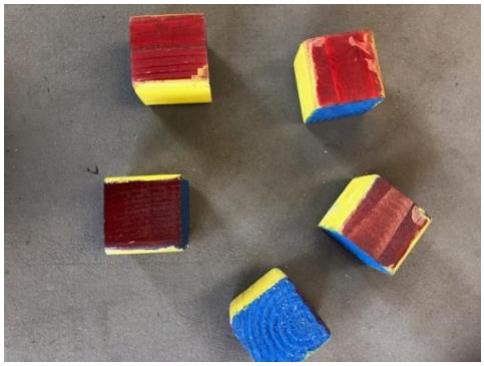
Field Boundaries:

A. The field boundaries will be defined by 1" PVC pipe and fittings as demonstrated in the diagram below.
B. The field surface will be 12 standard VEX field tiles (+ 1 for the loading zone).



Zone 1: Count Oxygen Level

A. Five 1 ½ " cubes (painted any color) will be randomly placed in zone 1 prior to demonstration. They will be all within one tile.



Zone 2: Organism Locations

A. 9 Organisms – Place a black sharpie dot in the center of each. All measurements will be based off that location.
   a. 3 Large (6" x 6")
   b. 3 Medium (4" x 4")
   c. 3 Small (3" x 3")

B. Prior to demonstration, 4 organisms will be randomly selected and placed on the floor. There will NOT be any organisms in the same tile as the blocks. An attempt will be made for all organisms to be 12" apart.

Zone 3: Crab Species Identification

Note: You can use any method to practice this, just have a 4" x 4" color placed approximately 4" in from the left of an empty paper ream box, and 2 ½" from the bottom of the box

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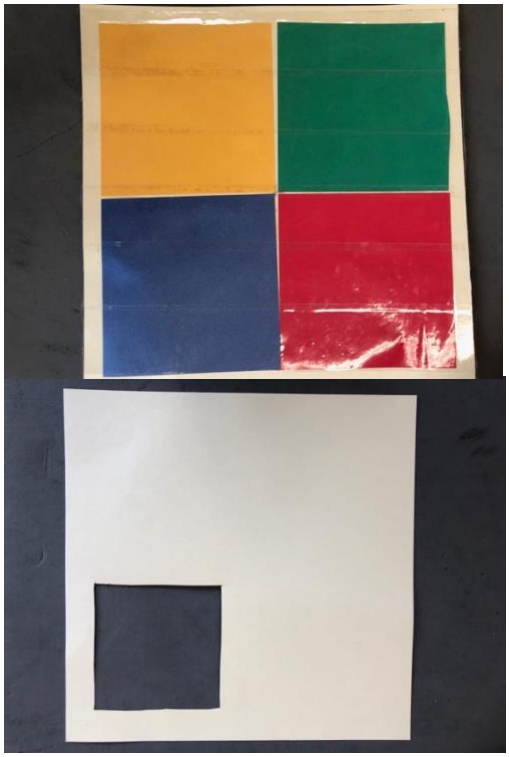
A. Crab Species – a paper wheel with 4 different color options. Place the 4 color construction pieces on one of the tag board pieces. I covered with packing tape to laminate.

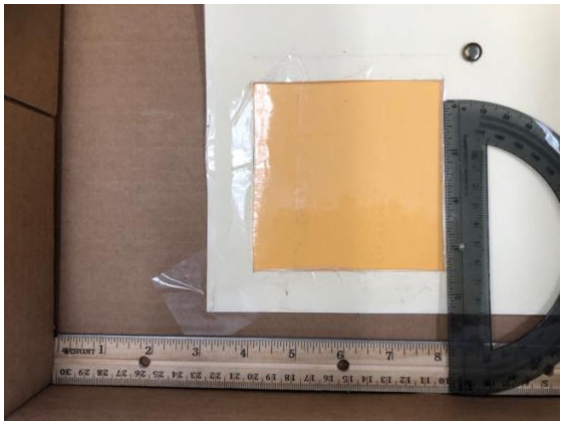
B. Cut a 4" x 4" "window" in the second piece of tagboard, 1" x 1" in from the lower left corner. I also laminated with packing tape.

C. Punch a hole in the center of both, and attach with the brad to create a color wheel. I cut off the corners of the COLOR tagboard to allow easier spinning. Be sure the entire square still shows in the window.



D. Place the paper box on its side so it opens to the left. Cut a slit along the rear top (about 1" in from the back) to place your color wheel inside.

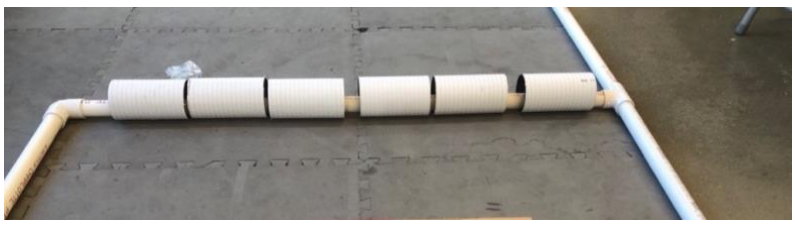
E. Position the front of the color wheel so the window is approximately 4" in from the left of the box, and 2 ½" from the bottom of the box. The top should be sticking out to allow the demonstrator to spin to a different color. Tape down the corners of the window tagboard to hold it in place. Yellow is shown below, but you should be able to spin from the top to allow any color to show.



