Version: 2025A

RoboCupRescue Robot League

2025 Championship, Salvador, Brazil

When disasters happen, emergency responders risk life and limb to save people and protect property all over the world. They need capable and easy to use robotic systems to improve their effectiveness and reduce risk as they selflessly provide aid to the rest of us in our time of need.

The RoboCupRescue Robot League gathers teams of researchers capable of developing robotic systems that enable emergency responders to perform extremely hazardous tasks from safer stand-off distances. These mobile robots need to demonstrate assistive and autonomous behaviors that can increase their reliability when operating remotely within complex environments, including even partially collapsed structures when necessary.

Established just prior to the World Trade Center collapse in New York City more than twenty years ago, the RoboCupRescue Robot League has hosted robot evaluations annually all over the world. In addition to demonstrating the state-of-the-science in robotics for unstructured environments, we help develop the standard test methods emergency responders use to objectively evaluate commercial robots, train with measures of remote operator proficiency, and compare results no matter where or when the evaluations happen.

This is just the first step out of the laboratory for many of these robots and researchers. It is a long process to harden and commercialize robots for deployment into such difficult environments. But these League participants are determined to use their skills and energy to help emergency responders stay safe as they save lives.

Bringing Robotics Researchers Together to Collaborate

The RoboCupRescue Robot League conducts comprehensive evaluations involving essential mission tasks required by emergency responders worldwide. The arenas include a variety of reproducible terrains, obstacles, and tasks with increasing difficulty to challenge even the most capable robots.

We measure *Maneuvering, Mobility, Dexterity, and Exploration*, all with an emphasis on developing the assistive and autonomous behaviors necessary for remote operators to be effective and reliable in complex environments.

- ***Mobility (MOB)*** refers to terrains and obstacles that are typically too difficult to mandate a particular driving direction. These are reproducible tests abstracted from real-world situations that robots need to perform in emergency response operations.
- ***Dexterity (DEX)*** refers to manipulator tasks embedded within the various terrains and obstacles. They include some standard tests that are easy for everyone to replicate and compare performance along with other tasks that are more operationally relevant and variable. They are on linear rails to evaluate manipulator reach and omni directional objects to evaluate orientational dexterity.
- ***Exploration (EXP)*** Exploration (EXP) refers to maneuvering tasks within complex terrains of the labyrinth to generate 2D and 3D maps of the environment while identifying objects of interest. The resulting maps are scored for accuracy and quality as if they were about to be handed to an emergency responder for immediate use. Avoid Holes test lane is reserved for autonomous operation only to test the perception and navigation capabilities of autonomous robots.

Competition Features

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Remote Operator Stations ensure the robot operators cannot see the robot inside the test lane. No communication with the operator is allowed. They must receive all their remote situational awareness through their system interface as if the robot is down range or in a structure. **One operator at a time only! Switching operators is OK. Operators must stay at the operator station and must not watch the robot during the trial.**

Difficulty Settings for Test Lanes enable incremental challenges for robots with various capabilities. When the apparatus difficulty setting is the same for all teams, and the time limit is the same, the trial results are comparable.

Trial Time Limits are not intended to make it a race. Rather, there is enough time for a capable robot to demonstrate a statistically significant number of task repetitions. This provides a measure of reliability that the task can be performed. Trials begin every 30 minutes:

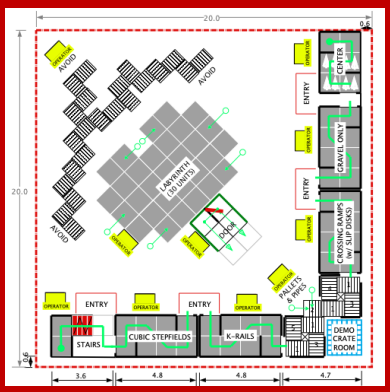
- 4 minutes to set up
- **20 minutes of operation**
- 2 minutes for sensor assessment (victim box)
- 4 minutes to exit

Assistive/Autonomous Behaviors are encouraged for maneuvering through complex environments with no guidance from the remote operator –**hands-off the interface throughout**. Assistive behaviors can use onboard sensors to help remote operators center through obstacles, coordinate manipulator joints, or control flippers to maintain contact with ground terrains. All such features help remote operators perform more reliably.

Radio Communications Degradation happens inside intact and partially collapsed structures. Assistive and autonomous behaviors are needed to improve the effectiveness and reliability of robots being operated from safe locations outside the structure. We provide scoring incentives to encourage teleoperated robots to work with intermittent and unpredictable communications.

Tethers are always allowed because they can provide secure communications and ongoing power to drive the robot or recharge batteries over time. Imagine finding a trapped victim and establishing communications, then running out of battery power! Tethers can avoid that while providing other benefits. For example, tethers can glow in the dark with arrows identifying the route the robot took. This can lead people who find it out through smoke. To avoid getting snagged on obstacles, tethers should be spooled on the robot and act as a winch when necessary to help descend stairs then climb back up if necessary. If tethers are dragged behind the robot within the test lanes, they must be managed from the lane door by a helper, not guided over the walls. Note**: Only one cable hander allowed during the mission. Cable handler MUST stay at the entrance of the lane (except the labyrinth).**

Test Methods within the Arena



MOBILITY

Terrains

- Crossing Ramps (with Slip disks) (Flat)
- K-Rails (15° slopes)
- Gravel (15° slopes)
- Cubic Stepfield (15° slopes)

