

Version 1.0

Competition Document: Game Description

Remote Rescue Robotics Challenge: Navigating Tomorrow's Emergencies

1. Introduction & Theme

Welcome, teams, to the Remote Rescue Robotics Challenge! In this competition, you will design, build, and operate a team of two robots – and Unmanned Aerial Vehicle (UAV/Drone) and an Unmanned Ground Vehicle (UGV/Rover) – to tackle a simulated disaster scenario. Your mission requires precision remote piloting, strategic thinking, and robust robot design to navigate complex environments and perform critical recovery tasks, all under a strict time limit and without direct line of sight to your robots.

Theme: Disaster Response and Recovery – focusing on rapid assessment, infrastructure restoration, medical aid delivery, and hazard mitigation in a simulated post-disaster environment.

2. Competition Objective

Teams must design, build, and operate one aerial drone and one ground rover to complete a series of tasks in a simulated disaster zone arena. The entire operation during the competition run must be performed with operators having no direct line of sight to the robots or the arena. The objective is to complete as many tasks as possible accurately and efficiently within the allocated time to maximize points.

3. Robot Specifications

3.1. General:

- Teams must field one (1) Drone and one (1) Rover.
- Both robots must be primarily controlled via wireless communication.
- Rover robot must be equipped with a camera for primary operation.
- Robots must be powered by onboard batteries only. Standard voltage limits may apply (e.g., common LiPo cell counts like 3S). All batteries must be safely enclosed.
- Autonomous operation is **not permitted** for navigation or primary task completion. Simple assistive functions (e.g., drone altitude hold) may be allowed – clarification available upon request.

3.2. Drone:

- **Type:** Multirotor(Quad) drone configuration is expected.
- **Size Limit:** Maximum dimension (rotor tip to rotor tip diagonally, or max width/length) not to exceed 600mm.

- **Weight Limit:** Maximum Take-Off Weight (MTOW) including battery and any payload/hook: 1.5 kg.
- **Payload Capability:** Must be capable of securely lifting and carrying the designated Medical Kit (estimated weight: 5 to 20 grams).

3.3. Rover:

- **Size Limit:** Must fit within a starting box of 30cm x 30cm (Width x Length). Height limit: 25cm (including antenna).
- **Weight Limit:** Maximum weight including battery: 5.0 kg.
- **Drivetrain:** Any drive system (wheeled, tracked) is permitted.
- **Manipulation/Interaction:**
 - Mechanisms (arms, pushers) highly recommended for switch, road blocks, victims, and medical kit placement.
 - Projectile Launching Mechanism Required: Must be equipped with a mechanism to launch the provided balls towards the Unstable Debris structure.
- **Camera:** Minimum one camera. Onboard lights are recommended for potential low-light areas.

4. Arena Description

- **Size:** 24 meters x 24 meters.
- **Environment:** Simulates a disaster-stricken area featuring various zones and obstacles:
- **Starting Zone:** Where robots begin.
- **Medical Kit Pickup Area:** Location of the medical kit at the start.
- **Medical Kit Dropping Area:** Designated zone for the drone to deposit the kit.
- **Communication Switch Location:** Position of the switch to restore communications.
- **Communication Tower:** A visual indicator (e.g., light, raised structure) that appears upon successful activation of the communication switch.
- **Broken Road Track:** A path simulating damaged infrastructure.
- **Road Repair Switches:** Switches located along the broken road needed to "rebuild" or clear the path.
- **Final Medical Kit Placement Zone:** The target destination for the rover to deliver the kit.
- **Central Ball Area:** Location where balls are staged for the blockade clearing task.
- **Blockade Objects:** Targets that need to be knocked down using the balls.
- **Firing Zone:** A marked area from which the rover must shoot at the Debris Structure.
- **Final Completion Switch:** A distinct button or target the rover must press/touch to signal task completion.

- **Operator Control Station:** Area outside the arena with no direct line of sight, where participants will operate their robots using monitors displaying camera feeds.
- **Game Complete Switch:** The final switch to be activated by the rover to end the run.

5. Game Flow & Task Sequence

Teams will have a set time to complete the following tasks in sequence. FPV view must be used throughout.

(Start: Timer begins)

Phase 1: Drone - Medical Kit Retrieval & Transport

- The Pilot flies the drone from the Starting Zone towards the Medical Kit Pickup Area.
- The drone must be positioned precisely near the Medical Kit (which has a hook or attachment point).
- The Assistant (the only team member allowed near the kit area at this time) physically attaches the Medical Kit to the drone's lifting mechanism.
- The Pilot flies the drone carrying the Medical Kit to the designated Medical Kit Dropping Area.
- The Pilot maneuvers the drone to safely release/drop the Medical Kit entirely within the boundaries of the Dropping Area and lands in the landing zone.