F. Place the box as shown below so that the driver can NOT see inside the box.

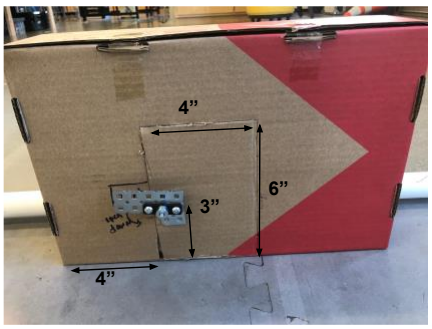
Zone 4 Boundary: Underwater Mountain Range

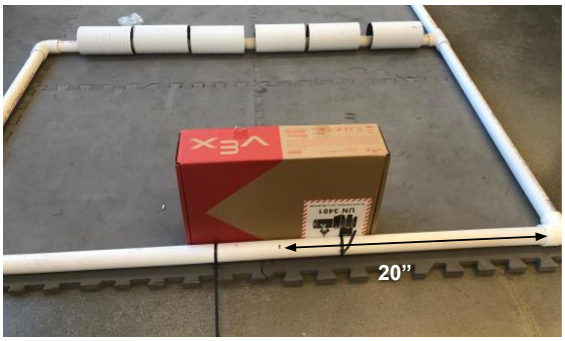
A. Place six of the 6" cans along the 45" piece of pipe as shown.



Zone 4: Airplane Crash

A. Airplane – thick cardboard box 13 ½" x 9" x 3 ¼". Cut door 4" from left, 4" x 6", hinge on right (scored cardboard). Ziptie box to pipe at back (centered 20" from corner pvc).





B. Black Box – Vex motor placed immediately inside door.

C. The handle is built out of misc. Vex parts – could be anything that turns 90".

3" shaft
2 2 x 5 hole flat plates (handles)
2 2 x 3 hole flat plates (against cardboard)
2 shaft collars

2 lockplates
4 3/8" screws + 4 keps nuts
1 ½" spacer (on outside) and 1/8" spacer (on inside)
1 post hexnut retainer with bearing

WTSA ROBOTICS: OFFICIAL SCORING RUBRIC

ROBOTICS CHALLENGE

2024 OFFICIAL RATING FORM **MIDDLE SCHOOL**

Robotics Challenge Specifications Compliance Go or No-Go

A robot that is marked No-Go for any of the requirements below will not advance to the performance stage of the event.

Team members must have safety goggles.	**Go**	**No-Go**
The robot is safe to operate	**Go**	**No-Go**
A portfolio is present	**Go**	**No-Go**

Engineering Journal Portfolio (50 points)

CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points	Record scores in the column space below
Portfolio (x1)	Portfolio is unorganized and missing 3 or more components.	Portfolio has most components, and it is somewhat organized.	One or no components are missing in the portfolio, and the content and organization are clear.	
Robot Description (x1)	A brief description of the robot is provided.	An explanation is provided of how the robot will meet most of the challenges.	A clear explanation is provided of how the robot is designed to meet each of the challenges. Any bonus features are described thoroughly.	
Design Process Documentation (x2)	Design documentation lacks information about the design process (including testing and adjustments) for the final robot.	Design documentation adequately conveys the design process (including testing and adjustments) for the final robot.	Documentation provides thorough and quality information about the design process (including testing and adjustments) for the final robot.	
Technical Drawings (x1)	Sketches and/or pictures do not help illustrate the design process.	Sketches and/or pictures are appropriate and help illustrate the design process.	Sketches and/or pictures are of excellent quality and thoroughly illustrate the design process.	
			ENGINEERING JOURNAL PORTFOLIO SUBTOTAL (50 Points)	

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Demonstration Scoring (100 points)			
CRITERIA	**Points Possible**	**Points Earned**	**Notes**
Missions			
Zone 1: Stack oxygen blocks	5 ea		5 points for each block stacked on another block (20 max)
Zone 1: Complete oxygen stack	10		10 extra points for all 5 blocks in one stack
Zone 2: For each organism, identify exact x and y coordinates (in inches).	5 ea		Exact location is the center of the object. Locations within 1 inch any direction are acceptable. (20 max)
Zone 3: Correctly identify the crab species (color)	10		Color may be spoken out loud or printed on screen
Zone 4: Cross the barrier	10		MUST cross the mountains, not the bare PVC
Zone 4: Open the door	10		
Return to Staging Zone	10		
Return with the Black Box	10		
Deductions			
Touched any PVC boundaries.	-3 each		Each occurrence (no max)
Disturbed any organism	-5 each		Each occurrence (20 max)
DEMONSTRATION SUBTOTAL (100 Points)			
Elapsed Time (for tie breaker only)			

TOTAL (150 points)	
ENGINEERING JOURNAL PORTFOLIO SUBTOTAL (50 Points)	
DEMONSTRATION SUBTOTAL (100 Points)	
Elapsed Time (for tie breaker only)	

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, coordinator, and manager of the event. Record the deduction in the space to the right. Indicate rule violated _____	
TOTAL (150 points)	

I certify these results to be true and accurate to the best of my knowledge and ability.

Evaluator's Signature_____