SkillsUSA®

URBAN SEARCH AND RESCUE

Explosive Ordnance Disposal (EOD)

2026 National Event Challenge Guide

(Version: February 2026)

Note: *Event rules/regulations are subject to revision prior to competition.*

Contents

Corporate Sponsor:

Pitsco Education, LLC

Explosive Ordnance Disposal Robot, Springfield (MO) Fire Department

Event

This document has been written to the SkillsUSA® Championships Technical Standards with the intent that individual states have the autonomy to change, modify, or abbreviate any or all the standards as outlined. Be advised that to make the most informed decisions regarding changes, modifications, or abbreviations of any or all of the standards, it is suggested you download and reference the actual Technical Standards here: http://updates.skillsusa.org to use as a complementary and supporting resource. Please note that for the resolution of any potential question or discrepancy in rules at the National event, judging will refer to the Technical Standards as the ultimate authority.

The 2026 Robotics: Urban Search & Rescue Challenge: Explosive Ordnance Disposal (EOD) enables students to create a mobile robot such as those employed by emergency service personnel (fire, police, and military). The robot is designed to secure an area by locating, neutralizing, moving, and disposing of explosive materials. The demand for designers, skilled technicians, and manufacturing workers who are fluent in mechanical design and electrical systems and highly skilled in troubleshooting and maintenance of robotic systems is projected to continue to grow. The current generation of students is expected to take artificial intelligence and robotics into the evolving world of emergency services, finding new ways to help trained personnel react more quickly and effectively. Therefore, our future labor force must be on the leading edge of current and emerging technologies and possess the technical and team skills necessary to maintain industry leadership in design, manufacture, maintenance, and operation of life-saving robotic equipment.

Purpose

- To evaluate team members' skills and preparation for employment in fields related to and including robotics, engineering, automation, manufacturing, electronics, and emergency services.
- To recognize outstanding performance by participants in scenarios that require problem-solving and teamwork in a real-world situation.
- To foster participant and spectator excitement and interest in careers focused on robotics, engineering, automation, manufacturing, electronics, and emergency services.

Clothing Requirement

Official SkillsUSA® Class E – Business Casual is required. Safety glasses are required when contestants are in the pit area working on their robots. Scoring deductions may be given and/or disqualification of contestants only if clothing safety standards are not met, according to the governing body of SkillsUSA. For complete details, visit www.skillsusastore.org. If you have questions about clothing or logo attire, call 844-875-4557.

Eligibility (Team of 2)

Open to active SkillsUSA members enrolled in programs with robotics, engineering, automation, manufacturing, electronics, and emergency services as the occupational objectives.

Equipment and Materials

Supplied by the Technical Committee

- Two Challenge fields: 30' x 30' simulated neighborhood (see Appendix C for state-level recommended modifications).
- Field elements:
    - Challenge Field Test: Simulated components of an urban area and obstacles to traverse, open, and manipulate in order to locate and dispose of simulated explosive ordnances. (See Technical Outline Skill Challenges Section in Appendix D)
    - Skills Challenge: Individual components needed to test unique skills typically used in Urban Search and Rescue events. (Outline Skill Challenges section in Appendix D.)
- A command center area equipped with a table, a Driver chair, a spotter area, a video monitor, and two-way communication equipment for Driver and Spotter. (See Technical Outline Skill Challenges section in Appendix D.))
- General workspace for each team designated as a "pit" area, including one table and two chairs. Shared access to a 120-volt electrical supply will be provided in the form of a common power station table(s) with multiple outlets intended for the use of recharging robot batteries.

Supplied by Competing Team

Note: The first five bulleted items following apply to virtual competitions.

- Computer with high-speed Internet capability and a camera to use applications such as Zoom or Teams. The minimum recommended Internet bandwidth speeds for joining Zoom meetings, accessing on-demand curriculum, and other online operations is 2.0 Mbps up and down. You can test your current Internet speeds by following this link: www.speedtest.net. Allow the page to load and click **Go**. Note that the computer is for technical purposes only, not for robot operation.
- The contestant's instructor or adviser shall be on-site to observe all competition activities to ensure a safe and healthy competition experience for all participants. That instructor or adviser will not be allowed to interact or interfere with the competitor unless a safety issue arises that requires interaction. Any other support or interaction between the contestant and the instructor/adviser will result in disqualification.
- All competitors must create a one-page résumé. Failure to do so will result in a 10-point penalty. Instructions for submission of the electronic résumé copy will be provided on the SkillsUSA website at http://updates.skillsusa.org.

- Safety equipment – Eye protection is required when contestants are in the pit area working on their robot.
- Fully assembled, tested, and operational ordnance disposal robot conforming to the guidelines and parts
  restrictions listed in this document. (See "Urban Search & Rescue Challenge Set Bill of Materials" in Appendix A .)
- Team number affixed to the robot in a way that it is always easily identified during the competition. (**Note:** Robots without team numbers attached in a manner that allows them to be easily identified will NOT pass inspection and will not be allowed to compete.)
- Presentation software for oral presentation to judges (optional)
- CAD/CAM software for blueprint design (optional)
- A completed Engineering Notebook that can be submitted in a digital format. Engineering Notebooks must be submitted digitally before the Championship event. The due date will be provided after all state championships conclude. Instructions for submission will be emailed to team advisors for teams who have qualified for the Championship event. (**Note**: Technical drawing/blueprint of robot drive chassis must be included in notebook.)
- Pens, pencils, and paper
- Tools (the following list of basic tools is a suggestion only, and ultimately the tool assortment for each team should fit that team's needs and requirements to construct and maintain their challenge robot successfully):
  - Allen wrench set (English)
  - Clamping vise
  - Metal tin snips
  - Power strip
  - Calculator
  - Tape measure
  - Hammer
  - Metal file
  - Flat-head and Phillips-head screwdrivers
  - Wire strippers (one set)
  - Wire cutters/snips (one set)
  - Roll of electrical tape
  - 4" nylon wire ties (25-Pack)
  - Multimeter
  - Multi-nut pliers
  - Metal-cutting hacksaw (manual)
  - Cordless drill with charger

- Set of standard drill bits
- Pliers (needle nose or regular)
- Set of box wrenches

Event Overview

A two-member team builds its robot and arm mechanism before the competition. During the competition, there will be two separate but related challenges. The first will be a demonstration of proficiency in two specific skill test challenges. The second is a simulated urban search and rescue mission to traverse a course and locate, secure, and properly dispose of ordnances. Both challenges will require teams to demonstrate proficiencies such as remotely operating the robot via camera, navigating, manipulating the arm mechanism to collect simulated ordnances, traversing various types of terrain, and communicating between the Driver and Spotter. Each team will have the opportunity to perform two rounds of the two skill challenges and two rounds of the Urban Search & Rescue (USAR) simulated challenge to locate and dispose of multiple ordnances. In both challenges, teams will be under time constraints to complete the objective. Challenge breakdown is as follows. (**Note:** See Appendix for technical details of each skill challenge.)

The two identified skills challenge areas are:

1. **Engineering Skill Challenge: The following three areas will be tested in this skill challenge.**
    a. Teams will demonstrate their Tele-Op/remote control driving proficiency using only POV (point of view) information transmitted from an onboard camera.
    b. Teams will demonstrate how effectively they can use their robot to collect an ordnance via opening a container, moving an obstacle, and on a non-static platform.
    c. Teams will navigate multilevel terrains to test the engineering of their chassis and overall robot design. (Examples might be driving up smooth or rough ramps, a teeter totter, or a debris field, and so on.)
2. **Collaboration Skill Challenge: The following two areas will be tested in this skill challenge.**
    a. Teams will demonstrate communication and collaboration skills by navigating a course using only direction from a spotter. This simulates a potential hardware failure on a robot where the Driver must depend only on information from the spotter for successful completion of the challenge.
    b. Teams will demonstrate basic robot navigation skills while controlling an ordnance by driving to specified areas of the field.

The Urban Search & Rescue (USAR) simulated challenge:

1. The USAR simulated challenge will have 15 total ordnances placed throughout the course, including in and around three structures, one of which has three levels. Ordnances will be mapped to known locations, and teams will be provided the map during event orientation. Ordnances are color-coded to indicate difficulty and point value, and there will be multiple disposal zones throughout the course that will have scoring levels based on location. Teams may enter the field and structures through several

access points and must complete their run within a set time limit. Because ordnance collection uses the same skills practiced in the skill challenge, teams should plan their routes carefully, considering higher-risk paths that may save time versus lower-risk routes that may take longer, to maximize their overall score.