Obstacles

- Traverse & Center (15° incline, variable width)
- Pallet Hurdles with Pipes (20cm elevations)
- Stairs (35°/40°/45° incline, 2/4 occlusions)
- Doors

DEXTERITY

Sensing Tasks (Victim Crate)

- Thermal Image Acuity (5 pts)
- Partial Image Recognition (4 pts)
- Motion Detection (4 pts)
- Proximity Sampling (3 pts)
- QR Code Acuity (2 pts)
- Visual/Color Acuity (1 pt)
- 2 –Way Audio Acuity (1 pt)

Classification Tasks

- Inspect (linear 1 pts, omni 2 pts)
- Touch (linear 2 pts, omni 4 pts)
- Insert (linear 3 pts, omni 6 pts)

Operational Tasks

- Push E-Stops (omni 10 pts)
- Rotate Valves (omni 10 pts)
- Insert Keys (omni 10 pts)
- Shore Blocks (stack 10 pts)

EXPLORATION

- Avoid Holes (elevated path to follow)
- Mapping Labyrinth (round fiducial, objects)

Innovate, Evaluate, and Compare

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The main objective for teams is to challenge their robotic system capabilities and refine their approaches. Teams learn what it takes for their robots to succeed in real-world applications.

Inclusiveness: Teams get as many trials as possible within the time available, so they can rigorously evaluate their robots across the terrains, obstacles, and tasks that support their research objectives. Teams schedule their own test plan each day to manage their own risks.

Resilience to Failure: Robot resets are allowed during trials to ensure some level of measurable success. A 2-minute penalty allows the robot to be safely carried and reset in the **previous end zone** to continue. After the penalty the trial continues as usual. No talking to the operator is allowed during the trial except to reset a robot. The operator or team member with the best view of the robot should declare a reset.

Every team get to comprehensively evaluate their robot. Teams seeking to accumulate scores can win awards to recognize their accomplishments.

- **Best-In-Class Awards** are given for teams that demonstrate the most capable and reliable robots within a class of tests: Mobility, Dexterity, and Exploration/Mapping. The trials are captured during the semi-finals when experienced judges are proctoring the trials. **Scoring for BiC is still under review.**
- **1st, 2nd, and 3rd Place Awards** are given to teams that combine all three categories of capabilities to demonstrate the best performance across the entire arena. These teams perform the most challenging mission sequences on the final day.
- **Certificate Awards** recognize important contributions across the league such as the most **intuitive operator interface** or particularly **effective design functionalities**.

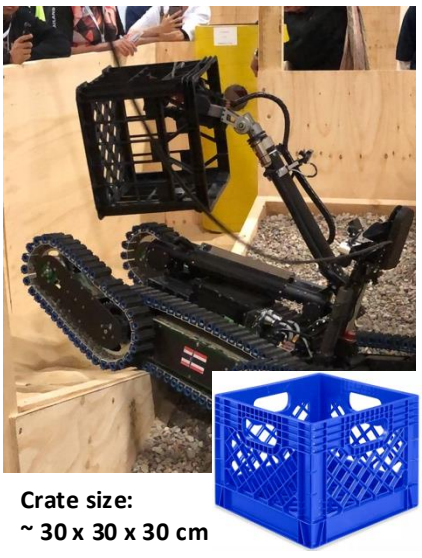
Additional Challenges
(Available in all Lanes)

Negotiate Leaning Obstacles:
Perform additional maneuvering tasks in the any lane to earn additional points. (See Mission Form)

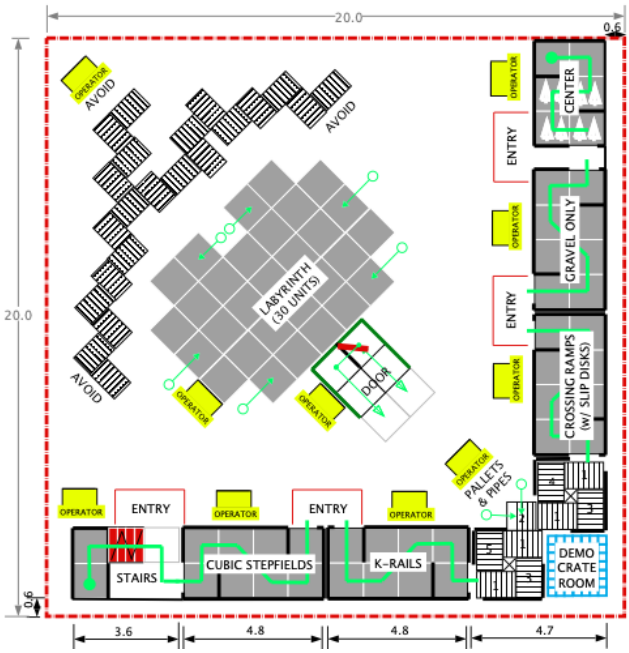
Carry Crate: Carry the crate in your gripper or as a payload on your chassis in all test lanes to additional points. (See Mission Form)

Radio Comms Degradation:
Perform the mission under increasingly challenging network conditions over time in all test lanes by using the league's Radio Degradation Box to earn additional points (See Mission Form).

