AERIAL DRONE COMPETITION PRO

RECF

MISSION 2026-2027

OFF GRID

Game Manual Version 2.1

RECF DRONE COMPETITIONS

RECF Aerial Drone Competition Pro Mission 2026-2027: Off Grid

Game Manual Version 2.1

November 10, 2026

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Prefix

Welcome and Thank You

Welcome to the Robotics Education & Competition Foundation (RECF) Aerial Drone Competition Pro!

In the Aerial Drone Competition Pro (ADC Pro), students have a unique hands-on learning experience that fosters essential STEM skills, including design, piloting, programming, and problem-solving, all within the context of unmanned aerial vehicles (drones) and unmanned ground vehicles (robots).

The competition environment mirrors real-world scenarios, demanding teamwork, critical thinking, and innovation to overcome mission challenges. Students learn to collaborate effectively, hone their communication skills, and build the resilience needed to tackle future obstacles. Along the way, they gain a deep understanding of flight principles, engineering design, computer science, documentation, and interpersonal skills, while igniting a passion for drone-related careers.

We are grateful that you have chosen the RECF as your competition program provider. With so many opportunities available, we are honored that you selected our program to support your students' learning and growth.

Thank you for joining our community. We cannot wait to see what your teams achieve this season!

About the RECF

The Robotics Education & Competition Foundation is a registered US 501(c)(3) non-profit organization that exists to spark interest in science, technology, engineering and math by engaging students in hands-on, sustainable, and affordable curriculum-based robotics programs.

Our global mission is to provide every educator with competition, education, and workforce readiness programs to increase student engagement in science, technology, engineering, math, and computer science. We see a future where every student designs and innovates as part of a team, overcomes failure, perseveres, and emerges confident in their ability to meet global challenges.

As a company, we embrace the core values of passion, integrity, and excellence, which we try to embody in everything we do.

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Revision History

RECF will release updated game manuals through the season, as listed below. Each event or league session must use the latest rule set published before the start of the event. Answers in the official Q&A system are effective immediately unless stated otherwise in the answer.

- February 2, 2026 - Initial v1.0 release
- September 29, 2026 - v2.0 release
- November 10, 2026 - Possible release with minor updates
- December 22, 2026 - Major v3.0 release that may include changes to gameplay
- February 2, 2027 - Possible release with minor updates
- March 16, 2027 - Major v4.0 release with changes for regional and world championship events

Version 1.0 - February 2, 2026

- Initial release

Version 2.0 - September 29, 2026

- 1.4.2 - Added collegiate teams
- 3.0, 4.0, & 7.4.1 - Changed solo match allocations from 3 of each match type to a flexible "pool" of 5 attempts
- Revised format
- Updated rule numbers
- No changes to scoring or match play

Version 2.1 - November 10, 2026

- 1.6 - Clarified that a scorekeeper referee can ground a drone in solo matches if necessary
- 2.5.5 - Expanded the rule to emphasize that vehicles shouldn't damage field elements
- 2.5.8 - Added new rule addressing battery and fire safety
- 3.1 - Removed color matching from solo piloting matches, and deleted rule 3.1.4
- 3.4.1 - Clarified that mission crew members can't enter the net while troubleshooting
- 7.3.1 - Added legal modification to tape down barrier segments in solo matches
- Field Assembly & Layout Instructions Step 1.7 - Added option to tape down barriers
- Field Assembly & Layout Instructions Step 2.5 - Added recommendations to firmly connect PVC in pumps
- Minor corrections throughout

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Section 1: RECF Aerial Drone Competition Pro

1.1 About RECF Aerial Drone Competition Pro

The Robotics Education & Competition Foundation's (RECF) Aerial Drone Competition Pro (ADC Pro) provides a hands-on STEM experience focused on drone and robot operation, programming, and problem-solving. The program emphasizes teamwork, critical thinking, communication, and real-world application of flight and robotics concepts.

ADC Pro teams consist of students up to 19 years old (categorized as high school teams) or collegiate students; see section 1.4.2 for more details. Student team members make all of the decisions about their strategy, piloting, driving, and coding—from blank paper all the way to championship events.

Each ADC Pro season consists of local qualifying events, which qualify teams to championship events including the RECF World Championship. For more information on the qualification structure, refer to the Qualifying Criteria for RECF Drone Programs.

1.2 ADC Pro Mission 2026-2027: Off Grid

Drones and robots aren't just for sci-fi movies. They're transforming how we power the world from the inside out. Inside power plants and other energy facilities, drones can fly through tight spaces like boiler rooms, turbine halls, and ventilation shafts to inspect equipment up close. Using downdraft and other integrated actuation systems, drones can interact with their surroundings to perform tasks such as moving objects, clearing debris, or triggering switches. This helps maintain critical systems in hard-to-reach or hazardous areas without direct human contact. Ground robots can safely navigate through areas with high heat or radiation to collect data or perform small tasks. This kind of technology keeps workers out of harm's way and helps keep the power flowing smoothly and safely.

In this competition, you'll step into the role of a high-tech first responder, using drones and robots to simulate a hacking response mission at a nuclear power plant. Just like real-world technicians, you'll use aerial drones and ground robots to restore communications and safely move hazardous material. This hands-on experience mirrors the way professionals in the energy industry use unmanned systems to respond to emergencies, perform maintenance, and keep critical infrastructure running. By completing these competition tasks, you'll get a glimpse of how cutting-edge technology is used in real careers. You might even discover a future in cybersecurity, robotics, or the power industry waiting for you.

Not every team will play the game the same way, and some ways to score are easier than others. Your strategies may change over time. As long as you follow the rules in this game manual and the official RECF Q&A system at games.recf.org, you can play the game however you like!