Each skill area will have a unique simplified field area from the overall Urban Search & Rescue field setup. (This is not to say that specific aspects of the overall field might not or could not be used for an individual skill area.)

Each skill challenge will be the same for all participants and will include a set time limit. Exceeding the time limit will result in a score reduction. To balance this, a proficiency time target will be provided for each challenge. Teams that complete the task before the proficiency time will earn bonus points.

Skill Challenge 1 is focused on robot design and function. Skill Challenge 2 is focused on communication and collaboration between the Driver and Spotter.

Contest Field

- Two 30' x 30' simulated urban areas (See Appendix C for state-level recommended modifications.)
- Features of the neighborhood:
    - Starting point from which the robot deploys
    - Containment boundaries marking the 30' x 30' challenge area
    - Simulated objects often found in urban settings: home, street, grass, and mailboxes

Note: Ordnances will be strategically positioned on the challenge course in locations that require a robot to open containers, move obstacles, and reach for and grab items to deliver them to a safe disposal site. Some ordnances may be located outside a direct line of sight from the command center. Each team will operate its mobile robot and navigate by first-person POV through the video feed from an onboard wireless camera.

Command Center

The command center will be within view of the playing field. The designated Driver must remain seated at the command center, while the designated Spotter remains in the defined Spotter area while competing. (See Command Center in Appendix B.)

Pit Area

A pit area where teams modify their robots and arm mechanisms will be provided. Each team will have a conference table, two chairs, and share common access to a 120-volt electrical outlet. **Note:** Robot cameras must remain *off* while in the pit area to minimize chances of interference for the team actively driving the course.

Recommended Content for Urban Search & Rescue Challenge Set

The Urban Search & Rescue EOD robot may be built using only components that comprise the Urban Search & Rescue Challenge Set and/or other approved parts listed in the Appendix. Each set contains everything necessary to construct a basic robot for the Urban Search & Rescue Challenge competition.

Upon registering for the event, if needed, teams may purchase an Urban Search & Rescue Challenge Set and other approved robotics supplies necessary to compete from Pitsco Education at www.pitsco.com.

Notes: Any off-the-shelf robotics building platform may be used for this event, as long as the robot complies with all parts restrictions (see page 14) and is operated by remote control; **autonomously controlled robots will be disqualified.** Any wireless camera system that can be mounted to the robot with output to video display will meet contest requirements. A video monitor/TV using RCA inputs will be supplied by the technical committee for the purpose of displaying the team's video feed in the command center. A bill of materials for the Urban Search & Rescue Challenge Kit and a list of approved optional parts and raw materials can be found in Appendix A. *Pitsco has evaluated and tested the eRapta 7" wireless backup camera for a truck system for performance, ease of use, and reliability. This is the system we recommend. The camera will be available on the Pitsco website starting in January 2026. However, teams are welcome to use any camera system that meets technical standards. Our recommendation is simply intended to provide a trusted option to help streamline your setup and ensure consistent results.*

Challenge Checklist

- ☐ Purchase robot challenge kit.
- ☐ Design and build a robot and arm mechanism within specifications that is capable of grabbing, holding, and moving objects. Document process and blueprints in the Engineering Notebook.
- ☐ Practice driving the robot on various types of terrain while looking at a video monitor displaying the feed from the onboard camera.
- ☐ Review basic mechanical, robotics, and electrical knowledge in preparation for the written test.
- ☐ Plan, prepare, and practice a presentation.
- ☐ Attend local, regional, state, and national Urban Search & Rescue Challenge competitions.

Sample Event Agenda

Following is a sample agenda for an Urban Search & Rescue Challenge event.

1. **Orientation**
2. **Robot Inspection**
3. **Technical Presentation**
4. **Skill Challenges**
5. **Lunch**
6. **USAR simulated challenge**

Contest Guidelines/Rules

Note for Virtual Competitions: Contestants may not be required to perform all the standards and competencies listed in this and the following sections. However, contestants should be prepared to perform competencies in all areas. Before the competition, the technical committee may determine which standards and competencies contestants will perform for the virtual contests. The technical committee will determine if additional information is needed for contestants before the competition. These changes will be posted on the SkillsUSA Championships contest update website at http://updates.skillsusa.org.

Note: Guidelines and rules are subject to change.

- Each **team** must consist of two members. If a team member is absent, the lone team member will be allowed to compete, but a 30-point penalty will be applied to the overall score.
- Each robot must have an **identification label** with the team's number prominently displayed so the robot can be easily identified.
- Each **technical presentation** should last a maximum of five minutes and should be primarily oral, with supporting materials of printed or electronic media and physical models. Students should be prepared to discuss the roles they played, their robot design, and the functions of their robot. (**Note:** The technical committee will **not** provide a projector, screen, or other presentation equipment.)
- **Before attending** the competition, team members should design, build, and experiment with robots constructed from the SkillsUSA Urban Search & Rescue Challenge Kit. Additional TETRIX® or other approved parts and raw materials (see Appendix A) may also be used. The prebuilt robot and arm mechanism will be required to grab, hold, and move objects during the mission. Teams should bring extra materials in case of repairs or minor modifications are needed on-site.
- The robot's arm mechanism must be prepared for and capable of:
    - Grabbing and securing a simulated ordnance. The ordnance could be on the floor, elevated above the floor up to nine inches, or inside a container with a front-facing door that opens down.
    - Reaching past any obstacle imposed by the open door and into the interior of a container at least five inches.
    - Moving any potential obstacles – obstacles will vary in size and will not weigh more than the ordnance.
    - Delivering ordnances to the designated disposal area/containers. A disposal area is defined as a container or marked-off area on the floor.

- The simulated ordnances (wooden block image, left) are not included in the competition kit and are **approximately 2.7 inches cubed** and **weigh 4.3 ounces**. The handles on container doors (mailboxes) are **3.3 inches long and 0.41 inches wide**.

Ordnance (wooden block)

Mailbox handle

- **Part Restrictions:**
    - Limit of **eight** motors/servos per competing robot
    - Maximum of **one** transmitter/remote
    - **One** rechargeable battery pack for drivetrain motor power. **Note:** Maximum voltage should not exceed the manufacturing specs of 12.8 V.
    - **Wireless camera system** that must be mounted on the robot (a supplemental battery for the express use of powering **only** the camera can be used)
    - Robot must fit into an **18" x 18" x 18"** space when starting **but may expand to a larger size during the challenge**.
    - Implementation of pneumatic systems is prohibited due to safety concerns of potential rupture of onboard pressure vessels used to power pneumatics on a mobile robot in an unprotected arena.
- Each team must provide in its Engineering Notebook a **technical drawing or blueprint** detailing the construction of its robot drive chassis and additional drawings/blueprints for its associated arm mechanism.
- The robot and arm mechanism must be **assembled by the team before robot inspection.**
- All robots will be required to **pass an initial inspection** by judges (see page 19) to determine if all the parts used are from the list of allowed. Any team whose robot fails the initial inspection will be disqualified if proper modifications have not been made and passed inspection within 30 minutes.
- Teams will use the opportunity during a designated period of time, after practice on the main field has been completed by all teams, to make robot modifications using the workorder process. Teams that decide to make design modifications must have their robot re-inspected and ready 30 minutes before their designated USAR simulated challenge. **Modifications cannot go outside the scope of the competition robot parameters**. Work order documentation will be provided in the team's orientation packet.
- Robots with an arm mechanism that poses a **danger** to competitors or could cause potential damage to the challenge field will not be allowed to compete.
- Accuracy of the robot's **construction must be documented via the engineering notebook and any work order requests, if applicable**. All necessary parts and tools for construction must be brought to the competition site.
- Team members will be required to follow proper safety procedures and use eye protection.
- Teams may bring a **laptop computer and blueprint drawings** of their robot and arm mechanism designs to the contest building area. A description of the assembly process is

required to be within the Engineering Notebook. The designs may be printed or hand-drawn copies.

- The USAR simulation challenge course **will be available for viewing and for practice by teams before the start of course runs.** Teams will be able to watch other competing teams' course runs from a designated area. All practice times will be scheduled and included in the orientation packet.

Engineering Notebook

The Engineering Notebook is intended to be a documented journal of many aspects of the Engineer's experiences over the course of a specific engineering project. It can be used for personal reflection of the engineer looking back over the project, and a method to communicate those experiences to others. In this use case, others will look at your Engineering Notebook to determine if they can follow your journey through the project just by looking at the information you've provided. Minimal elements they will expect to see documented follow. Keep in mind personal perspective can have an impact on this. For example, what you think is neat and professional might not be the same for someone else. A good thought to always keep in mind is, how will what you're documenting look to someone else? **Ask yourself, would they be able to read, understand, and even recreate your project with the same results using only what you've provided in your Engineering notebook**?