To train for radio degradation in advance, follow the build instructions of the Radio Degradation Box published by the Communications Network Institute of TU Dortmund University here: https://github.com/tudo-cni/vsting-sa"



Crate size:
~ 30 x 30 x 30 cm



Lane Overview

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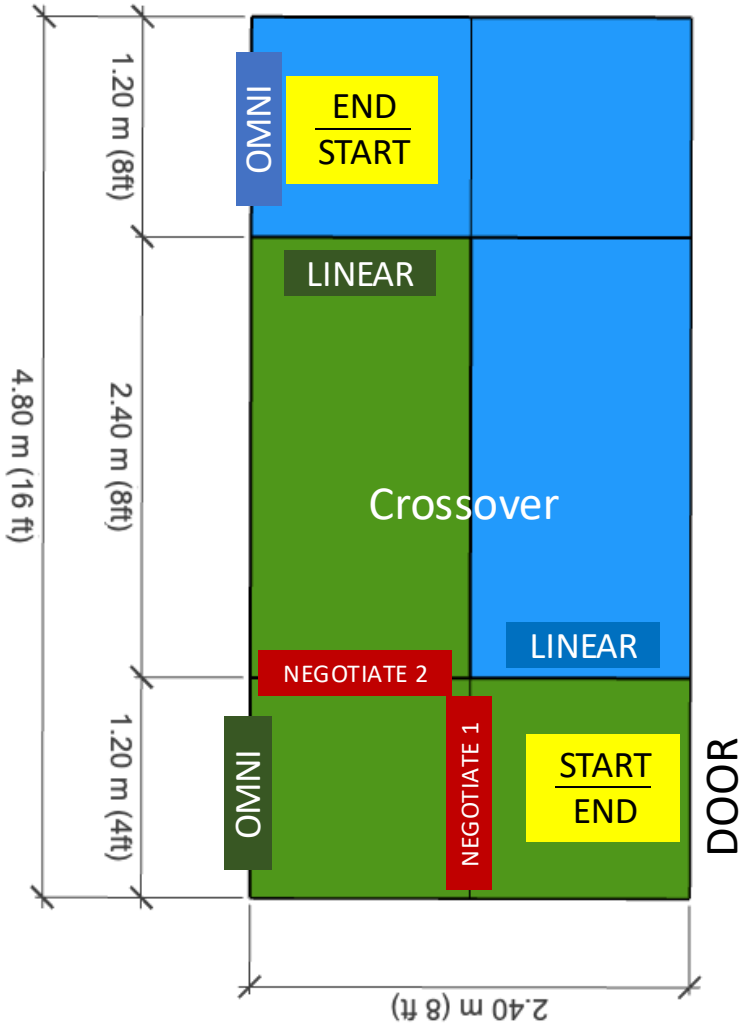
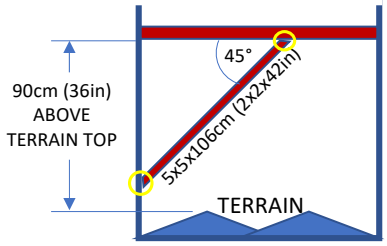
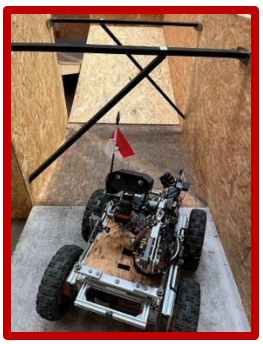


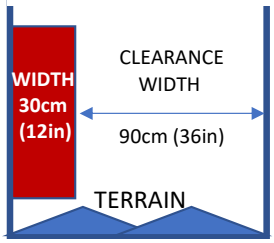
NEGOTIATE

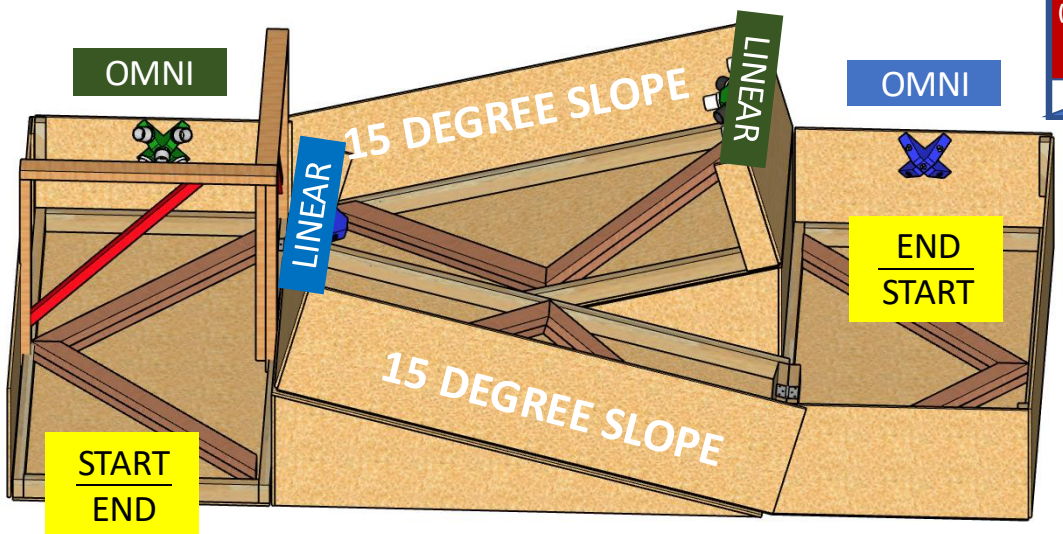
ROBOT VIEW OF "NEGOTIATE" OBSTACLES



ANGLED BEAM HANGS FROM THE CROSSBAR AND IS AFFIXED TO THE SIDE WALL WITH A MAGNET AND WASHER SO IT CAN RELEASE IF BUMPED.