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1.3 Four ADC Pro Competition Missions

- Solo Piloting Mission (see section 3) - Team members manually pilot a drone and drive their robot through obstacles, and strive to optimize their time to complete the tasks. Matches are 60 seconds each.
- Solo Autonomous Mission (see section 4) - A drone and robot operate fully autonomously to complete tasks. Matches are 60 seconds each.
- Alliance/Teamwork Mission (see section 5) - Your team collaborates with another team at the field, each using a drone and a robot in an attempt to outscore an opposing two-team alliance. Matches are 2 minutes each.
- Communications Mission (see section 6) - Document and share your team's work and use of the iterative design process in a notebook throughout the season, and describe your work to judges during interviews

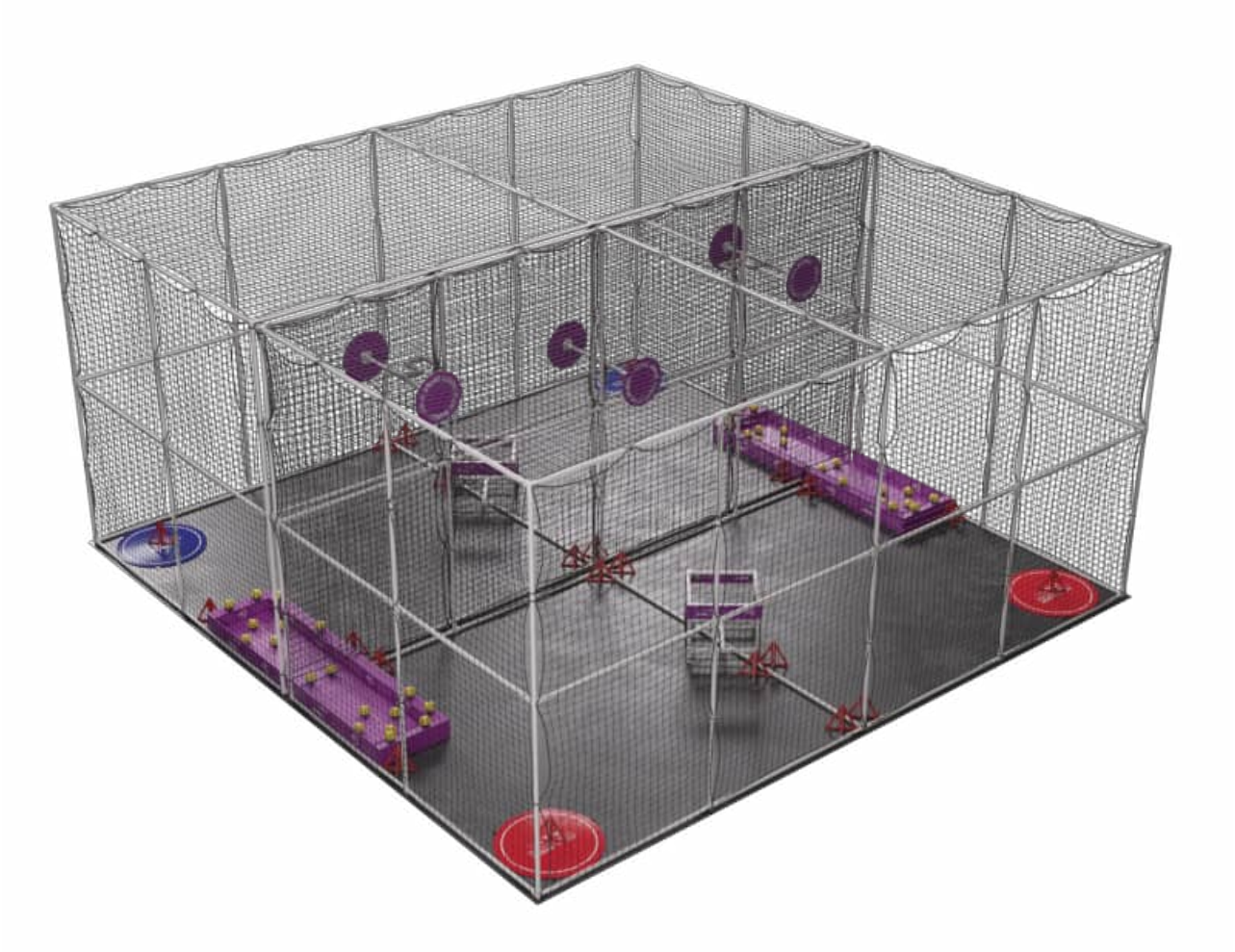

Figure 1.3.1: Off Grid alliance mission field

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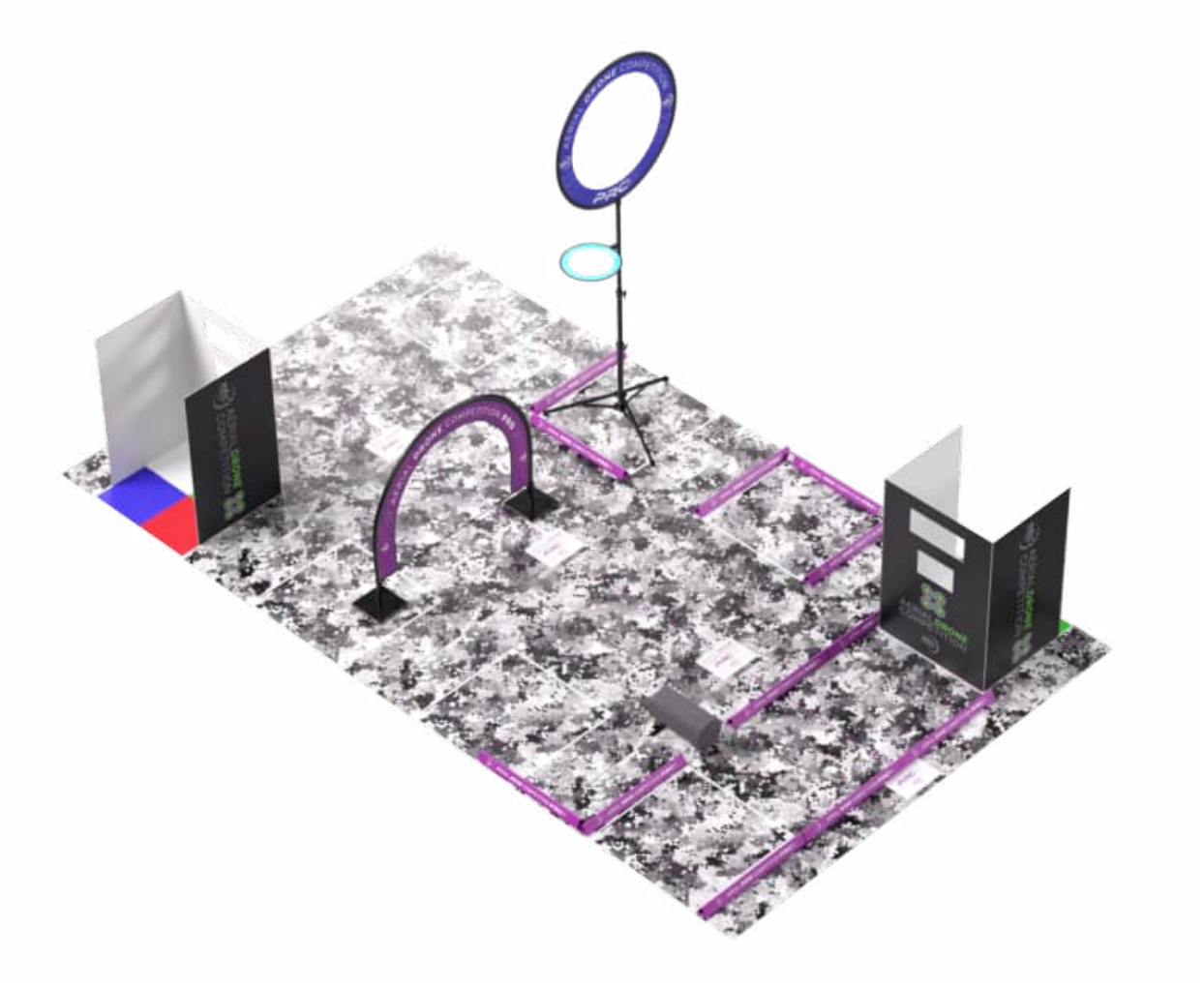

Figure 1.3.2: Off Grid solo mission field

1.4 RECF Program Rules

1.4.1 RECF Policies

All participants must follow the guidelines and rules in this game manual, the official ADC Pro Q&A at games.recf.org/pro, and these additional official RECF policies.

- RECF Organizational Policy
- RECF Student-Centered Policy
- RECF Code of Conduct
- RECF Drone Programs Qualifying Criteria
- RECF Drone Programs: Guide to Judging
- RECF Youth Protection Policy
- RECF Commitment to Coach Excellence
- RECF Commitment to Event Excellence

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1.4.2 ADC Pro Teams & Students

Teams must be registered in RECFevents.org for the RECF ADC Pro program to participate in ADC Pro qualifying events.

Each ADC Pro team has two or more students. Students are categorized by their age at the end of the 2027 RECF World Championship.

- To compete in the 19U / high school category, a student must be 19 years of age or younger on May 6, 2027, and not yet graduated from secondary school.
- To compete in the collegiate category, a student must have graduated from secondary school, not be dual-enrolled in secondary and post-secondary coursework, and be enrolled in post-secondary coursework and working toward a certificate or degree -or- have earned a post-secondary degree during the six months preceding the RECF World Championship.

Team structure must follow the RECF Organizational Policy. Teams must be student-centered and follow the RECF Student-Centered Policy and the RECF Code of Conduct at all times, including at practices and when attending events.

1.4.3 Supervision & Release Forms