- Submission will be via digital format; qualifying teams will be notified upon uploading process, and the due date by which the notebooks must be turned in.
- Overall neat and professional appearance
- A complete bill of materials for the robot drive chassis and arm mechanism designed and used in competition at the event
- A detailed description of the assembly process for the robot drive chassis and arm mechanism
- Illustrations, sketches, photos, and written log entries accurately documenting the design and prototyping iterations, detailing the evolution and logical progression of the robot's design
- Explanations noting how testing was conducted, why modifications were made, what skills were learned, and how the robot might further be modified to improve performance and achieve desired objectives if no restrictions were in place
- Engineering notebooks will be reviewed and scored by USAR judges who will be attending the event.
    - Scoring feedback will be provided.

Skill & Challenge Course Rules

Note: All teams will be expected to adhere to the official rules for the USAR competition and compete positively and professionally.

- All teams will be required to compete in both skill challenges before the USAR Simulated Challenge.
- At the competition site, the **simulated urban area** will be provided and maintained by the technical committee. During the competition, the course will be reset to its original state before

each team competes. The ordnances will be placed in the same locations throughout the course for each run. Teams will receive a copy of the ordnance map during orientation.

- The USAR Simulated Challenge: Explosive Ordnance Disposal event will consist of **two timed missions** for each team. During the missions, the robot has up to six minutes to navigate the course, complete the challenge, and return to home base.
- Each team will **operate its mobile robot** and navigate by line of sight and by the video feed from an onboard wireless camera. The command center will be within view of the playing field. The Driver must remain seated at the command center, and the Spotter must stay within the boundaries of the spotter station while competing.
- An official will oversee placing the team's robot at the starting point on the challenge course. (**Reminder:** For robot inspection purposes, in a powered-off state, without disassembling any part of the robot, it must be able to fit completely in an 18" x 18" x 18" volume of space. During actual competition in a powered-on state, it may expand beyond those boundaries.)
- After a "clear" signal is issued by a challenge course official, **time will begin** as soon as the robot moves. Following completion of a mission, **time will stop** upon successful completion of collecting and disposing of the 15 ordnances and returning to the start location or when the time limit expires.
- Robots should remain on roads and paths within the urban area to avoid property damage.
- The USAR Simulated Challenge will be a **maximum of six minutes**.
- Team members are **not allowed to touch** their robot at any time while a Skill Challenge or Urban Search & Rescue Field Challenge is in progress, unless instructed to do so by a judge.
- An official will award points for the team's mission based on the official **"Urban Search and Rescue Simulated Mission Field Challenges" rubric**.

Penalties

- A deduction will be assessed each time an ordnance is **dropped**.
- Each time the **robot stalls or becomes hung up** and must be rescued by an official, a deduction will be assessed. An official will rescue a robot only at the request of a team member, but a deduction will be assessed.
- **Rescues** could be further defined as:
    - Rescue type one – robot turns over and needs assistance to right itself. The judge will be upright, and the team can continue from the current location with only a point deduction penalty.

    - Rescue type two – robot becomes disabled due to mechanical failure. The judge will rescue the robot and bring it back to the starting position. Time will continue with a point deduction. Spotter can take the robot back to the Driver for repair. The driver cannot leave the Driver Station, and the robot must resume competing from the starting position.

- A deduction will be assessed whenever a robot goes off the designated path within the USAR Simulated Challenge field or **outside of the skill course boundaries**. **Shortcuts are not allowed**.

- Due to safety concerns, **any battery that becomes partially or fully detached** from the robot during a run will immediately halt the run. Time will stop, the team will incur a penalty, and the judge will retrieve and bring the robot and battery to the starting position. The Spotter will have one minute to reattach the battery in the starting position to resume the run. If the battery is not attached within one minute, the run will end. If the battery becomes detached a second time, the run will
automatically end.

Robot Inspection Checklist

Inspector: _____ Team Number: _____

Time of Inspection: _____ Pass/Fail: _____

Inspection Type: ___ Initial ___ Mandated ___ Random

Pass	Fail	Rules/Guidelines	Notes
		Robot fits in the size limitation of 18" L x 18" W x 18" H.	
		Team name/number is attached and visible on the robot.	
		The robot does NOT contain components that will intentionally detach on the playing field.	
		The robot does NOT contain any components that could damage the playing field.	
		Robot does NOT contain any parts that are sharp, jagged, or pointed.	
		Robot poses NO obvious unnecessary risk of entanglement with any element on the playing field.	
		Robot contains a total of no more than eight DC motors, servo motors, or a combination thereof.	
		The robot contains only ONE transmitter/controller and receiver.	
		The robot contains only ONE 12 V, 3,000 mAh battery for the drive train.	
		The robot may contain a supplemental battery for the express use of powering the wireless camera. It cannot exceed a maximum of 9 V.	
		Robot wiring MUST be secured to the chassis, free and clear of any moving parts, to avoid entanglement while competing.	
		Robot battery pack(s) MUST be securely fastened to the robot's chassis away from sharp edges, corners, screws, and moving parts.	
		Robot MUST contain a securely fastened wireless camera.	
		Robots using a chain and sprocket, or tank treads, MUST have sufficient slack in the chain and/or tank treads.	
		The robot is built ONLY using approved materials listed in Appendix A ofthe current Urban Search & Rescue Technical Standards.	

Scoring Rubrics

Skill Challenge #1 Engineering – Possible Points: 150	**TEAM #**
Skill challenge scores will be subject to the judge's opinion – points shown are to be guidelines and awarded points might fall between levels shown.	
Time Limit: 5 minutes	
Time Proficiency target: 3 minutes	
Bonus: 25pts	
The robot is successful at traversing the full course, including collecting and disposing of the ordnances, without going outside of the marked boundaries or impacting the obstacles under the time proficiency target.	

Skill Challenge #1: Engineering

Objective	# of Ordnances Retrieved (Total of 3)	# of Points (10pts each)
Ordnance Retrieval		

Objective	# of Ordnances Disposed Inside (Total of 2)	# of Ordnances Disposed Outside (Total of 1)	# of Points (10pts each)
Ordnance Disposal			

Objective	Return to Start Location (10 pts)
Return to Start Location	

Proficiency Bonus	3:00 minutes (25pts)
Complete All Tasks and Return to the Starting Location	

Total Points	

Deductions	# of Infractions	Total Points
Ordnance Drop 5 pts		
Pushing or Dragging Ordnance 5 pts		
Robot Becomes Disabled 5 pts		
Battery Becomes Detached from the Robot 10 pts		
Spotter Leaves the Spotters Box 10 pts		
Team Member Interference with the Robot 10 pts		
Robot Breaks the Plane of the Course Boundary Line 10 pts		

Skill Challenge #2 Communication & Navigation – Possible Points: 150	TEAM #
Skill challenge scores will be subject to the judge's opinion – points shown are to be guidelines and awarded points might fall between the levels shown.	
Time Limit: 5 minutes	
Time Proficiency target: 3 minutes	
Bonus: 25pts	
The team spotter is successful at providing verbal instructions to the driver to successfully drive a robot through a course, collect and dispose of an ordnance, and open a mailbox without going outside of the marked boundaries, or impact the obstacles within the time proficiency target.	