Trial Scoring for Missions

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Scoring Mobility

- Mobility scoring is based on continuous driving **end-to-end traverses** in the lane. The robot must **start** and **end** each traverse completely within the designated squares (Lane Overview).
- Driving teleoperatively **scores 1 point** for successful completion in each direction. Additional points are available for carrying a crate, Negotiate thru Leaning Obstacles and Radio Comms Degradation.
- Driving autonomously (hands off the interface) **scores 10 points** for successful completion in each direction. The remote operator may take over control at any time to finish a traverse teleoperatively for 1 point and try again autonomously on the next repetition. Additional points are available for carrying a crate, Negotiate thru Leaning Obstacles and Radio Comms Degradation. Teleoperation is allowed in both end zones in any case to set waypoints, evaluate maps, etc.
- *Single Lane Missions* perform up to **10 end-to-end traverses** in the first 10 minutes of the trial. If finished early, use the elapsed time as a measure of efficiency. Wait for the Dexterity time to start before performing any Dexterity tasks.
- Mobility scores are normalized relative to the best score so the results can be combined with other lanes that are easier/harder for teams in general.

Scoring Dexterity

- **In order to score any dexterity points, you must score at least 1 point during the mobility portion**.
- Performing dexterity tasks autonomously will score additional points. The attempt must start outside the hallway which contains the dexterity task (around at least one corner). While inside the hallway, if the robot successfully performs a task with the manipulator being autonomous (no teleoperation of the manipulator), a score multiplier of 4 is applied (TA = teleoperated approach, autonomous manipulation). If both manipulation and driving are performed autonomously (completely hands off the interface), a multiplier of 8 is applied (AA = autonomous approach, autonomous manipulation). Teams may map, scan, and/or mark targets for manipulation at any time during the run.
- After completing the designated Mobility repetitions or when Mobility time expires, perform the Dexterity tasks starting anywhere and in any order. No repeated tasks are allowed.
- Dexterity scores are normalized for comparison.

Scoring Exploration/Mapping

- See Rule Document for Mapping

Single Lane Missions

Prelims (30-minute rotations, 20-minute trials)

Each test lane can be conducted individually to capture a statistically significant set of repetitions from end-to-end. This enables teams to refine their systems and tactics for the challenges in each test lane.

There are 10 concurrent start points and operator stations at each lane. Teams schedule their own test plan each day to balance their objectives with related risks. Teams typically try every lane in the Preliminaries, but several scores can be dropped from the totals.

Each team provides a "Proctor" to score and attest to the results of other team trials. This ensures all teams go home with experience conducting objective evaluations for their ongoing development process.

Multiple Lane Missions

Semis (30-minute rotations, 20-minute trials)

These sequences challenge teams to optimize their systems across different capabilities. There are 4 concurrent lane sequences with different operational objectives. **The lanes are conducted in any order** but no repeats are allowed until all lanes are completed.

Approach an Urban Dwelling in a Disaster

- Crossing Ramps (Slip disks)
- Gravel
- Traverse & Center

Approach a Country Dwelling in a Disaster

- Cubic Stepfield
- K-Rails
- Pallet Hurdles

Search the Dwelling and Vehicle for Victims

- Avoid Holes
- Stairs
- Doors

Map a Dwelling in a Disaster

- Labyrinth

Combined Scenario Missions

Finals Challenge the Best Robots to Their Limits

A final combined scenario mission can challenge teams to optimize their systems across a wide variety of different capabilities, much like an operational deployment with various phases.

This is intended for the best few teams because it requires traversing ALL the available test lanes. Teams may choose their own order to minimize risks.

The time limit should be set to enable the best teams to finish the set of lanes, perform one dexterity task within each, and map their path for a total score.

Scoring Mobility

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ROUND	DATE	TIME	TEAM / COUNTRY	PROCTOR: FULL NAME / COUNTRY
P1	7/15	10:00	TEAM A/COUNTRY	Jane Doe/USA

TERRAINS (TER)

- ☒ (10) Crossing Ramps
- ❑ (9) K-Rails
- ❑ (2) Cubic Stepfields
- ❑ (3) Gravel

OBSTACLES (OBS)

- ❑ (1) Incline/Center
- ❑ (5) Stairs
- ❑ (8) Pallets with Pipes
- ❑ (6) Doors

EXPLORATION (EXP)

- ❑ (4) Avoid Holes
- ❑ (7) Mapping Labyrinth

CIRCLE SUCCESSFUL TASKS AND STRIKE THROUGH UNFINISHED OR PENALIZED TASKS.

MOBILITY: Drive TELEOPERATVELY or AUTONOMOUSLY (no hands-on interface) end-to-end in the lane.