When attending events, students on high school teams must be accompanied by a responsible adult over the age of 18 for the duration of the event. All participants in RECF events must complete an RECF Participant Release Form each season.

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1.5 Definitions

1.5.1 General Definitions

- **All-Clear** - A signal from a head referee that teams may retrieve their drones and robots
- **Alliance** - Two teams assigned to work cooperatively during a match to score shared points
- **Alliance Match** - A two-minute match that includes one or more cooperative alliances; sometimes referred to as a teamwork match
- **Alliance Selection** - The process used to determine which teams will participate in elimination matches (see section 7.4.4)
- **C²** - RECF Competition Control, the software used to run matches, inspection, check-in, scoring, and other functions at an RECF competition
- **Coach / Mentor** - A person who helps students learn concepts used in RECF competitions, and who helps create and organize teams, but who cannot contribute to the students' work used at competitions
- **Competition Notebook** - A physical or electronic document that records a team's iterative design process and their work during a competition season
- **Drone** - A machine designed to perform one or more tasks autonomously or by remote control from a pilot or co-pilot
- **Elimination Bracket** - A series of matches that includes the two-team alliances that were formed during the alliance selection process; identifies the tournament winners (see section 7.4.5)
- **Field Element** - An element on the competition field that is part of the ADC Pro game or field kit; many are reused across multiple competition seasons (see section 1.5.2 for details)
- **Flight Zone** - An area where drones are allowed to fly at an event (approximately 10' height limit)
    - **Alliance Field Flight Zone** - The internal volume enclosed by the netted teamwork Field Perimeter
    - **Solo Match Field Flight Zone** - A conceptual area defined by the outer edges of the coding mats
    - **Additional Flight Zones** - The event partner may designate additional flight zones to be used as practice or testing areas
- **Foul** - The act of breaking a rule during a match or event (see section 1.6 for more details)
- **Foul Card** - A tracking system for repeated rule infractions (see section 1.6 for more details)
- **Game Element** - An element on the teamwork or solo match field that is part of the ADC Pro game kit, and and used to score points in a match (see section 1.5.3 for details)
- **Grounded** - Description of a drone or robot that has broken a safety rule and is no longer allowed to participate in the match; the machine must land or stop movement