Skill Challenge #2: Communication & Collaboration

Objective	# of Boundary Infractions	Total Points
Navigation of the Front Course (40 Pts)		

Objective	# of Points (30)
Ordnance Disposal	

Objective	# of Points (25)
Opening a Mailbox	

Objective	# of Points (30)
Secure ordnance with gripper	

Proficiency Bonus	3:00 (25 pts)
Bonus	

Deductions	# of Infractions	Total Points
Ordnance Drop 5 pts		
Pushing or Dragging Ordnance 5 pts		
Robot Becomes Disabled 5 pts		
Battery Becomes Detached from the Robot 10 pts		
Team Member Interference with the Robot 10 pts		
Robot Breaks the Plane of the Course Boundary Line Beyond the Front Course 10 pts		

Total Points	

Urban Search & Rescue Challenge – Possible Points: 175 **Team:**

Engineering Technician Notebook

Objective	Points Performance Level					Points
	5	**10**	**15**	**20**	**25**	
Overall content format and appearance	Notebook does not follow mission format/guidelines or demonstrate understanding of the task.	Notebook adequately follows some, but not all, of the mission format/guidelines and demonstrates understanding of the task.	Notebook adequately follows mission format/guidelines and demonstrates understanding of task.	Notebook meets the mission format/guidelines and demonstrates understanding of the task.	Notebook is outstanding and goes above and beyond format/guidelines and demonstrates understanding of the task.	
Logical structure and documentation	The team does not sufficiently document the project.	The team adequately documents the project, but lacks logical flow and structure of the project from start to finish.	Team completed documentation, flow, and structure in an average manner, but more could have been done.	Team documented the project journey with good flow and structure from beginning to end.	The team's documentation of the project demonstrates an effort that goes above and beyond.	
Technical accuracy and bill of materials	Technical content (descriptions, sketches, drawings, tables, and figures) does not match robot project build.	Technical content (descriptions, sketches, drawings, tables, and figures) only vaguely resembles a robot project build.	About half of the technical content (descriptions, sketches, drawings, tables, and figures) matches robot project build.	About three-quarters of the technical content (descriptions, sketches, drawings, tables, and figures) matches robot project build.	Technical content (descriptions, sketches, drawings, tables, and figures) matches robot project build with outstanding detail and clarity.	
Technical drawing quality (if no drawing provided, score is 0)	Drawing detail and quality are inferior.	Drawing detail and quality are adequate.	Drawing detail and quality are average.	Drawing detail and quality are above average.	Drawing detail and quality are excellent.	
Accuracy of technical drawing to assembled drive train	Technical drawing does not match assembled drive train.	Technical drawing matches few components of the assembled drive train.	Technical drawing matches major components of the assembled drive train.	Technical drawing matches all major and most minor components of the assembled drive train.	Technical drawing matches all major and all minor components of the assembled drive train.	
					Total:	

Judge's comments:

Urban Search & Rescue Challenge – Possible Points: 75 **Team: _____**

Technical Presentation

Objective	Points Performance Level					Points
	5	10	15	20	25	
Explanation of mechanical and electrical systems within the robot	Does not explain mechanical and electrical parts and their functions.	Demonstrates minimal knowledge of mechanical and electrical parts and their functions.	Demonstrates adequate knowledge of mechanical and electrical parts and their functions.	Demonstrates a working knowledge of mechanical and electrical parts and their functions within the mechanical system.	Demonstrates a thorough knowledge of mechanical and electrical parts and their functions within the mechanical system.	
Description of design challenges and solutions implemented for the robot	Does not explain design challenges faced or solutions implemented.	Demonstrates minimal knowledge of design challenges faced and solutions implemented.	Demonstrates adequate knowledge of design challenges faced and solutions implemented.	Demonstrates a working knowledge of design challenges faced and solutions implemented.	Demonstrates a thorough knowledge of design challenges faced and solutions implemented.	
Overall presentation quality	Teammates do not equally share responsibilities and presentation quality is poor.	Teammates do not equally share responsibilities or demonstrate adequate presentation skills.	Teammates somewhat share responsibilities and demonstrate adequate presentation skills.	Teammates mostly share responsibilities and demonstrate good presentation skills.	Teammates share responsibilities and demonstrate polished presentation skills.	

					Total:	
Judge's comments:						

Urban Search & Rescue Challenge – Possible Points: 250 **Team: _**

Urban Search & Rescue Simulated Mission Field Challenge

Points Performance Level				
Objective	**Yellow Ordnance 5 pts**	**Black Ordnance 10 pts**	**Red Ordnance 15 pts**	**Total**
Ordnance Collection (15 Total)				
Objective	**Inside Disposal 3 pts**	**Outside Disposal 5 pts**	**Total**	
Ordnance Disposal				
Proficiency Bonus	**Bonus (25 pts)**	**Total**		
Mission Completed and Robot Returned to Starting Position before End of Run				

Point Deduction Worksheet		
Infraction	Number of Incidents	Points to Deduct
Loss of ordnance (5 points per incident)		
Vehicle stalled; official asked to rescue (5 points per incident)		
Robot intentionally outside of boundaries (25 points per incident)		
The battery constitutes a hazard by becoming partially or fully detached from the robot during the run. (25 points per incident)		
Deduction Total (insert into main scoring rubric)		

Total Time	
Field Challenge Points (subtotal)	
Deduction Total (from Point Deduction Worksheet)	
Field Challenge Point Total	

Urban Search & Rescue Challenge – Possible Points: 100

Team: _____

Written Test

	Number of Questions	Points Possible per Question	Points Possible	Points Scored
	25	**25 Multiple-Choice: 4 points each**	**100**	

Judge's comments:

Team: _____

Urban Search & Rescue Challenge Total Possible Points: 1,000

Category	Possible Points	Points Scored	Judge's Comments
Skills USA Professional Development Test	**100**		
Skill Challenge #1	**150**		
Skill Challenge #2	**150**		
Engineering Technician Notebook	**175**		
Technical Presentation	**75**		
Urban Search & Rescue Field Challenge	**250**		
Written Test	**100**		
Team Total:	**1,000**		
No résumé (deduction)	**- 10**		
Team member absent (deduction)	**- 30**		
Team Total (minus deductions):			

Appendix

(A) TETRIX® MAX Urban Search & Rescue Challenge Kit

- **Option A | USAR Kit with PRIZM® Pro and Tele-Op Controller**

https://www.pitsco.com/products/robotics-urban-search-and-rescue-challenge-set-with-prizm-pro

Control System	
Item	**Quantity**
2.4 GHz 6-channel R/C Controller	1
PRIZM® Pro Controller with Tele-Op	1

- **Option B | USAR Kit with 6-Channel Remote Control**

https://www.pitsco.com/products/robotics-urban-search-and-rescue-challenge-set-with-6-channel-remote-control

- (Any off-the-shelf robotics controller may be used for this event, as long as the robot complies with all parts restrictions and is operated by remote control; autonomously controlled robots will be disqualified.)
- Part restrictions are covered in the SkillsUSA Technical Standards competition guidelines.
- Kit materials linked in this guide replace the "Bill of Materials" found in the SkillsUSA Technical Standards.

Additional parts and raw materials legal for use:

- TETRIX Building System parts (https://www.pitsco.com/collections/skillsusa, 800-835-0686, or competitions@pitsco.com)
- 3-D-printed parts of original design
- Raw material used for fabricating custom robot parts

- **Option C | Other Brand Robot Kits/Parts**
  - Other robot parts similar in size and design to either of the Urban Search & Rescue Challenge kit materials linked here.

(B) Command Center

- (1) Six-foot table or equivalent positioned **in close proximity to the field with Driver view of the field blocked.**
- (1) Chair for Driver
- Designated Spotter area within communication range of Driver
- (1) Video monitor
- (1) Assistive communication system to aide communication between Driver and Spotter
- Access to a 120-volt electrical outlet

(C) State-Level Example Challenge Field

Challenge Overview

- Objective: Teams operate a teleoperated robot to locate, retrieve, and safely dispose of as many ordnances as possible within the time limit, simulating an urban search and rescue mission.
- Team Composition:
    - 1 Driver (operates the robot).
    - 1 Spotter (provides verbal navigation and task guidance).
- Key Skills: Remote navigation, problem solving, strategic planning, and precise manipulation.

Field & Structures

Field Layout

- Overall area: 30' x 30' course.
- Clearly marked Start/Finish Zone where each run begins and ends.

Structures

- Two Wooden Houses:
    - Each has at least one primary entrance and one alternate or more complex entrance.
    - May include narrow passages, ramps, or small interior spaces requiring careful maneuvering.
- Main Three-Story Structure (Parking Garage Simulation):
    - Multi-level with ramps with varying slopes and surface types (smooth, rough, textured).
    - Curved ramps and turns to test control and traction.
    - Multiple entry points of differing difficulty (easier, more complex routes).

Terrain and Obstacles

- Ramps at different inclines and curvatures to encourage route selection and strategy.
- Obstacles and barriers that may need to be moved or manipulated to access specific ordnances.
- Areas with a limited line-of-sight that make the camera view critical.

Roles, Visibility, and Communication

Driver

- Located behind a solid barrier with no direct view of the course.
- Operates the robot exclusively through the onboard camera feed.
- May not leave the driver area or look over/around the barrier during a run.