Phase 2: Transition - Kit Transfer to Rover

- The Assistant retrieves the Medical Kit from the Dropping Area.
- The Assistant carefully places the Medical Kit securely onto the Rover
- Once the kit is placed, the Assistant must return to the designated team area.

Phase 3: Rover - Restore Communication

- The Pilot navigates the Rover via FPV from its current location to the Communication Switch (its location will be fixed but may require searching).
- The Pilot uses the Rover to activate the switch (e.g., by pushing it).
- Successful activation will trigger the appearance/activation of the Communication Tower, providing visual confirmation (visible via rover camera if positioned correctly).

Phase 4: Rover - Navigate & Repair Road

- The Pilot navigates the Rover to the start of the Broken Road Track.
- The track will be impassable or difficult until repaired. The Pilot must identify and activate specific Road Repair Switches located along or near the track using the Rover.

- Activating these switches simulates road repair, potentially clearing obstacles or creating a passable path.
- The Pilot navigates the Rover through the now "repaired" track.

Phase 5: Rover - Deliver Medical Kit

- After traversing the repaired road, the Pilot navigates the Rover (still carrying the Medical Kit) to the Final Medical Kit Placement Zone.
- The Pilot uses the Rover to carefully place or deposit the Medical Kit entirely within the boundaries of this zone. The method of placement depends on the rover's design (e.g., tilting bed, simple release, careful positioning before driving away).

Phase 6: Rover - Clear Blockade

- The Pilot navigates the Rover to the Central Ball Area, where multiple balls are located.
- The Pilot uses the Rover to manipulate these balls.
- The objective is to use the balls to knock down designated Blockade Objects located elsewhere in the arena from within the firing zone.

Phase 7: Rover - Complete the Mission

- After successfully clearing the required blockade(s), the Pilot navigates the Rover to the Game Complete Switch.
- The Pilot uses the Rover to activate this final switch.

(End: Timer stops upon activation of the Game Complete Switch or when the 10-minute time limit expires)

6. Scoring System

Core Scoring Principle: Points are awarded sequentially upon successful completion of each major task phase. A team cannot earn points for a subsequent task if the preceding task was not successfully completed. The objective is to complete the entire mission sequence correctly within the time limit.

Task 1: Medical Kit Secured by Drone

- Condition: Drone positioned correctly, Assistant successfully attaches kit according to rules.
- Points: +50 Points
- Note: Points awarded only if the attachment is successful and the drone is ready for takeoff with the kit.

Task 2: Medical Kit Successfully Dropped by Drone

- Condition: Task 1 completed. Drone successfully transports and releases the Medical Kit entirely within the designated Medical Kit Dropping Area.
- Points: +75 Points
- Note: If the kit is dropped outside the zone, these points are forfeited, and the team cannot proceed to Task 3.

Task 3: Medical Kit Transferred to Rover

- Condition: Task 2 completed. Assistant retrieves the kit from the Dropping Area and successfully places it securely onto the Rover according to rules.
- Points: +25 Points
- Note: Points awarded once the Assistant has placed the kit and returned to the team area. If the kit falls off immediately, points may not be awarded.

Task 4: Communication Restored

- Condition: Task 3 completed. Rover navigates to and successfully activates the Communication Switch, triggering the Communication Tower confirmation.
- Points: +150 Points
- Note: The tower must visibly activate. Failure to activate means these points are forfeited, and the team cannot proceed to Task 5.

Task 5: Road Repair Switches Activated

- Condition: Task 4 completed. Rover navigates to the Broken Road area and successfully activates ALL designated Road Repair Switches.
- Points: +200 Points (Awarded only if all required switches are activated).
- Note: Partial activation earns no points. Failure to activate all switches means these points are forfeited, and the team cannot proceed to Task 6 (even if the path becomes physically passable by chance).

Task 6: Rover Traverses Repaired Road

- Condition: Task 5 completed. Rover successfully navigates the entire length of the designated Broken Road Track from start to finish.
- Points: +50 Points
- Note: Points awarded upon exiting the defined track area.

Task 7: Medical Kit Delivered by Rover

- Condition: Task 6 completed. Rover transports the Medical Kit to the Final Medical Kit Placement Zone and deposits it entirely within the zone boundaries.
- Points: +150 Points
- Note: If the kit is dropped outside the zone or falls off the rover before reaching the zone, these points are forfeited.