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immediately and is not allowed to operate for the remainder of the match, and the controller should be placed on the floor or another nearby position

- **Mission Crew** - 2-3 students who participate in a match as representatives for their team
    - **Pilot** - A mission crew member who operates their team's drone during a match
    - **Driver** - A mission crew member who operates their team's robot during a match
    - **Mission Specialist** - An additional student who supports the pilot and driver during the match
- **No-Fly Zone** - Anywhere in or around a venue that is not a flight zone
- **Robot** - A machine designed to perform one or more tasks autonomously or by remote control from a driver
- **Solo Autonomous Match** - A one-minute match with one drone, one robot, and one mission crew, during which the drone and robot operate only by code created by the students; sometimes referred to as a skills match
- **Solo Piloting Match** - A one-minute match with one drone, one robot, and one mission crew, during which students operate the drone and robot by remote control; sometimes referred to as a skills match
- **Student** - A team member who meets all requirements of the program, is within the age bracket (see section 1.4.2), and who contributes to a team's notebook, code, and/or strategies, or serves as a mission crew member; a student can only participate on one ADC Pro team during a season in any role (coder, pilot, driver, mission specialist, etc.)
- **Tournament** - An official ADC Pro event that meets the requirements of the RECF Drones Programs Qualifying Criteria, and includes teamwork matches, solo piloting matches, solo autonomous matches, and optional judging
- **Vehicle** - A robot or drone that has passed inspection and is used by a team in a match

1.5.2 Off Grid Solo Match Definitions

- **AprilTag** - A visual reference marker used to mark locations on the field that can be identified with computer vision. AprilTags representing numbers from 001 to 015, each printed at a size of 2.15" x 1.8" are attached to field elements and game elements as shown in figure 1.5.2. AprilTags were created by the APRIL Robotics Laboratory at the University of Michigan, and more information can be found at april.eecs.umich.edu/software/apriltag.
- **Arch Gate** - A purple arched field element with outer dimensions of approximately 37" wide and 33" tall from the floor, inner dimensions of approximately 28" wide and 28" tall from the floor, and a tension wire that is approximately 4.5" from the floor (see figure 1.5.2).
- **Barrier** - A purple field element that consists of a folded section of corrugated plastic, approximately 2' long by 2" high (see figure 1.5.2)
- **Canister** - A black, cylindrical, foam scoring object that is approximately 12" high with a diameter of 6" (see figure 1.5.2); the canister can earn points by ending a match in one of the three decontamination zones

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- **Cleared** - A drone has successfully cleared a field element when all parts of the drone have passed through the imaginary 2D plane of that field element's opening or other designated space.
- **Coding Mat** - A flat, printed, 4-piece, vinyl field element used in solo matches to aid in setup and provide consistent sensor readings, with dimensions of 96"x42" (see figure 1.5.2)
- **Color Match** - The status of a drone that has landed on a multi-color pad and changed its LED to match the quadrant beneath its fuselage (see rules 3.1.4 and 4.2.1)
- **Containment Bay** - A defined area of the coding mat, approximately 24" x 24", bordered by barrier segments, the outer edges of a white square outline, and the edge of coding mat 3; the drone and robot can earn points by ending the match parked in the containment bay (see rule 3.1.8)
- **Decontamination Zones** - Defined areas of the coding mat where canisters can be scored, each approximately 2.5' x 1', bordered by barrier segments and gridlines on the coding mat (see rule 3.1.7); the decontamination zones are adjacent to the staging area, and are off-limits to the robot
- **Docked** - The status of a drone that ends in the match solely in contact with the robot after flight during the match (see rule 3.1.9)
- **Fly-Through Panel** - A 24" x 26" tri-fold, corrugated plastic field element with two rectangular holes; the front face of the panel is black and the back is white (see figure 1.5.2)
- **Fuselage** - The main body of a solo match drone, excluding the propeller guards and propeller/motor supports (see figure 1.5.2)
- **Keyhole Gate Assembly** - An field element assembly comprising a blue keyhole gate, a teal keyhole gate, and a keyhole gate stand (see figure 1.5.2)
    - **Blue keyhole gate** - A field element with an outer diameter of approximately 30" and an inner diameter of approximately 24"; the bottom edge of the blue keyhole gate is placed approximately 50" from the floor and the gate is mounted vertically
    - **Teal keyhole gate** - A field element with an outer diameter of approximately 19.5" and an inner diameter of approximately 15"; the bottom edge of the blue keyhole gate is placed approximately 31" from the floor and the gate is mounted horizontally
- **Landed** - The status of a drone that ends the match in contact with a multi-color mat or the floor in an upright position, and is no longer moving horizontally or vertically
- **Mission Crew Station** - A defined area at the solo match field where mission crew members must remain during a match
- **Multi-color Pad** - A 24" x 24" corrugated plastic field element printed with four equal 12"-square, colored sections: red, blue, green, and white (see figure 1.5.2)
- **Solo Piloting Stop Time** - The time remaining, rounded down to the nearest even number, in a solo piloting match when a team has completed all other scoring tasks and wishes to earn points by ending the match early (see rule 3.1.10); the default stop time is 0 seconds