Spotter

- Positioned in designated spotter zones along the field perimeter.
- Responsibilities:
    - Provide verbal instructions to the driver about navigation, structure entry, mailbox/obstacle interaction, and ordnance handling.
    - Help choose and adjust routes based on difficulty and time remaining.
- Constraints:
    - Must remain within the assigned spotter zone for the entire run.
    - No physical interaction with the robot, field elements, or driver controls unless approved by a judge.

Ordnances & Task Types

Ordnance Count and Placement

- 15 ordnances on the course in fixed locations.
- Ordnance locations and disposal sites are identical for all teams and all runs.
- Teams receive a field map during orientation showing:
    - Ordnance locations.
    - Disposal container locations (inside and outside the course).

Ordnance Complexity Levels & Point Values

Each ordnance is pre-classified into one of three difficulty levels:

- Level 1 – Basic Retrieval (5 points each):
    - Simple pick-up from open floor or easy-access surface.
    - Moving an obstacle obstructing access to an ordnance
    - Minimal maneuvering or alignment required.
- Level 2 – Moderate Retrieval (10 points each):
    - Requires at least one added challenge, such as:
        - Opening a mailbox and extracting the ordnance.
        - Approaching from a restricted angle.
        - Performing a precise stop on uneven/curved surfaces.
- Level 3 – Complex Retrieval (15 points each):
    - Requires at least one specialized operation, such as:
        - Maneuvering multiple levels of a structure with varying ramps and curves
        - Retrieving a suspended ordnance (hanging from a structure or under a ledge).
    - Designed to demand careful communication and advanced gripper control.

Disposal Rules

Disposal Locations

- Inside-Course Containers:
    - Multiple disposal containers placed within the field/structures.
    - Each successful ordnance disposal inside the course is worth +3 points (in addition to the retrieval value).
- Outside-Course Container:
    - At least one disposal container located outside the main course area (e.g., near or beyond Start/Finish).
    - Each successful ordnance disposal in the outside container is worth +5 points (in addition to the retrieval value).

Disposal Constraints

- Ordnances must be carried and deliberately released into a disposal container.
- Teams may choose disposal locations strategically:
    - Shorter path to internal containers for speed.
    - Longer path to outside container for higher disposal bonus.

Rules

Run Duration

- Each run lasts up to 6 minutes.
- The run ends when either:
    - The 6-minute time limit expires, or
    - The team has collected and disposed of all 15 ordnances and returned the robot to the Start/Finish Zone.

Start & End Conditions

- Robot starts stationary in the Start/Finish Zone.
- At the end of the run, if all ordnances are collected and disposed of, the robot must return fully inside the Start/Finish Zone to complete the mission early.

Number of Runs & Role Swap

- Each team completes two runs of the challenge.
- Between runs, the team members must swap roles:
    - Run 1 Driver becomes Run 2 Spotter.
    - Run 1 Spotter becomes Run 2 Driver.
- The team's official event score is the average of the two run scores.

Scoring System

Retrieval Points

For each ordnance successfully retrieved (picked up under control and transported to any disposal container):

- Level 1 Basic Ordnance: +5 points.
- Level 2 Moderate Ordnance: +10 points.
- Level 3 Complex Ordnance: +15 points.

Disposal Bonus Points

For each ordnance successfully deposited:

- Disposal in inside-course container: +3 points.
- Disposal in outside-course container: +5 points.

Example: A complex ordnance (15 pts) disposed in an outside container (5 pts) = 20 total points for that object.

Possible Penalties: You can add penalties such as:

- Dropping or losing control of an ordnance. (5 pts)
- Pushing or dragging an ordnance instead of carrying it securely. (5 pts)
- Spotter stepping out of the designated spotter area. (10 pts)
- Driver obtaining unauthorized line-of-sight. (10 pts)
- Crossing the plane of the field boundary. (10 pts)
- Robot becomes disabled (5 pts)
- The robot battery becomes detached from the robot (10 pts)

(D) Technical Outline Skill Challenges

Skill Challenge #1 – Engineering Skill Challenge

- **Challenge Overview**
- Objective: Locate, secure, transport, and properly dispose of three “ordnances” on a 15' x 15' field.
- Emphasis on: precise manipulation, navigation over varied terrain, communication between Driver and Spotter, and strategic decision-making
- **Field Layout**
- Overall size: 15' x 15'
- Start/Finish Zone:
    - Located along one field edge
    - Contains one ordnance disposal container
- Central raised platform: 2' x 4'
- Access via two ramps:
    - Smooth Ramp: gentle, uniform surface
    - Rough-Terrain Ramp: bumpy/uneven surface
- At the top of the platform:
    - A mailbox mounted or positioned to require a precise approach and gripper control
    - One ordnance located inside the mailbox
- Uneven Surface Zone:
    - Includes bumps, gaps, and uneven terrain
- Barrier:
    - Physical element (e.g., removable block, gate, or bar) that must be lifted/removed to gain access
- Mailbox 2:
    - Located behind the barrier
    - Contains one ordnance to be retrieved
- Ordnance 3:
    - Suspended from the side or underside of the 2' x 4' platform

    - Requires careful alignment and gripping without pushing or dragging
- Three disposal containers will be located within the course interior
- One disposal container at the Start/Finish Zone
- Constraint: Each disposal container may hold only one ordnance

Team Roles

- Two students per team:
    - Driver: operates the robot using the onboard camera feed.
    - Spotter: visually tracks the robot from a designated Spotter box and communicates verbally with the Driver.
- The Driver will be seated behind a visual barrier and cannot see the field directly.
- The Driver will drive the robot and navigate the course using the robot's mounted camera.
- Blind spots are intentionally built into both sides of the course, requiring reliance on the camera view.
- There will be two marked Spotter boxes located on opposite sides of the field.
- The team will select one Spotter box before the run and must remain in that box for the entire run.
- The Spotter will provide verbal guidance.

Core Objectives

- Retrieve and safely dispose of all three ordnances while:
    - Maintaining continuous control of each ordnance with the robot gripper.
    - Navigating ramps, uneven terrain, and barriers without disabling the robot.
- Correct disposal pattern:
    - Two ordnances must be placed in two different disposal containers located inside the course.
    - The final ordnance must be placed in the Start/Finish disposal container.

Ordnance Handling

- The robot must grip and carry ordnance; pushing, dragging, or herding ordnance will result in a deduction.
- If an ordnance is dropped or becomes dislodged from the gripper:
    - The team may attempt to re-grip it.
    - Each drop/loss of control incurs a point deduction.

Robot Status and Rescues

- A robot is considered disabled if:
    - It is hung up and cannot move.
    - It tips over and cannot self-right.
    - It becomes disabled and cannot continue.
    - The battery becomes detached from the robot.
- Teams must call out “Rescue” to request judge assistance.
    - The judge may reposition or remove the robot according to event rules.
        - If the robot becomes hung up on the course and a team requests a rescue, the judge will free the robot. The run will continue from the current location; time will not stop.
        - If the robot becomes overturned and unable to continue the run, and a rescue is requested, the run will continue from the current location, time will not stop.
        - If the robot becomes disabled, loses connection, and is unable to continue the run, and a rescue is requested, the judge will bring the robot back to the start location, and the Spotter can troubleshoot or repair the robot. Time will not stop, and teams will continue from the start location.
        - If a battery becomes detached from the robot, the judge will immediately stop the run and pause the time. The judge will bring the robot back to the start location. The Spotter will have 1 minute to reattach the battery. The time will restart, and the robot will start from the start location.
    - Each rescue incurs a point deduction and may restart from a designated zone or the Start/Finish, as specified in the final rules.

Run Attempts and Role Swap

- Each team may complete up to two runs.
- If a team chooses to make a second run:
    - The first run’s score is automatically forfeited.
    - Driver and Spotter must swap roles for the second run.
    - The second-run score (only) becomes the team’s official score.

Time

- Each run will be five minutes
- Proficiency time: 3:00 minutes.