Task 8: Blockade Cleared

- Rover successfully uses the provided balls to knock down ALL designated Blockade Objects.
- Points: +90 Points (Awarded only if all required objects are knocked down).
- Note: Partial clearing earns no points. Failure to clear all objects means these points are forfeited, and the team cannot proceed to Task 9.

Task 9: Mission Complete Switch Activated

- Condition: Task 8 completed. Rover successfully navigates to and activates the Game Complete Switch.
- Points: +75 Points
- Note: Activating this switch stops the official game timer.

Time Bonus

- Condition: Task 9 (Mission Complete Switch Activated) is successfully completed.
- Bonus: +1 Point for every full second remaining on the 10-minute clock.
- Calculation: $\text{Time Bonus} = (600 - \text{Final Time in Seconds}) * 1 \text{ Point}$
- Example: If a team successfully completes all tasks and hits the final switch at 8 minutes 30 seconds (59 seconds), their time bonus is $(600 - 59) = 90$ points.
- IMPORTANT: If the team does not successfully complete all tasks up to and including activating the Game Complete Switch, NO time bonus is awarded, even if they finish early on a partial run.

Tie Breaker: Fastest time to complete all tasks, or highest score achieved if not all tasks completed. Secondary tie-breakers may be based on time to complete a specific milestone task (e.g., Road Repair).

Penalties (Negative Points)

Penalties are deducted from the total accumulated score.

Assistant Interference:

- Providing navigation cues based on direct sight, touching robots or game elements outside the permitted actions (Kit-to-Drone attachment, Kit-to-Rover transfer).
- Penalty: -50 Points per instance.

Incorrect Zone Placement/Drop:

- Medical Kit dropped by drone outside the designated Dropping Area
- Medical Kit placed by rover outside the Final Placement Zone
- Penalty: -40 Points in addition to forfeiting task points and ending the possibility of further progress.

Robot Out of Bounds:

- Any part of a robot fully crosses the marked 24m x 24m boundary line. The robot must be returned to its last valid position within bounds by judges (if feasible) or potentially requires a reset.
- Penalty: -25 Points per occurrence.

Significant Arena Damage:

- Robot action causes clear, unintended damage to arena structures, switches (beyond normal activation), or field elements. Judged based on severity.
- Penalty: -30 Points per significant instance.

Required Robot Reset/Manual Intervention:

- If a robot becomes irretrievably stuck or overturned and requires manual repositioning by judges/team (beyond the allowed Assistant actions). This may depend on specific recovery rules defined separately.
- Penalty: -75 Points per required intervention. May halt further points accumulation if ruled a mission-ending failure by judges.

Safety Violation:

- Actions deemed unsafe by judges (e.g., reckless driving causing hazards, battery safety issues, violation of specific safety protocols).
- Penalty: -50 Points up to Disqualification (DQ) based on severity, at Lead Judge's discretion.

Final Score = (Total Points from Completed Sequential Tasks) + (Time Bonus (if applicable)) - (Total Penalty Points)

7. Game Rules & Regulations

- **FPV Operation:** During the timed run, operators **MUST NOT** have direct line of sight to the arena or their robots. Operation must be solely via the video feed(s) displayed on their monitor(s) at the Operator Control Station. Judges will monitor this strictly.

