



Robotics: Urban Search and Rescue

Contest Date(s):

Video and Notebook Submission date ONLY – March 26, 2021 by 11:00pm

Live Off-Site Contest date – March 27, 2021 at 10:00am

Contest Type: LIVE OFF-SITE

746 Morrison Road, Gahanna, OH 43230

(Strict COVID-19 Protocols will be in place)

(Waivers and Questionnaires are located on the State Championships Webpage)

Contestants must:

- **Submit COVID-19 Waiver a minimum of 24 hours in advance to:**
<https://www.dropbox.com/request/otCWzViGM9l89cian7Lg>
- **Submit the COVID-19 Questionnaire 24 hours in advance to:**
<https://www.dropbox.com/request/Xt0hUQh0MuL7fsPJc1BX>

(Contestants will be required to complete this again the morning of the contest)

- **Masks must be worn at ALL TIMES**
- **ONLY CONTESTANTS will be allowed into the contest space**
 - **Temperatures will be taken upon arrival**

**VIOLATION of any of these conditions may result in the contestant(s)
being unable to compete and/or being sent home**

Submission Link(s) – Due by 11pm on March 26, 2021:

Dropbox: <https://www.dropbox.com/request/BQ5YNIfmfXR4idR9c60c>

or

Google Drive: <https://forms.gle/nh11NLs5zYLBbBsa9>

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PURPOSE

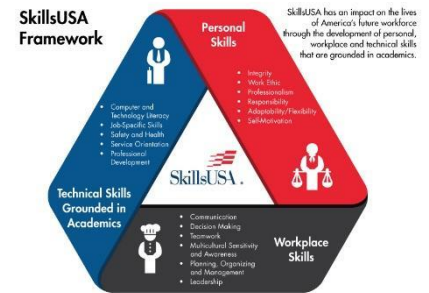
To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of robotics.

ELIGIBILITY

Open to active SkillsUSA members enrolled in programs with robotics, engineering, automation, manufacturing, electronics, and emergency services as the occupational objectives. In accordance with the SkillsUSA Ohio Guidelines Book. Team Competition.

ORIENTATION

You will receive a brief orientation prior to competing, you will be assigned a competition time. You should plan to arrive 30 minutes early and report to 760 Morrison Rd. Ste B. Gahanna OH 43230. This will be where you will stage and prep your robot prior to competition. STRICT COVID 19 PROCEDURES WILL BE IN PLACE.



CLOTHING REQUIREMENTS

Official SkillsUSA dress or business attire (business attire includes no sneakers, blue jeans, or t-shirts). No school names can be displayed on any apparel.

Official SkillsUSA Dress	<ul style="list-style-type: none"> Official SkillsUSA white polo shirt Black dress slacks (accompanied by black dress socks or black or skin-tone seamless hose) or black dress skirt (knee-length, accompanied by black or skin-tone seamless hose) Black leather closed-toe dress shoes
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TOOLS PROVIDED BY CONTESTANTS

- One copy of a 1-page typed personal résumé
- Safety equipment — eye protection is required at all times in the contest area
 - Laptop computer (optional) if needed for programming
 - Fully assembled, tested, and operational ordnance disposal robot conforming to the guidelines and parts restrictions listed in this document (see “Urban Search and Rescue Challenge Kit Bill of Materials” in Appendix)
 - Video Camera attached to Robot
 - Video Camera receiving unit capable of connecting to LED Video Display Screen supplied by Technical Committee, or goggles, tablets or hand held devices may be used.
 - Pens, pencils and paper
 - Tools:
 - 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)

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- k. Wire cutters/snips (one set)
- l. Roll of electrical tape
- m. 4" nylon wire ties (25 pack)
- n. Multimeter
- o. Multinut pliers
- p. Metal-cutting hacksaw (manual)
- q. Cordless drill with charger
- r. Set of standard drill bits
- s. Pliers (needle nose or regular)
- t. Set of box wrenches

Note: ONLY the above listed items will be allowed in the contest area during the competition.

TOOLS PROVIDED BY TECHNICAL COMMITTEE

1. Challenge competition field 12' x 12' and scoring objects.
2. One table or table space for two contestants and 2 chairs for each team. In the "Pit" area.
3. One standard 120V electrical outlet
4. The description of the Robotics Urban Search & rescue challenge
5. Command Center 24" LED video display Screen w/Component video connections and HDMI.
6. Robot Team Number Plate W/ attaching fasteners

SPECIAL INFORMATION

- No smart watches or phones are permitted during the contest.

Challenge Overview

A two-member team builds its robot and arm mechanism prior to the competition and then, during the competition, remotely operates the robot, which should be capable of locating, grabbing, and moving simulated ordnances on the challenge course. This remotely operated vehicle (ROV) must traverse the course, locate the ordnances, secure them, and properly dispose of them. Each team will perform one round of competition consisting of a **time-limited mission to locate and dispose of the two ordnances**.

- During the mission, each team must complete several procedures specified in the rules provided at the event.
- The mission will be limited to **six minutes**.

Each two-member team will work from a command center to remotely operate its robot to carry out the mission. The command center will be equipped with a monitor displaying the video feed from an onboard wireless camera system attached to the robot. The robot will begin the challenge course from a starting point.

The timed mission starts when the robot begins to move and ends when the robot drops the last ordnance into the containment unit, or when time runs out.

Contest Field

- 12' x 12' simulated residential area (See photos in Appendix)

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- Features of neighborhood:
 - Starting point from which robot deploys
 - Containment boundaries marking the 12' x 12' challenge area
 - Objects often found in a neighborhood setting: home, street, grass, mailboxes

Note: Ordnances are randomly and strategically positioned on the challenge course in locations that require a robot to open doors 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, in which case tele-op capabilities will be put to use.