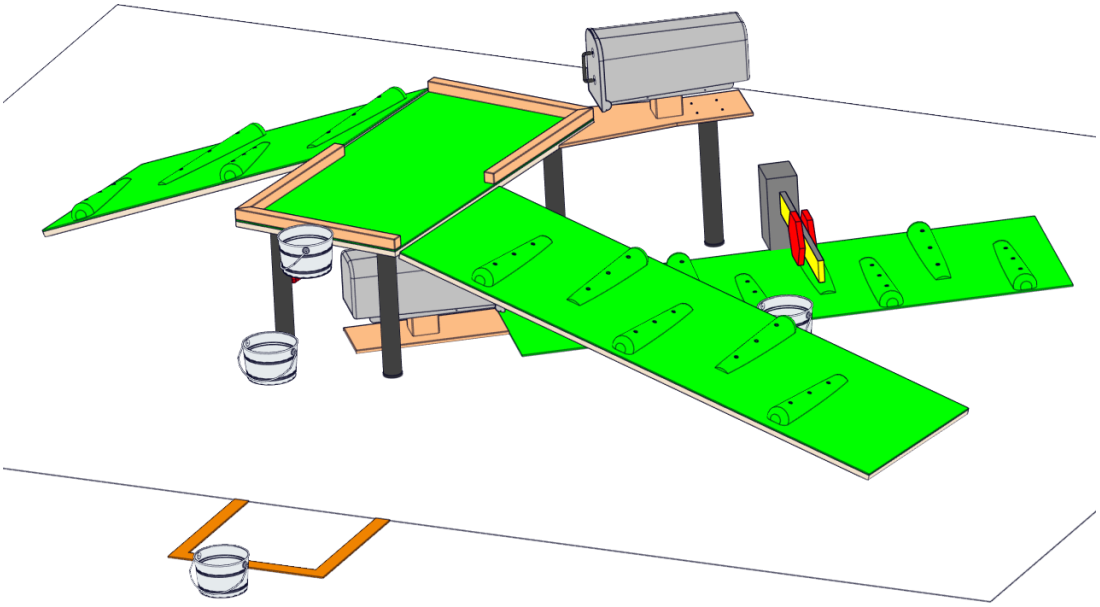
- If all tasks (all three ordnances retrieved and disposed correctly, robot back at Start/Finish) are completed at or before 3:00, the team earns a +25-point proficiency bonus.

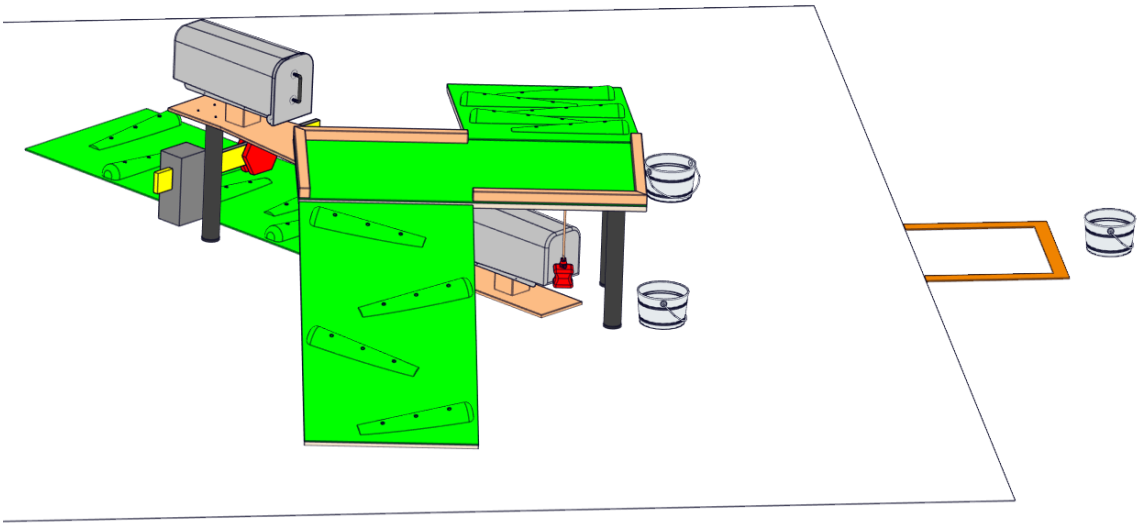
Scoring

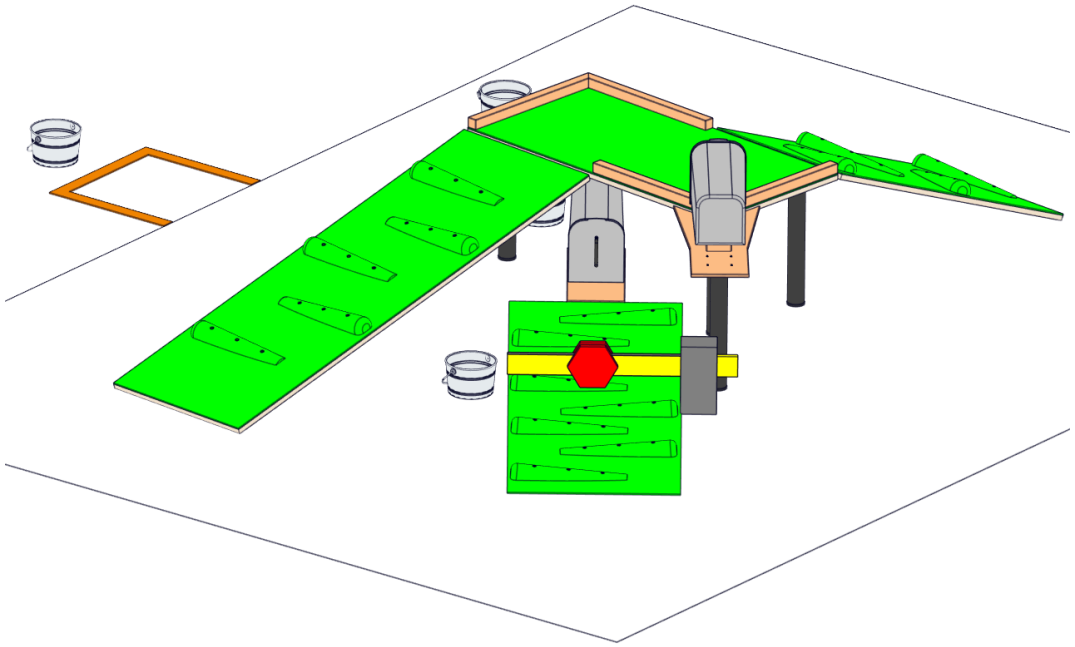
- Ordnance retrieval:
  - Ordnance: 10 points each
- Correct disposal:
  - Disposal: 10 points each
- Navigation :
  - Return to start location: 10 points
- Proficiency bonus (+25) for completion by 3:00.

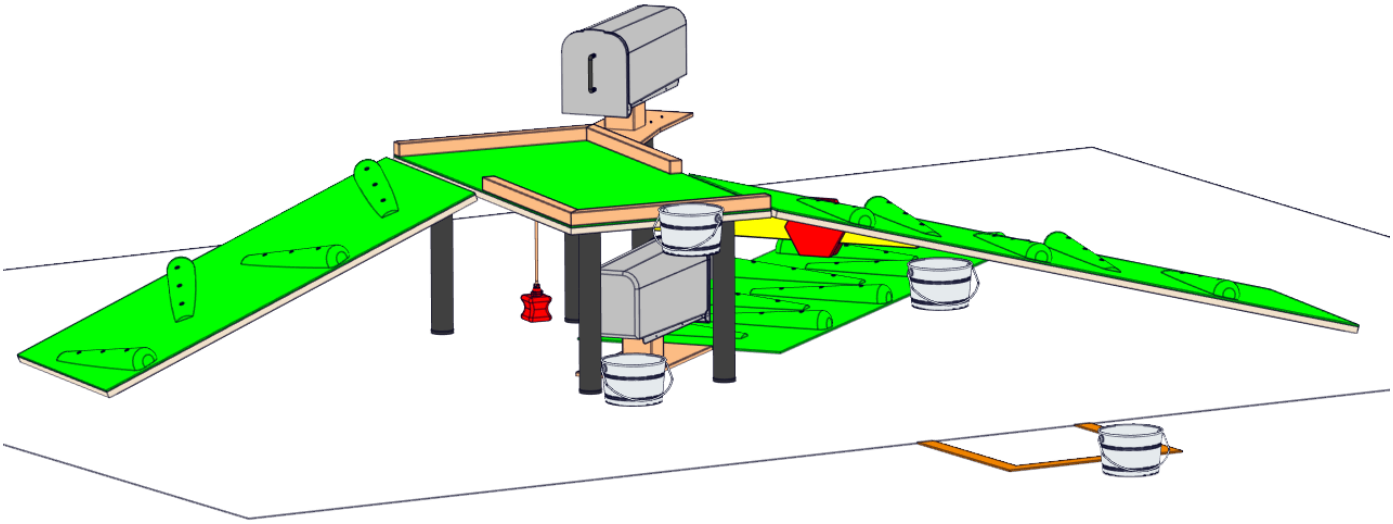
Deductions

- Ordnance handling:
  - 5-point deduction each time an ordnance is dropped or falls out of the robot gripper.
  - 5-point deduction for pushing/dragging an ordnance instead of carrying it
- Robot becomes disabled:
  - 5-point deduction for each rescue requested due to:
    - Robot stuck or hung up.
    - Robot tipped and unable to right itself.
    - Robot is disabled and needs technical attention.
  - 10-point deduction if the battery becomes detached from the robot.
- Course deductions:
  - 10-point deduction if the Spotter leaves the Spotter box.
  - 10-point deduction for the Driver or team touching the robot or field elements without judge approval.
  - 10-point deduction if the robot breaks the plan of the course boundary lines.