			TeleOp (Choose all that apply)			Auto (Choose all that apply)			
	CIRCLE A SINGLE LANE IN THE LIST ABOVE OR WRITE SEQUENCE OF LANES IN ORDER	TELEOP ONLY	TELEOP + CRATE	TELEOP + NEG	TELEOP + COMMS	AUTO ONLY	AUTO + CRATE	AUTO + NEG	SCORE PER LAP
1		(1)	2	2	2	10	2	4	1
2	RETURN UP RANGE TO START POINT	1	(2)	2	2	10	2	4	2
3		1	(2)	(2)	2	10	2	4	4
4	RETURN UP RANGE TO START POINT	1	(2)	(2)	(2)	10	2	4	6
5		1	2	2	2	(10)	2	4	10
6	RETURN UP RANGE TO START POINT	1	2	2	2	(10)	(2)	4	12
7		1	2	2	2	(10)	2	(4)	14
8	RETURN UP RANGE TO START POINT	1	2	2	2	(10)	(2)	(4)	16
9		(1)	2	2	2	10	2	4	1
10	RETURN UP RANGE TO START POINT	(1)	2	2	2	10	2	4	1

52 AUTO POINTS

67 TOTAL POINTS

Embedded Dexterity Tasks/Scoring

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Sensor Crate (White) Prelims/Semis/Finals

- QR Code Acuity, Visual/Color Acuity, Proximity, Hazmat, Motion, Thermal, 2-Way Audio

Inspect Tasks (Green) Prelims/Semis/Finals

- Linear – 1 point each (does not include multiplier)
- Omni – 2 point each (does not include multiplier)

Touch Tasks (Blue) – Prelims Only (easier, use your own tool)

- Linear – 2 point each (does not include multiplier)
- Omni – 4 point each (does not include multiplier)

Insert Tasks (Blue) - Semis (add the grasp shaft tool in center)

- Linear – 3 point each
- Omni – 6 point each

Operational Tasks (Black) – Finals only due to force & friction

- **Omni – 10 point each**

DEXTERITY: Perform the available SETS OF TASKS starting anywhere and in any order. No repeated tasks.

CIRCLE SUCCESSFUL TASKS AND STRIKE THROUGH UNFINISHED OR PENALIZED TASKS.

TT = Teleop Approach/Teleop Dex | CM = Comms | TA = Teleop Approach/Auto Dex | AA = Auto Approach/Auto Dex

LINEAR TASKS		TT	CM	TA	AA		TT	CM	TA	AA		TT	CM	TA	AA		TT	CM	TA	AA		TT	CM	TA	AA
INSPECT	L 90°	01	02	04	08	L 45°	01	02	04	08	Center	01	02	04	08	R 45°	01	02	04	08	R 90°	01	02	04	08
TOUCH (P)		02	04	08	16		02	04	08	16		02	04	08	16		02	04	08	16		02	04	08	16
INSERT (S/F)		03	06	12	14		03	06	12	14		03	06	12	14		03	06	12	14		03	06	12	14
OMNI TASKS		TT	CM	TA	AA		TT	CM	TA	AA		TT	CM	TA	AA		TT	CM	TA	AA		TT	CM	TA	AA
INSPECT	Left Bottom	02	04	08	16	Left Top	02	04	08	16	Center	02	04	08	16	Right Top	02	04	08	16	Right Bottom	02	04	08	16
TOUCH (P)		04	08	16	32		04	08	16	32		04	08	16	32		04	08	16	32		04	08	16	32
INSERT (S/F)		06	12	24	48		06	12	24	48		06	12	24	48		06	12	24	48		06	12	24	48
PUSH E-STOPS		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80
CLOSE VALVES		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80
INSERT KEYS		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80

P = Prelim Only
S = Semi
F = Finals

VISUAL ACUITY PTS: IDENTIFY 3C'S | THERMAL PTS: IDENTIFY 2C'S

SENSOR TASKS	VISUAL Cs	AUDIO	VISUAL QR	PROXIMITY	MOTION	HAZMAT	THERMAL
VICTIM CRATE (ALWAYS)	1	1	2	3	4	4	5

TEAM LEADER SIGNATURE

DEX (TELEOP POINTS) + COMS (POINTS) + DEX (AUTO POINTS) + (SENSOR CRATE) = DEXTERITY (TOTAL POINTS)

Sensing Tasks (Victim Crate)

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A - THERMAL IMAGE ACUITY (5 pts)
Hand warmer with 3D printed Concentric Cs
Process: Using a thermal camera display on operator's screen the heat signature in the pattern of the Concentric Cs 2 levels deep.

B- **PARTIAL IMAGE RECOGNITION (4 pts)**
Random hazmat labels from a known set.
Process: **Autonomously** detect hazmat label. Display bounding box around hazmat label and display name of label.

C - MOTION DETECTION (4 pts)
Rotating disk with target
Process: **Autonomously** detect the rotating target square or other shapes. Display on operator's screen a bounding box around square and track while the target is in motion for 360 degrees

D - PROXIMITY SAMPLING (3 pts)
Magnet
Process: Using magnetometer attached to the tool tip/ manipulator to detect the presence of the magnet

E - QR CODE ACUITY (2 pts)
QR Code
Process: **Autonomously** QR code. Display text on the operator's screen .

F – 2-WAY AUDIO ACUITY (1 pt)
MP3 Player with alpha-numeric sequence to identify
Process: Using your speaker/microphone, detect sound at the operator station and at the robot. Must clearly detect one line of the alpha-numeric sequence .

G - VISUAL/COLOR ACUITY (1 pt)
Concentric Cs
Process: Concentric Cs Identify the gap in the ring 3 levels deep.