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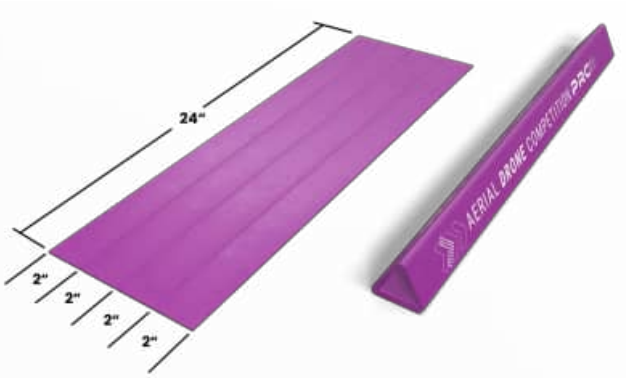
- **Staging Area** - A defined area of the coding mat, approximately 2.5’ x 3’, bordered by barrier segments and gridlines on the coding mat; the staging area is adjacent to the decontamination zones and is off-limits to the robot (see rule 3.1.7)
- **Take Off Zone** - A defined area of the coding mat, approximately 24” x 24”, bordered by the outer edges of the white square outline and the edge of coding mat 4 (see rules 3.2.2 and 3.2.3)

AprilTags 	**Arch Gate** 
Barrier 	**Canister** 
Coding Mat 	**Fuselage** *(highlighted in green)* 

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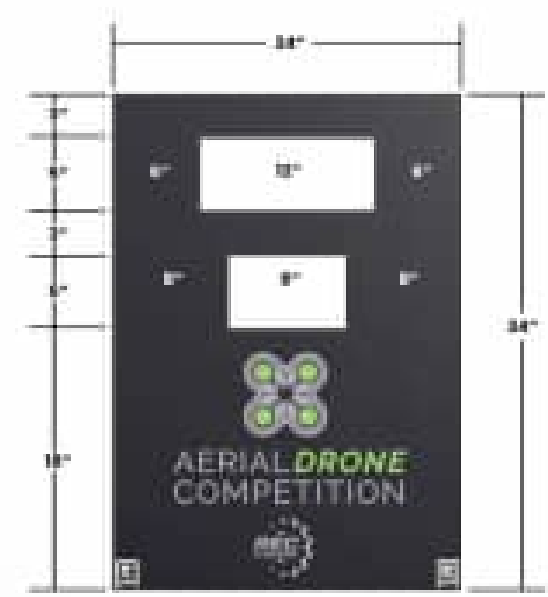
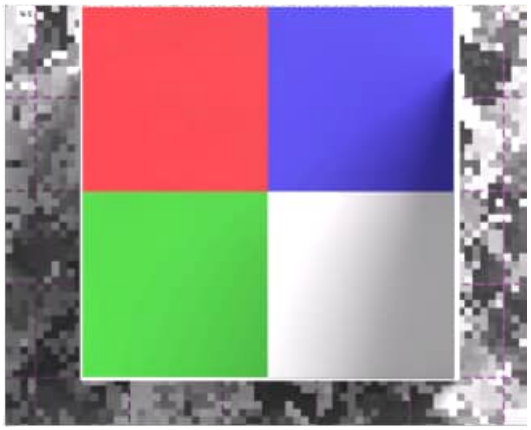
Keyhole Gate Assembly	Fly-Through Panel
	 
Multi-color Pad	
	

Figure 1.5.2: Off Grid solo match field and game elements

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1.5.3 Off Grid Alliance/Teamwork Match Definitions

- **Alliance Field Perimeter** - A pair of 10’ wide x 20’ long, by 10’ high field elements constructed from PVC, netting, and additional accessories, where teams play Off Grid alliance/teamwork matches; see the ADC Pro Off Grid Field Assembly & Layout Instructions
- **Alliance Field Zone** - A 3D volume that includes one half of the Off Grid alliance match field, approximately 10’ wide by 20’ long by 10’ high, used by either the red or blue alliance during a match (see figure 1.5.3)
- **Alliance Station** - A defined area at the solo match field, assigned to either the red or blue alliance, where mission crew members must remain during a match (see rule 5.2.1); the alliance station can be marked with tape or other means, or can be a conceptual area
- **Cooling Pool** - A coroplast field element that consists of a rim and a goal area; each cooling pool is approximately 24”x48”x6” and consists of a raised rim where fuel begins the match and a lower flat surface referred to as a cooling pool goal (see figure 1.5.3)
- **Cooling Pool Goal** - The lower flat surface within a cooling pool, approximately 20”x44” and bounded by a raised rim (see figure 1.5.3)
- **Comms Tower** - A field element constructed from PVC, netting, and additional accessories, where power cells can be scored; a comms tower consists of a comms tower drop zone and a comms tower supply station (see figure 1.5.3)
- **Comms Tower Drop Zone** - A 10”x10” piece of coroplast that is mounted at the top of a vertical segment of PVC on a comms tower (see figure 1.5.3)
- **Comms Tower Supply Station** - The 3D volume inside the lower portion of a comms tower, formed from a PVC structure and netting, and approximately 24”x24” wide and 21.5” high (see figure 1.5.3)
- **Docked** - The status of a drone that ends in the match solely in contact with the robot after flight during the match (see rule 5.1.6)
- **Fuel** - A yellow & black plastic ball, approximately 3.5” in diameter with a weight of approximately 32 grams (see figure 1.5.3)
- **Power Cell** - A 2-part, orange, triangular, plastic game element, secured with zip ties, that is approximately 10” wide by 10” high (see figure 1.5.3)
- **Pump** - A PVC and coroplast game object that spans the two alliance field zones; includes two 16” circular faces connected by a segment of PVC (see figure 1.5.3)
- **Recovery Pad** - A red or blue circular field element with an outer diameter of approximately 30” (see figure 1.5.3)
- **Starting Quadrant** - A section of the alliance field where a team will place their drone and robot at the start of an alliance/teamwork match; defined by the inner edges of the PVC frame and the floor