- **Time Limit:** Each team will have a total of **10 minutes** for their competition run. This includes final setup checks and the completion of tasks.
- **Start Signal:** The run begins on the judge's verbal command or signal.
- **Stop Signal:** The run ends when the Final Completion Switch is activated, the time limit expires, or the team declares forfeit.
- **Robot Interaction:** Robots should generally avoid damaging arena elements beyond the scope of the tasks (e.g., don't intentionally ram walls unless part of the task). Gentle contact is expected.
- **Fair Play:** Teams are expected to compete ethically and respectfully. Sabotaging other teams or attempting to cheat will result in disqualification.
- **Rule Amendments:** The organizers reserve the right to make minor amendments to the rules or scoring for clarification or safety. Any changes will be communicated clearly to all teams in advance.
- **Communication Rules:**
 - **FPV Feed:** This is the only visual information Pilots may use to control the robots during the run.
 - **Team Communication:** Verbal communication between team members (Pilot, Assistant, others in the team area) is permitted. However, the Assistant or other members cannot provide navigation cues or instructions based on direct visual observation of the robots or arena layout. Cues must be based on strategy, timing, or information relayed from the Pilot viewing the FPV feed.
 - **External Communication:** No communication with persons outside the competing team (coaches, mentors, audience members) is allowed during the timed run. Electronic communication devices not directly used for robot control or FPV are prohibited in the Pilot/Assistant area during the run.
- **Interaction Rules:**
 - **Assistant Interaction:** Physical interaction by the designated Assistant is strictly limited to:
 - * Attaching the Medical Kit to the Drone's mechanism while the drone is positioned in the Pickup Area.
 - * Retrieving the dropped Medical Kit from the Dropping Area and placing it securely onto the Rover.
 - * The Assistant must perform these actions swiftly and carefully, then immediately return to the designated team area. They cannot touch the robots or other field elements at any other time, nor manually reposition robots.
 - **Robot-Field Interaction:** Robots interact with the field by traversing terrain, activating switches, manipulating balls, picking up/dropping the kit, etc., as required by tasks. Destructive or unintentional interaction is penalized.
 - **Robot-Robot Interaction:** Intentional interference between a team's own drone and rover is generally discouraged unless part of a specific, rule-compliant strategy. Contact that impedes progress or violates other rules is not allowed.

- **Boundary Violations:** If any part of a robot fully crosses the outer arena boundary line, it is considered Out of Bounds. Penalties apply (Section 8). Judges will direct the procedure for return/reset if applicable.

8. Safety Regulations

8.1. General Safety: Robots must be constructed and operated safely. No unnecessarily sharp edges or exposed hazardous components. Wiring should be neat and secure.

8.2. Battery Safety: Teams using Lithium Polymer (LiPo) batteries MUST follow strict safety protocols:

- * Use appropriate, balanced chargers.
- * Charge batteries in LiPo-safe bags or containers.
- * Handle damaged or puffed batteries with extreme caution and dispose of them properly (do not bring damaged batteries to the competition).
- * Batteries must be securely mounted within the robot.

8.3. Kill Switches: Implementing easily accessible physical or remote kill switches for both robots is strongly recommended and may be mandated by organizers.

8.4. Eye Protection: Safety glasses may be required in pit areas and potentially near the arena.

8.5. Operational Safety: Reckless driving/flying that endangers personnel, other robots, or arena integrity is prohibited. Judges have the authority to stop any robot deemed unsafe.

8.6. Emergency Stop: Judges may call an immediate halt ("E-Stop") to a match for safety reasons. The handling of the run after an E-stop (resume, reset, score as-is) is at the Head Judge's discretion.

9. Judging and Disputes

9.1. Authority: Judges are responsible for monitoring gameplay, enforcing rules, assessing task completion, and assigning scores and penalties. The Head Judge has the final authority on all rulings during the competition.

9.2. Decisions Final: Decisions made by the judges during the match based on their observation and interpretation of the rules are final.

9.3. Formal Disputes: If a team believes a major rule misinterpretation significantly affected their match outcome, the Team Captain may file a formal written dispute with the Head Judge

within a specified time window (e.g., 30 minutes after the run). The dispute must clearly state the rule in question and the reasoning. The Head Judge's decision on the formal dispute is final.

10. Code of Conduct and Fair Play

10.1. Sportsmanship: All participants (team members, mentors, associates) are expected to exhibit courtesy, respect, and good sportsmanship towards judges, volunteers, organizers, and other teams.

10.2. Integrity: Teams must compete honestly. Attempting to circumvent rules, tamper with field elements or opponent equipment, or engage in any form of cheating is strictly prohibited.

10.3. Consequences: Violations of the Code of Conduct may result in warnings, penalties, or disqualification from the competition, at the discretion of the organizers and Head Judge.

11. Disclaimer

While every effort will be made to ensure a fair and functional competition environment, the organizers are not liable for unforeseen circumstances, equipment malfunctions (arena or team), or minor variations in arena setup between runs. All participants compete at their own risk. Have fun, be creative, and good luck! . Rules can be changed anytime. Please prefer the latest rule book.

***** NOTE: Competition organizers reserve the right to amend, clarify, or modify any aspect of the competition, including but not limited to these Rules and Regulations, the Game Description, Scoring System, Arena Layout, Field Elements, and Technical Specifications, as deemed necessary. All changes will be communicated to registered teams via official channels (e.g., email, competition website). It is the sole responsibility of the participating teams to ensure they are referencing the latest published versions of all official competition documents. Non-compliance arising from failure to consult the latest documentation will not be considered grounds for appeal.**