CLASSIFICATION TASKS – INSPECT OBJECTS (Green)
Available in All Rounds

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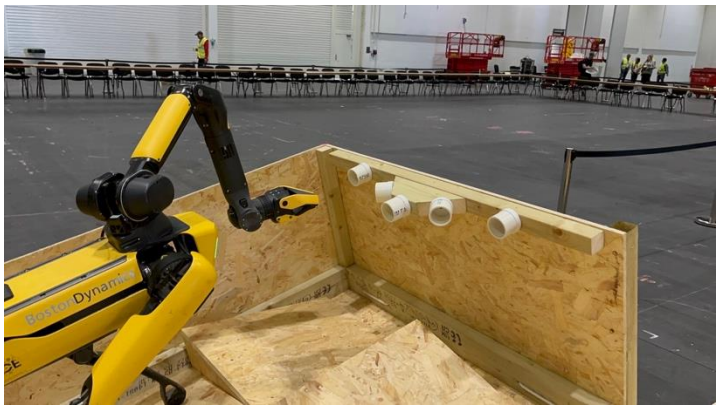
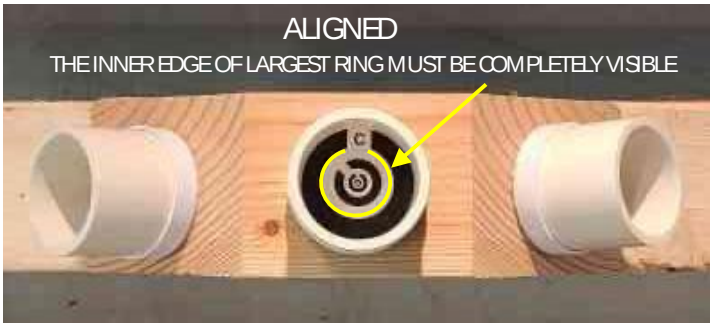
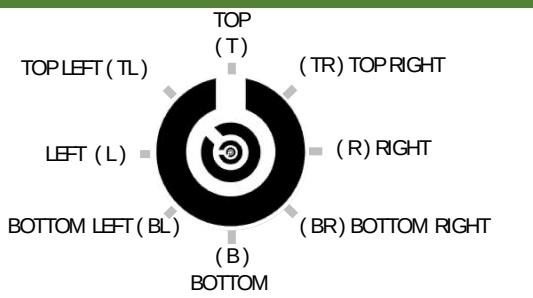
LINEAR





OMNI



50 mm (2 in) inside diameter PVC Pipe
https://www.amazon.com/PVC-Pipe-Sch-Inch-White/dp/B072Q9M54Z/

ONCE ALIGNED
MUST IDENTIFY
ORIENTATION OF GAPS IN
CONCENTRIC Cs
TO SCORE POINTS

Scoring matrix is found on the mission form

CLASSIFICATION TASK – TOUCH or INSERT TOOLS (Blue)

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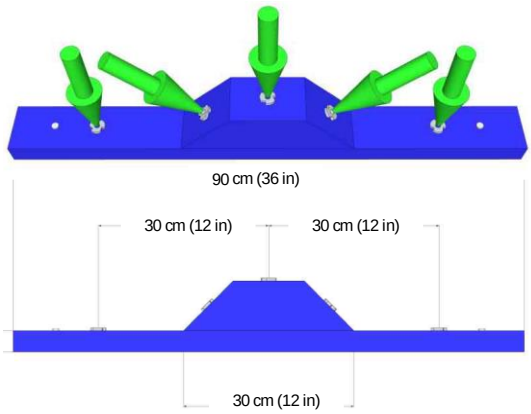
TOUCH = Sustained contact of shaft tip to hole interior in any orientation Easier – Only in Preliminaries

INSERT = Perpendicular penetration of shaft into hole at least 25mm (1in) Harder – In Semis and Finals

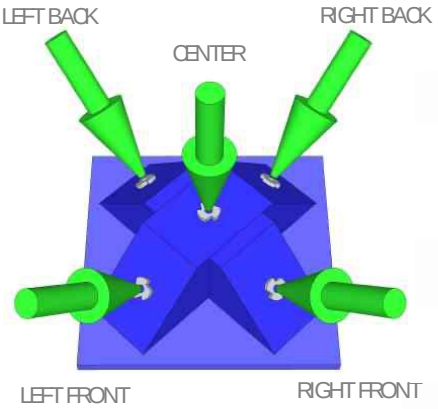
LINEAR

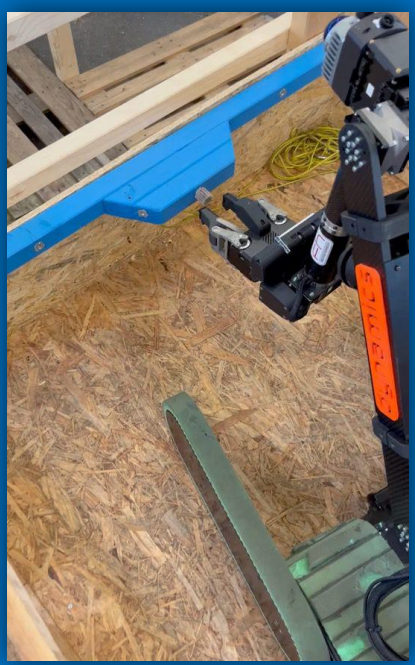
Scoring matrix is found on the mission form