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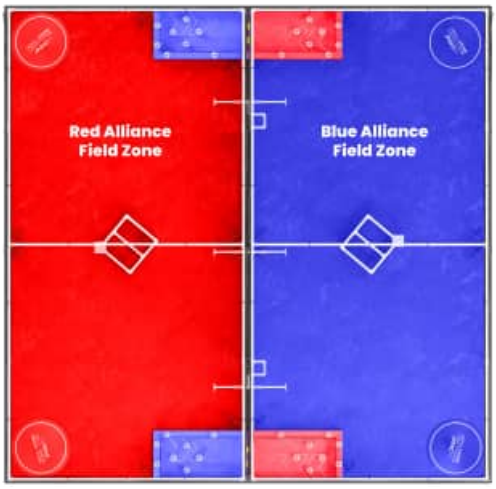
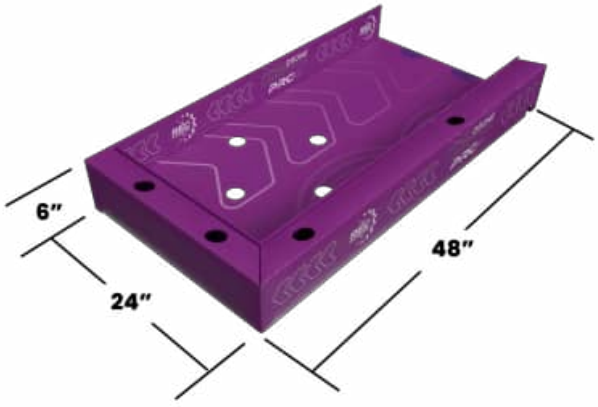
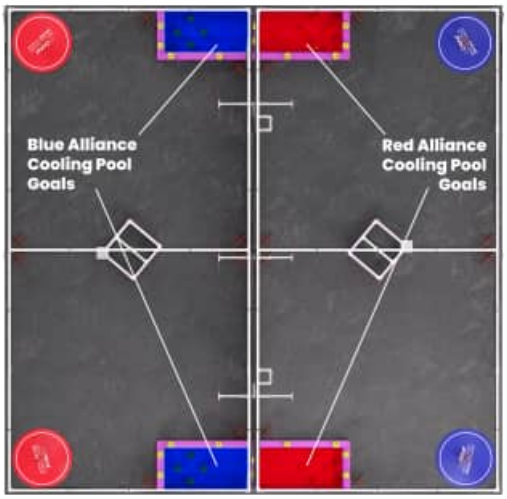
Alliance Field Zones



Cooling Pool



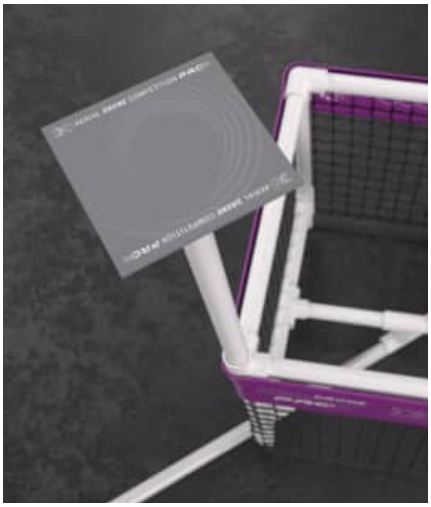
Cooling Pool Goals



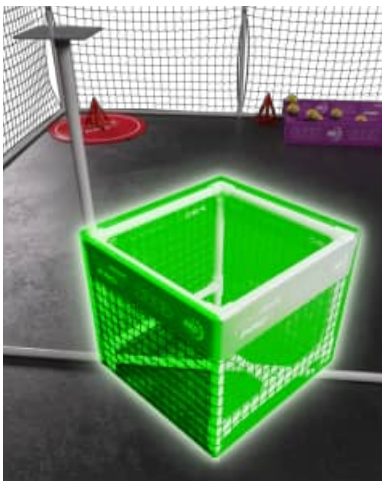
Comms Tower



Comms Tower Drop Zone



Comms Tower Supply Station
(highlighted in green)



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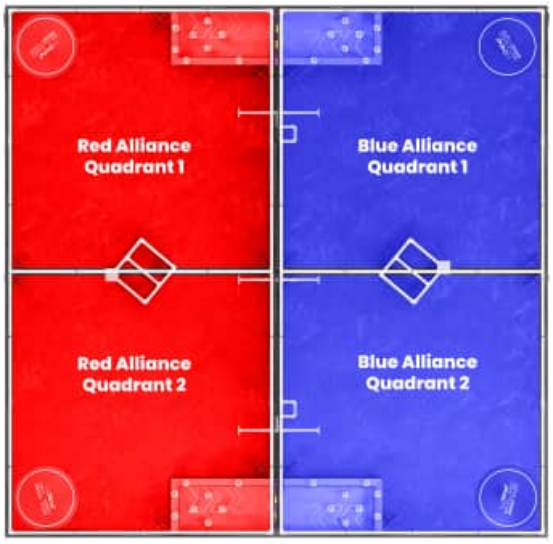
Fuel	Recovery Pad
	
Power Cell	**Pump**
	
Starting Quadrants	
	

Figure 1.5.3: Off Grid alliance/teamwork match elements

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1.6 Fouls & Foul Cards

Fouls are decided by a head referee during a match and occur when a rule of gameplay or safety is broken. Fouls may also occur when the Code of Conduct is violated during an event, as determined by the event partner or the head referee. For fouls that involve damage or potential damage to the field, people, or other vehicles, a head referee (or in a solo match, a scorekeeper referee) may also require that a vehicle be grounded.