Command Center

The command center will be located within view of the contest field and equipped with a table, two chairs, and a video monitor. Contestants may not leave this area during the competition. (See “Command Center” specifications in USAR)

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 access to a 120-volt electrical outlet. **Note:** Cameras must remain *off* while in the pit area to minimize the chance of interference for the team actively driving the course.

Urban Search & Rescue Challenge Kit

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

Any off-the-shelf robotics building platform 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**. 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 the USAR.

The VEX Claw Kit P/N 276-2212 may be used as a manipulator.

Contest Guidelines/Rules

Note: Guidelines and rules are subject to change.

- Each **team** must be composed 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** (supplied by Committee) with the team’s number listed.
- **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) may also be used. The prebuilt robot and arm mechanism will be required to grab, hold, and move objects during the

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mission. The robot's arm mechanism must be capable of opening a standard-size mailbox and reaching **into the box up to five (5) inches**, grabbing the simulated ordnance, and pulling it out of the mailbox. The arm mechanism must be capable of reaching items positioned **up to nine (9) inches above the floor**.

- The simulated ordnances (wooden block below, left) are not included in the competition kit and are **approximately 2.7 inches cubed**. Can be purchased from Home Depot #773204302002 Bun Foot.
- The handles on doors and mailboxes (below, right) are **3.3 inches long and .41 of an inch wide**.



Ordnance



Mailbox

- **Part Restrictions:**
 - Limit of **four** continuous rotation DC motors or servo motors per competing robot
 - Limit of **four** standard-scale proportional servo motors or equivalent
 - Maximum of **one** transmitter (up to six channels)
 - Maximum of **two** DC motor controllers
 - **One** rechargeable battery pack for drivetrain motor power, maximum 12V.
 - **One** battery pack for receiver and/or servo power, maximum 6V.
 - **One** battery operated wireless camera, maximum 9V. This single camera must be mounted to the robot.
 - Robot must fit into an **18" x 18" x 18"** space when starting **but may be expanded to a larger size during the challenge**.

(Note: Any other battery-operated components installed on the robot must use one of the above listed power sources.)

- 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 prior to the competition**.
- All robots will be required to **pass inspection** by judges to determine if all of the parts used are from the list of allowed parts. Any team whose robot fails inspection will be disqualified if proper modifications have not been made.
- Robots will not be allowed to compete with an arm mechanism that poses **danger** to competitors or could potentially cause damage to the challenge field.

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- Accuracy of the robot's **construction matching the blueprint** will be considered during scoring. 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 also may be printed or hand-drawn copies.
- Teams **have until the competition begins to practice**, and may watch other competing teams during the challenge event.

Presentation

- Video file of **technical presentation needs to be uploaded to the Dropbox or Google Drive links provided before 11:00pm on March 26, 2021**. Videos should last no more than 2 minutes and should be primarily oral, with supporting materials of printed or electronic media and physical models. discuss the roles each contestant played in their robot design, and the functions of their robot and design challenges faced and solutions. Desired format mp4 (may also be uploaded to YouTube and the URL provided via the Google Drive link).

Engineering Notebook

The **Engineering Notebook will be Digitally submitted by 11:00pm on March 26, 2021 via the Dropbox or Google Drive links provided**. It will be one single document preferably in PDF format.

Required elements:

- 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, skills learned, and how robot might further be modified to improve performance and achieve desired objectives if no restrictions were in place

Challenge Course Rules

Note: Team members must wear safety glasses at all times while they are in the competition area! All teams will be expected to adhere to the official rules for the Urban Search & Rescue Challenge competition and compete in a positive and professional manner.

- At the competition site, the **simulated residential area** will be provided and maintained by the technical committee.
- During competition, the course will be reset to its original state before each team competes.
- A time trial must be completed prior to the timed mission. The ordnance will be placed in a specified location on the course and the route traveled to retrieve and dispose of the ordnance must be identical

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for all teams. This route will be determined by the event chairperson. The fastest time will be awarded a 50-point bonus; the second-fastest time will be awarded a 30-point bonus.

- The Urban Search & Rescue Challenge: Explosive Ordnance Disposal event will consist of a **single timed mission** for each team. During the mission, 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, and team members must remain seated at the command center while competing.
- An official will be in charge of placing the team's robot at the starting point on the challenge course. (**Reminder:** The robot must fit within an 18" x 18" x 18" space at the start but **may expand to any size after it enters the neighborhood.**)
- 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 return to home base following disposal of two simulated explosive ordnances.
- Robots should remain on roads and paths within the neighborhood in order to avoid property damage. Shortcuts are not allowed and will result in penalties.
- The mission will last a **maximum of six minutes**.
- Team members are **not allowed to touch** their robot at any time while a mission is in progress, unless instructed to do so by a judge.
- The **containment unit** where the ordnance pieces are placed by the robot after removal from the course must remain outside of the field of play and as close to the starting position as possible. Any team that deliberately moves the containment unit from its starting point may be disqualified.
- An official will award points for the team's mission based on the official "**Challenge Field Skills**" rubric.

Penalties

- A deduction (see rubric in Appendix) will be assessed each time an ordinance is dropped
- Each time the **robot stalls or becomes hung up** and has to be freed by officials, a deduction will be assessed. An official will free a robot at the request of a team member.
- A deduction will be assessed whenever a robot goes off the designated path within the neighborhood or **outside of the course boundaries. Shortcuts are not allowed.**

SCOPE OF THE CONTEST

The contest will be judged based on the criteria established in the current year's National Technical Standards, which are updated annually. National Technical Standards are accessed through your Professional SkillsUSA Membership benefits by logging on to your SkillsUSA account at <https://www.skillsusa-register.org/Login.aspx>.