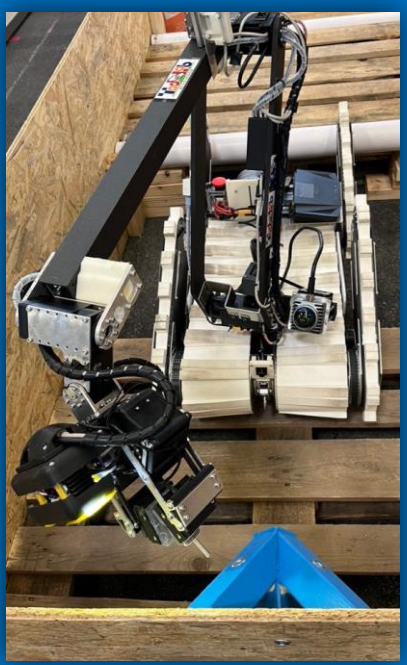


OMNI

Scoring matrix is found on the mission form







One of the standard dexterity tests is “Touch” tools which is conducted in every terrain. See the blue apparatuses shown in both Linear (easier) and Omnidirectional (harder) configurations.

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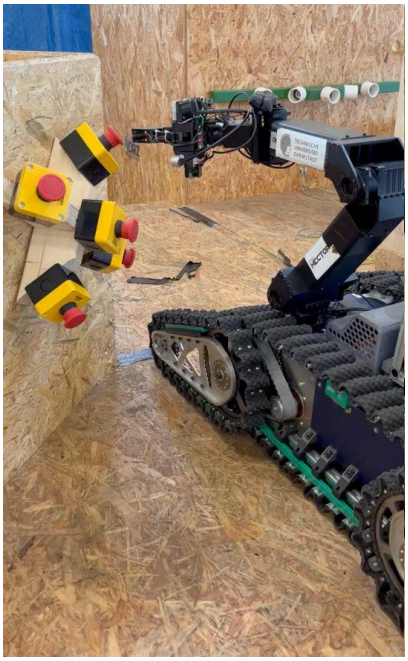
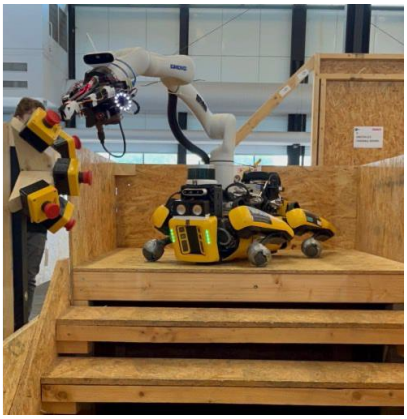
OPERATIONAL TASK – PRESS BUTTONS (Black)

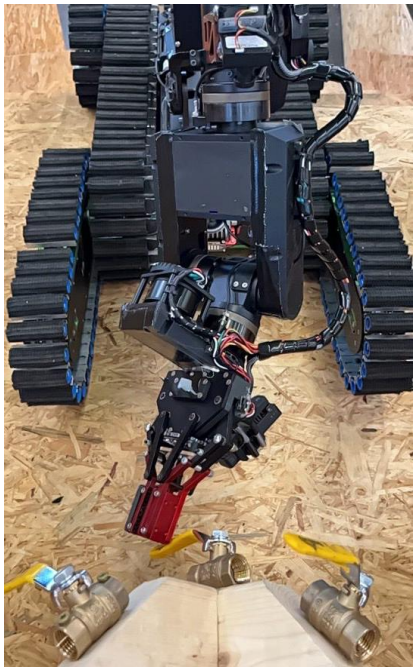
Harder due to force, friction, or precision. Omni configuration only

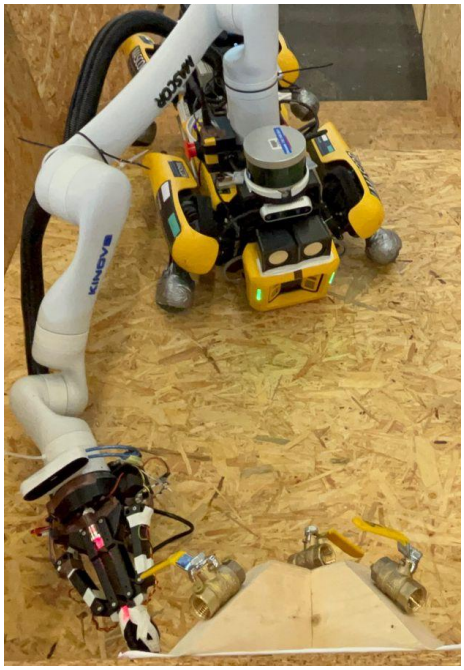




OPERATIONAL TASK – TURN VALVES (Black)

Harder due to force, friction, or precisions. Omni configuration only





Single Lane or Multi Lane Mission Form

Version: 2025A

ROUND	DATE	TIME	TEAM / COUNTRY	PROCTOR: FULL NAME / COUNTRY

TERRAINS (TER)

- ❑ (10) Crossing Ramps
- ❑ (9) K-Rails
- ❑ (2) Cubic Stepfields
- ❑ (3) Gravel

OBSTACLES (OBS)

- ❑ (1) Incline/Center
- ❑ (8) Pallets with Pipes
- ❑ (5) Stairs
- ❑ (6) Doors

EXPLORATION (EXP)

- ❑ (4) Avoid Holes
- ❑ (7) Mapping Labyrinth

CIRCLE SUCCESSFUL TASKS AND STRIKE THROUGH UNFINISHED OR PENALIZED TASKS.