Foul cards serve as a tracking system for fouls. Foul cards are announced verbally and recorded by a head referee after a match. All foul cards stay with the team for the entire tournament.

Head referees should focus on helping teams avoid fouls before they happen, by calling out actions that may lead to a foul. Advance warnings like these do not count as official warnings, and are not recorded by referees.

1.6.1 Official Warning

An official warning is given to an alliance, team, or team member verbally by the head referee the first time they break a specific rule, provided the foul does not improve the score of a match. This official warning helps students learn how to prevent future fouls before they lead to penalties. Future violations of the same rule should result in a yellow card for that rule. For example, the first time a team continues flying after the timer hits zero (without scoring points), they will receive an official warning if the violation didn't improve the match score.

1.6.2 Yellow Card

A yellow card is given to an alliance, team, or team member the second time they break a rule (after they have received an official warning for breaking that specific rule). For example, if a team continues flying after the timer hits zero (without scoring points) a second time during an event, they will receive a yellow card if the violation didn't improve the match score.

1.6.3 Red Card

A red card is given to an alliance, team, or team member the third time they break a rule (after they have received a yellow card for breaking that specific rule). For example, the third time (and any additional times) a team continues flying after the timer hits zero (without scoring points) they would earn a team a red card.

A team that receives a red card will earn zero points for the current match. In an alliance match, a team that does not receive the red card will receive the actual score of the match. In finals matches, both teams in the alliance will receive a zero score.

Any foul that improves the score of the match will receive a red card for each offense. Fouls related to the RECF Code of Conduct, the RECF Student-Centered Policy, or safety rules may also receive a red card for each offense.

1.6.4 Fouls affect eligibility for elimination matches

Any team that receives three or more red cards during an event cannot be part of an alliance for elimination matches. Eligibility for judged awards may also be affected.

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Section 2: Drone & Robot Rules

A team can bring as many drones and robots to a competition as they wish, but each robot and drone must pass inspection before it can operate in matches at an official RECF event. Intentionally breaking a drone or robot rule for improved performance may be handled as a violation of the RECF Code of Conduct. Drones and robots that don't comply with the rules in sections 2.1 and 2.2 cannot be used in matches.

2.1 Required Components

2.1.1 Minimum drones and robots for competition

Each team must bring at least one teamwork match drone, one solo match drone, and one robot to be eligible to participate in any type of match at an ADC Pro qualifying tournament. If a team arrives without one or more of these machine types, they will not be eligible to compete. Teams can bring an unlimited number of drones and robots to a competition for use in matches at the event.

Teams cannot borrow robots or MINDS-i drones from other teams for use in matches, although they may borrow a CoDrone EDU for use in solo flight matches if their own CoDrone is damaged.

2.1.2 Solo match drones & firmware

All teams must use the CoDrone EDU and/or the CoDrone EDU JROTC Edition for ADC Pro solo matches. CoDrone EDUs must be running the firmware approved by Robolink. The most current list of approved versions can be found at codrone.robolink.com.

2.1.2.1 No modifications to the CoDrone EDU or its electronics

The CoDrone EDU and its electronic components cannot be modified in any way, other than labeling and/or external decorations. Replacement motors, propellers, frames, and drone batteries must be identical official parts.

2.1.3 Teamwork match drones

All teams must use the MINDS-i drone model MCK-ADCP-MR2 and/or model CPK-UAM2-001 for ADC Pro teamwork matches.

2.1.3.1 Customizations are allowed for MINDS-i drones

A MINDS-i drone can be customized provided that the drone includes the components in assembly 1 and assembly 2 that are provided by MINDS-i Education. These components cannot be substituted with custom parts and must be purchased from MINDS-i Education (or an authorized MINDS-i reseller).

- Assembly 1: Drone Frame components
    - MINDS-i Beams
    - MINDS-i Motor Mounts

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    - MINDS-1 Safety Ducts (propeller guards)
- Assembly 2: Drone Electronics components
    - Hobbywing XRotor F7 flight controller
    - XRotor 4-in-1 Speed Controller

Additional custom mechanisms, servos, motors, sensors, custom 3D parts, decorations, etc. can be added to the MINDS-i Drone assemblies if they do not violate other rules. Pneumatics are not allowed.

2.1.3.2 MINDS-i drones must have safety ducts for each propeller

All MINDS-i drones must have safety ducts for each propeller so that they pass a “wall test”. In general, if the drone approaches a wall from any angle, any other part of the drone (such as safety ducts) should be the first thing to contact the wall to mitigate risk of propeller entanglement with the field and game elements.

2.1.4 Solo and teamwork match robots

Teams are allowed to use any type of robot in matches, but each robot must meet these requirements during all matches.

- Each robot must fit within a volume of 15” x 15” x 15” for the entire match
- Each robot can use one battery with a capacity up to 1500mAh
- Each robot must be controlled wirelessly using 2.4 GHz or Bluetooth
- Pneumatic systems are limited to a maximum pressure of 50 psi, and must include a visible pressure gauge and pressure release valve
- Wheels and other mechanisms that contact the floor cannot leave marks or residue

2.1.5 Teamwork drones and robots must have license plates

Your official registered ADC Pro team number must be clearly visible on your robot and drone on red or blue plates (to be changed depending on your alliance color). Only the current license plate color can be visible during a match.