Skill Challenge # 2 – Collaboration Skill Challenge
Challenge Overview

- Goal: Assess teams' communication and navigation skills.
- Team Roles:
    - Driver: operates the robot but cannot see the course (behind a visual barrier).
    - Spotter: has a full view of the course and gives verbal instructions.
- Objective: Navigate a marked navigation section, open a mailbox, secure an ordnance, and dispose of it in a disposal container using verbal communication between the Driver and the Spotter only.

Field Setup

Course Dimensions

- Overall field size: 15' x 15'
- Start Location:
    - Positioned offset from the entrance to the navigation section of the course

Navigation Section

- Marked with tape lines and cones forming a defined path
- Will Include:
    - Left and right turns
    - Possible rounded turns or curves
- Boundaries:
    - Robot must stay within taped lines.
    - Robot must not bump into or knock over cones.
    - Crossing boundary lines or displacing cones will result in point deductions.

Task Elements

- Mailbox:
    - Located beyond the navigation section
    - Must be opened by the robot (e.g., lifting door or pulling handle)

- Ordnance:
    - Single object placed at a separate location after the mailbox
    - Must be picked up by the robot gripper
- Disposal Container:
    - Located in a designated area reachable after ordnance pick up
    - Time stops when ordnance is released into the container

Roles, Communication, and Constraints

Driver

- Will be stationed behind a visual barrier with no line-of-sight to the course
- Will drive the robot using only verbal direction from the Spotter
- May not leave the Driver's area or look around/over the barrier

Spotter

- Will be able to move around the course
- Responsibilities:
    - Guide the Driver from the Start to the navigation entrance
    - Provide precise verbal directions through the navigation path
    - Direct Driver to the mailbox, ordnance, and disposal container
- Constraints:
    - Verbal communication only (no touching robot, field, or driver controls)

Task Sequence

1. Start and Entry to Navigation Section
    - Robot begins at start location.
    - Spotter verbally guides Driver from start to the entrance of the navigation section without hitting cones or crossing lines.
2. Navigation Section

- Driver navigates through the taped/corded path, making required left, right, and rounded turns.
- Robot must stay within boundaries and avoid cones.

3. Mailbox Operation
    - After exiting the navigation section, the Spotter directs the Driver to the mailbox.
    - Driver positions the robot and opens the mailbox using the robot arm.
4. Ordnance Retrieval
    - Spotter guides the driver from the mailbox to the ordnance location.
    - Driver positions the gripper, opens the gripper, secures ordnance, and lifts/carries it.
5. Ordnance Disposal
    - Spotter guides Driver to disposal container.
    - Driver aligns and releases ordnance into the container.
    - Time stops when the ordnance is fully released into the container.

Timing Rules

- Maximum run time: 5 minutes
- Proficiency time: 3:00 minutes
    - If the team completes all tasks (navigation, mailbox, ordnance retrieval, disposal) at or before 3:00, they earn a +25-point bonus.

Scoring Breakdown

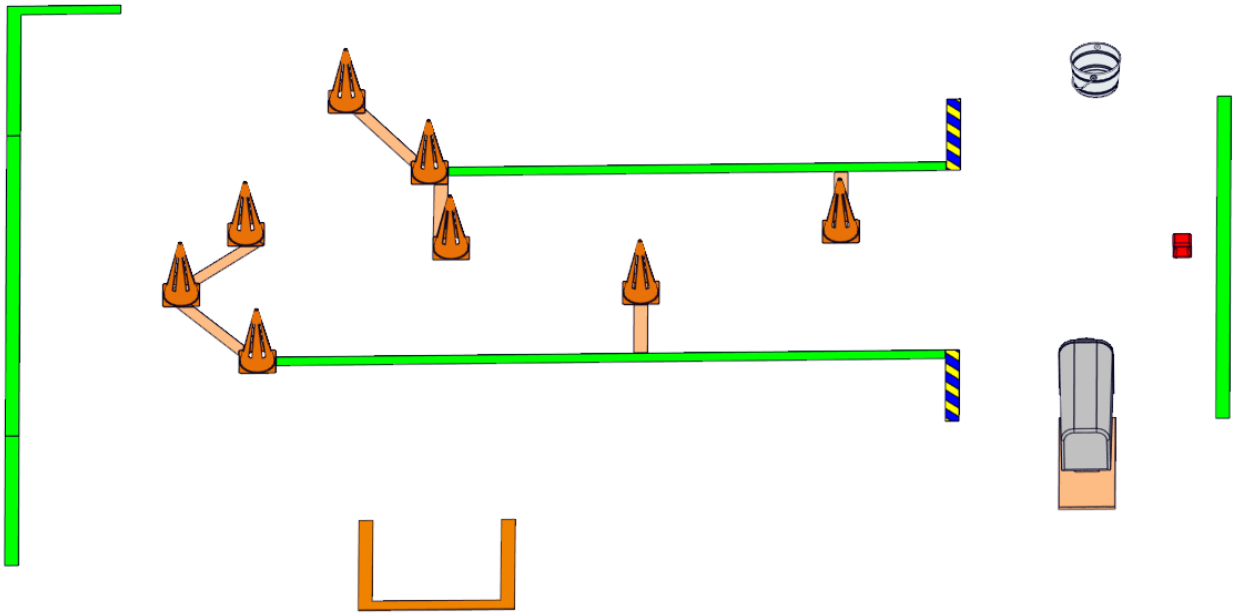
Total base points available: 125 points, plus potential +25-point proficiency bonus.

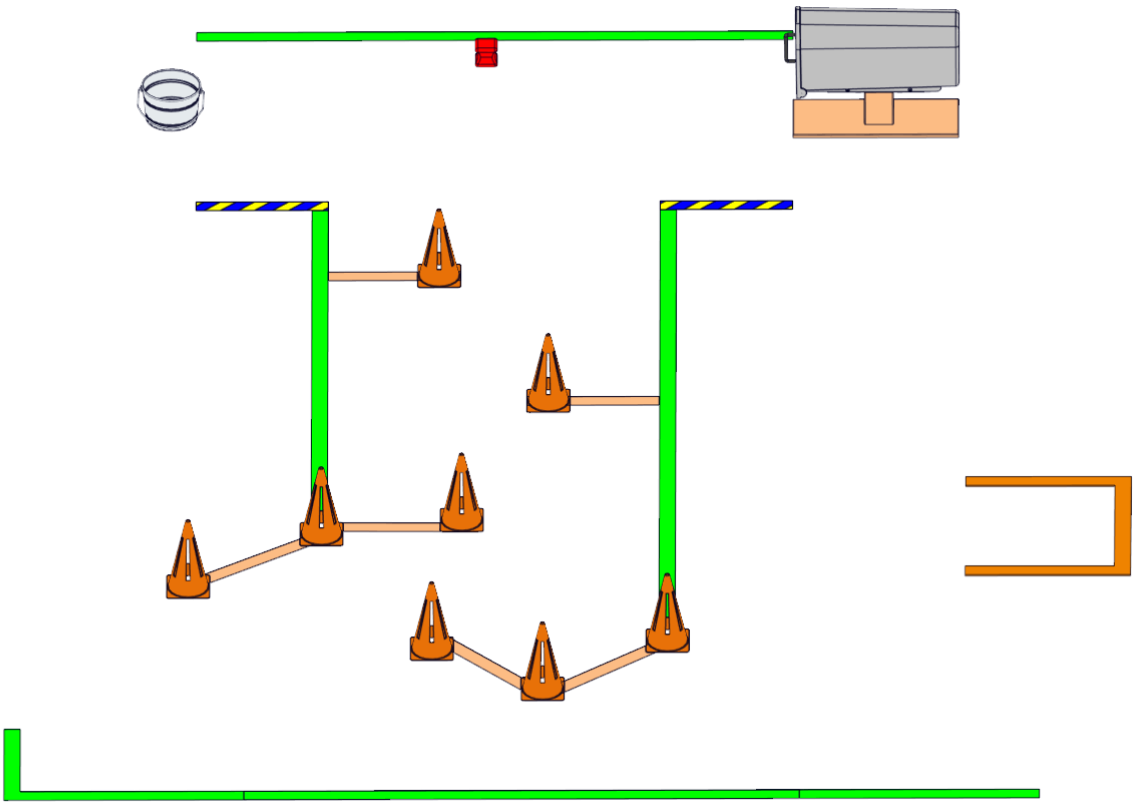
1. Navigation Section – 40 points
    - Successfully reach the end of the navigation section while:
        - Staying within boundaries.
        - Not knocking over or moving cones.
2. Mailbox Operation – 25 points
    - Correctly reach the mailbox zone and open the mailbox using the robot.