MOBILITY: Drive TELEOPERATVELY or AUTONOMOUSLY (no hands-on interface) end-to-end in the lane.

CIRCLE A SINGLE LANE IN THE LIST ABOVE OR WRITE SEQUENCE OF LANES IN ORDER		TELEOP ONLY	TeleOp (Choose all that apply)			Auto (Choose all that apply)			SCORE PER LAP
			TELEOP + CRATE	TELEOP + NEG	TELEOP + COMMS	AUTO ONLY	AUTO + CRATE	AUTO + NEG	
1		1	2	2	2	10	2	4	
2	RETURN UP RANGE TO START POINT	1	2	2	2	10	2	4	
3		1	2	2	2	10	2	4	
4	RETURN UP RANGE TO START POINT	1	2	2	2	10	2	4	
5		1	2	2	2	10	2	4	
6	RETURN UP RANGE TO START POINT	1	2	2	2	10	2	4	
7		1	2	2	2	10	2	4	
8	RETURN UP RANGE TO START POINT	1	2	2	2	10	2	4	
9		1	2	2	2	10	2	4	
10	RETURN UP RANGE TO START POINT	1	2	2	2	10	2	4	

AUTO POINTS

TOTAL POINTS

DEXTERITY: Perform the available SETS OF TASKS starting anywhere and in any order. No repeated tasks.

CIRCLE SUCCESSFUL TASKS AND STRIKE THROUGH UNFINISHED OR PENALIZED TASKS.

TT = Teleop Approach/Teleop Dex | CM = Comms | TA = Teleop Approach/Auto Dex | AA = Auto Approach/Auto Dex

LINEAR TASKS		TT	CM	TA	AA		TT	CM	TA	AA		TT	CM	TA	AA		TT	CM	TA	AA		TT	CM	TA	AA
INSPECT	L 90°	01	02	04	08	L 45°	01	02	04	08	Center	01	02	04	08	R 45°	01	02	04	08	R 90°	01	02	04	08
TOUCH (P)		02	04	08	16		02	04	08	16		02	04	08	16		02	04	08	16		02	04	08	16
INSERT (S/F)		03	06	12	14		03	06	12	14		03	06	12	14		03	06	12	14		03	06	12	14
OMNI TASKS		**TT**	**CM**	**TA**	**AA**		**TT**	**CM**	**TA**	**AA**		**TT**	**CM**	**TA**	**AA**		**TT**	**CM**	**TA**	**AA**		**TT**	**CM**	**TA**	**AA**
INSPECT	Left Bottom	02	04	08	16	Left Top	02	04	08	16	Center	02	04	08	16	Right Top	02	04	08	16	Right Bottom	02	04	08	16
TOUCH (P)		04	08	16	32		04	08	16	32		04	08	16	32		04	08	16	32		04	08	16	32
INSERT (S/F)		06	12	24	48		06	12	24	48		06	12	24	48		06	12	24	48		06	12	24	48
PUSH E-STOPS		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80
CLOSE VALVES		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80
INSERT KEYS		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80		10	20	40	80

P = Prelim Only
S = Semi
F = Finals

VISUAL ACUITY PTS: IDENTIFY 3C'S | THERMAL PTS: IDENTIFY 2C'S

SENSOR TASKS	VISUAL Cs	AUDIO	VISUAL QR	PROXIMITY	MOTION	HAZMAT	THERMAL
VICTIM CRATE (ALWAYS)	1	1	2	3	4	4	5

TEAM LEADER SIGNATURE

DEX + COMS + DEX + = DEXTERITY

TELEOP POINTS | POINTS | AUTO POINTS | SENSOR CRATE | TOTAL POINTS

Overall Score Calculation

Version: 2025A

Raw Scores

CONTINUOUS RAMPS			
MOB	Auto MOB	DEX	AUTO DEX
20	10	0	0
49	0	10	0
40	40	50	40
20	0	4	0
0	0	0	0
29	0	28	0

Max Score

=IF(B$25=0,0,B4/B$25)

MOB	Auto MOB	DEX	AUTO DEX
49	40	50	40
41%	25%	0%	0%
100%	0%	20%	0%
82%	100%	100%	100%
41%	0%	8%	0%
0%	0%	0%	0%
59%	0%	56%	0%

<u>Normalize Scores</u> for Mob and DEX are combined for total score.
Note: MOB includes AUTO MOB and DEX includes AUTO DEX

Normalize Scores

MOB	Auto MOB	DEX	AUTO DEX
49	40	50	40
41%	25%	0%	0%
100%	0%	20%	0%
82%	100%	100%	100%
41%	0%	8%	0%
0%	0%	0%	0%
59%	0%	56%	0%

MOB + DEX = Lane Score (max 200%)

Sum of all lane scores = Total Score (max 2000%)

Score Calculation for Best in Class

Version: 2025A

- Best in Class Autonomy score is calculated by using the sum of all **Normalized Lane Scores** for AUTO MOB and AUTO DEX

- Best in Class Mobility score is calculated by using all **Normalized Lane Scores** for MOB (AUTO MOB and TeleOp MOB)

- Best in Class Dexterity score is calculated by using all **Normalized Lane Scores** for DEX (AUTO DEX and TeleOp DEX)