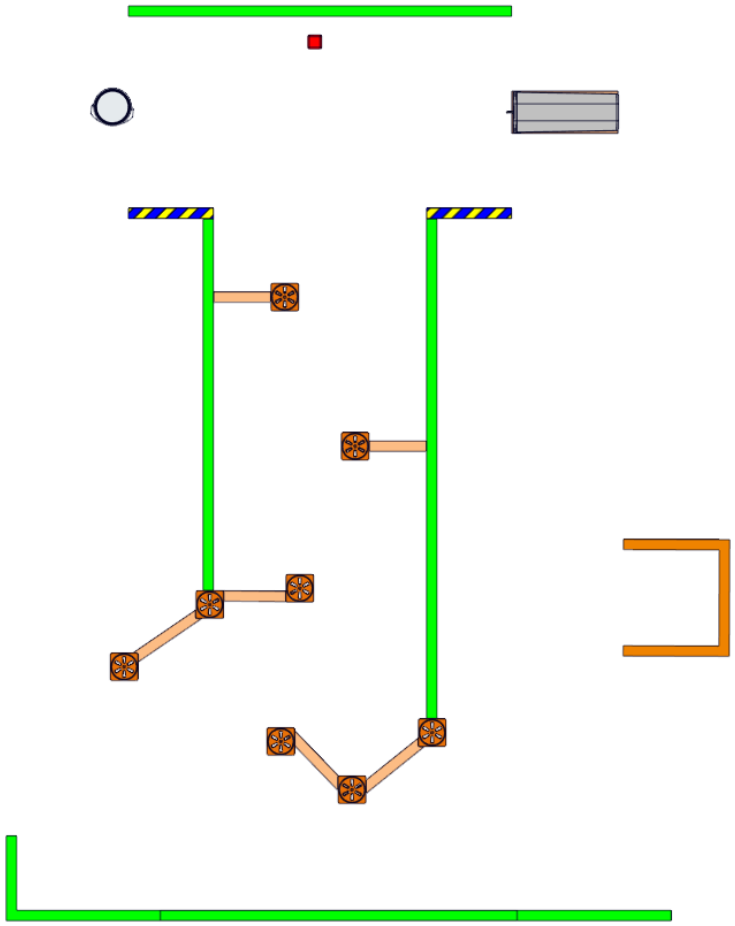
3. Ordnance Securing – 30 points
    - Position the robot, open the gripper, securely grasp ordnance, and lift/carry without dropping.
4. Ordnance Disposal – 30 points
    - Transport ordnance to the disposal container and fully release it inside.
5. Proficiency Bonus – 25 points
    - Awarded if all the above tasks are completed within 3:00 minutes.

Possible Deductions

- 5-point deduction each time the robot crosses a taped boundary line in the navigation section
- 5-point deduction if the robot bumps or knocks over a cone
- 5-point deduction each time the robot drops the ordnance or loses control during transport
- 10-point deduction each time the robot breaks the plane of the 15' x 15' course boundary
- 5-point deduction each time the robot becomes hung up or disabled
- 10-point deduction if the battery becomes detached from the robot.







(E) Standards, Competencies, and Academic Skills

Standards and Competencies

- **RR 1.0 Demonstrate knowledge in safety rules and practices**
- 1.1 Maintain a safe work area.
- 1.2 Demonstrate safe and correct use of hand tools.
- 1.3 Follow safety rules during robotic assembly.
- 1.4 Demonstrate safe operation of robotic equipment in tele-op mode.

- **RR 2.0 Produce technical documentation**
- 2.1 Keep an engineering notebook detailing design discussions, design details, design changes, and troubleshooting notes.
- 2.2 Develop a technical drawing of the final competitive robot design.
- 2.3 Produce a bill of materials for the final competitive robot design.
- 2.4 Explain design choices and changes made within the engineering design process.

- **RR 3.0 Demonstrate knowledge of robot parts**
- 3.1 Identify mechanical and electrical parts of the final robot design.
- 3.2 Demonstrate understanding of the mechanical and electrical functions of the parts of the final robot design.

- **RR 4.0 Demonstrate understanding of robot mechanical systems**
- 4.1 Identify mechanical systems within the final robot design.
- 4.2 Demonstrate the function of control systems of the final robot design.
- 4.3 Demonstrate and explain the functioning of the drivetrain of the robot.
- 4.4 Demonstrate and explain the functioning of the package delivery system of the robot.

- **RR 5.0 Demonstrate understanding of robot electrical systems**
- 5.1 Identify electrical/electronic systems within the final robot design.
- 5.2 Demonstrate and explain the function of electrical control systems of the final robot design.

- **RR 6.0 Demonstrate tele-op skills and real-time problem solving**
- 6.1 Demonstrate ability to safely and quickly maneuver the robot through rough and unknown terrain via tele-op.
- 6.2 Demonstrate ability to overcome challenging areas of course terrain via tele-op.
- 6.3 Demonstrate ability to locate objects through remote robotic manipulation via tele-op.
- 6.4 Demonstrate ability to transport objects via tele-op.

- **RR 7.0 Demonstrate ability to present and explain technical information**
- 7.1 Demonstrate correct and effective use of oral, written, and technological tools to present technical information regarding engineering design process, robot construction, and robotic tele-op control.
- 7.2 Demonstrate knowledge of design choices and implementations during the engineering design process.
- 7.3 Demonstrate knowledge of team processes and individual team member contributions.

Committee-Identified Academic Skills

Math Skills

- Students use fractions in contextual applications to solve problems.
- Students use percentages in contextual applications to solve problems.
- Students solve problems through the contextual application of proportions.
- Students measure time, distance, and angles within contextual problem-solving applications.
- Students simplify numeric expressions.
- Students use comparisons, predictions, and inferences in analyzing data to solve a problem.
- Students utilize modeling techniques to solve problems.
- Students write and solve algebraic expressions in one or more variables.
- Students use derived measurements to solve problems.

Science Skills

- Students apply the scientific method to plan and conduct experiments.
- Students apply knowledge of heat, sound, mechanical, chemical, electrical, and light energy within contextual problem-solving applications.
- Students apply knowledge of kinetic and potential energy in contextual applications to solve problems.
- Students apply knowledge of Newton's laws of motion to solve problems.
- Students apply knowledge of simple and compound machines to solve problems.
- Students apply knowledge of gears, motors, and linkages to solve problems within contextual applications.
- Students use formulas to solve problems.
- Students apply scientific knowledge within the engineering design process.
- Students apply knowledge of force and motion concepts in contextual problem-solving.

Engineering Skills

- Students apply the engineering design process to solve a contextual problem.
- Students apply the principles of circuit analysis.
- Students apply the elements of circuit design and construction.
- Students understand and apply energy and power types, sources, and conversions.
- Students apply methods of maintaining, servicing, troubleshooting, and repairing systems.
- Students apply skills and techniques related to building, repairing, and maintaining robotic mechanisms.
- Students apply techniques and technologies related to the production of technical drawings.
- Students apply basic mechanical skills related to robotic design, construction, and troubleshooting.
- Students understand and apply knowledge of safety during construction and use of equipment.
- Students apply problem-solving and engineering-design processes to solve unforeseen challenges.

Language Arts Skills

- Students make effective use of spoken, written, and visual communications with team members within the problem-solving and engineering-design processes.
- Students make effective use of spoken, written, and visual communications with a variety of audiences.
- Students use appropriate information resources within the research-and-design process.
- Students organize and synthesize information for use in research-and-design processes and in formal presentations.
- Students demonstrate the ability to correctly read and interpret rules, instructions, and specifications within the robotic challenge.
- Students demonstrate the proper use of language, both written and verbal.