- Plates must be at least 3” x 1”, and use a text font and color that is legible from a distance.
- License plates matching your alliance color must be securely attached to your robot and teamwork drone before the start of your teamwork match. Failure to have the appropriate license plates on your robot or drone is a foul.
- Robots used in solo matches must have a license plate, but it can be any color.
- Solo match drones do not need license plates.

2.1.6 Drone and robot parts should stay connected

Your drones and robots can’t have parts or mechanisms that intentionally detach during the match.

2.1.7 Drone batteries must be charged before launch

A drone will not be permitted to launch if it indicates a low battery level.

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2.2 Optional Components

2.2.1 Battery packs

Connecting an external battery pack to a drone or robot controller is allowed.

2.2.2 Decorations

Decorations are permitted on drones and robots if they don't break other rules, don't create safety hazards, don't interfere with a drone's ability to sustain flight, and reflect the spirit of an educational competition.

2.2.3 Fabricated parts

Custom-fabricated parts are allowed on teamwork drones and robots.

- All custom parts must be designed or customized by student team members, but can be manufactured by an outside entity (e.g., SendCutSend)
- Please document your creation and use of custom parts in your competition notebook

2.3 Disallowed Components

Some materials and components pose safety or damage risks and are not allowed on robots or drones.

- Materials with sharp edges or which may shatter
- Real flames or pyrotechnics of any kind
- Anything that compromises the safety of people, other drones/robots, the field, or game pieces
- Exposed or disorganized wires that pose electrical safety risks
- Wires, protrusions, or mechanisms that pose an unnecessary entanglement risk
- Liquids, including oil, grease, sealant, and hydraulic fluid
- Any material or part that leaves residue or marks on the field or floor

2.4 Drone & Robot Code

2.4.1 Students create their own code

A team's student members get to decide what their drone's code looks like, and what it does. Adults may teach coding concepts, but may not tell students what should or should not be included in their code. Students have many choices in the tools and languages they use to code their drones, including laptops, tablets, and the TI-Nspire calculator.

2.4.2 Coding libraries are okay as starting points

Teams can use coding libraries as a starting point, but should modify the resulting code to make it their own. They should be able to explain how their code works and how it has been modified from the original ideas when asked. Outside references should be appropriately credited and described in teams' competition notebooks.

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2.5 Drone & Robot Safety

2.5.1 A pre-flight checklist is required before each match

Mission crews must use a pre-flight checklist to self-inspect their drone and controller before each match.

2.5.2 Fly only in designated flight zones

Drones may only be operated within designated flight zones and must comply with all posted event rules. All other areas (e.g., hallways, pits, parking lots) are no-fly zones at all times. Unsafe, reckless, or intentional actions can result in an immediate red card or removal from the event without warning.

2.5.3 Wear eye protection

Team members must wear eye protection (e.g., prescription glasses) in and around all flight zones. We highly recommend safety glasses with non-shattering lenses and side shields for maximum safety. Students cannot participate as mission crew members without eye protection, and will be asked to leave the field.

2.5.4 Stay in control of your drones and robots

If a referee believes there is an immediate safety issue (e.g., a pilot isn't in control of a drone or it's too close to the audience), they'll indicate that the drone or robot should be grounded.

2.5.5 Robots and drones shouldn't grab or damage field elements

Robots and drones can grab and move game elements (e.g., fuel & power cells in alliance matches), but should never grab or become tangled in field elements including nets, the perimeter, comms towers, or cooling pools.

Teams should consider vehicle modifications, such as additional propeller guards, to prevent damage to field elements.

2.5.6 If a drone or robot is grounded, it must land or stop immediately

If a head referee indicates that a drone or robot should be grounded during a match, the team must land or stop the drone/robot immediately and place their controller on the floor or other surface. The drone or robot must remain grounded for the remainder of that match.

2.5.7 Additional safety practices

While a coach or mission crew member may choose to implement additional safety practices for their own team, an event partner is not allowed to add/enforce additional safety rules or practices at the match fields that are not required in this game manual.

Additional safety practices that a coach or mission crew member have as part of their team safety plan are allowed, as long as they don't conflict with the rules in this game manual.

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Examples of optional safety practices at teams' discretion:

- Tie hair back.
- Remove loose jewelry.
- Wear a hard hat or safety vest.
- Wear closed-toe shoes.

2.5.8 Battery and fire safety

Teams and events should prioritize safety when charging and using LiPo batteries. Teams should monitor batteries during charging, not overcharge, and use balance chargers and LiPo-safe bags/containers.

Damaged or swollen packs are not safe for use. If a battery pack begins smoking, swelling, or hissing it should be disconnected from the charger if it is safe to do so. Sand or a Class D fire extinguisher can help contain a LiPo fire.

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Section 3: Off Grid Solo Piloting Mission

In the ADC Pro solo piloting mission, student mission crews have 60 seconds to score as many points as possible while operating their drone and robot with remote controllers. Solo matches aren't pre-scheduled, and each team will have up to five total solo match attempts per competition that can be allocated across the two solo match types however the team likes. Some awards consider a team's solo autonomous score, so it is advised that teams complete at least one solo autonomous mission. The field setup is shown in figure 3.0.

A full power plant system inspection is required to ensure no threats or failures exist. Your drone must complete a series of diagnostic tasks that simulate real-world inspection challenges in restricted areas where human access and visual oversight are limited.

Your drone will navigate complex pathways, flying through keyholes, small and large panel holes, and under a low-clearance arch. The ground disposal unit robot will push a containment canister into a designated staging area, allowing the drone to use its downdraft to move the canister into one of three decontamination zones, with each zone representing various levels of radiation shielding.

At the end of the match, the drone can land precisely on top of the robot, completing a coordinated shutdown sequence that reflects real-world drone retrieval protocols.

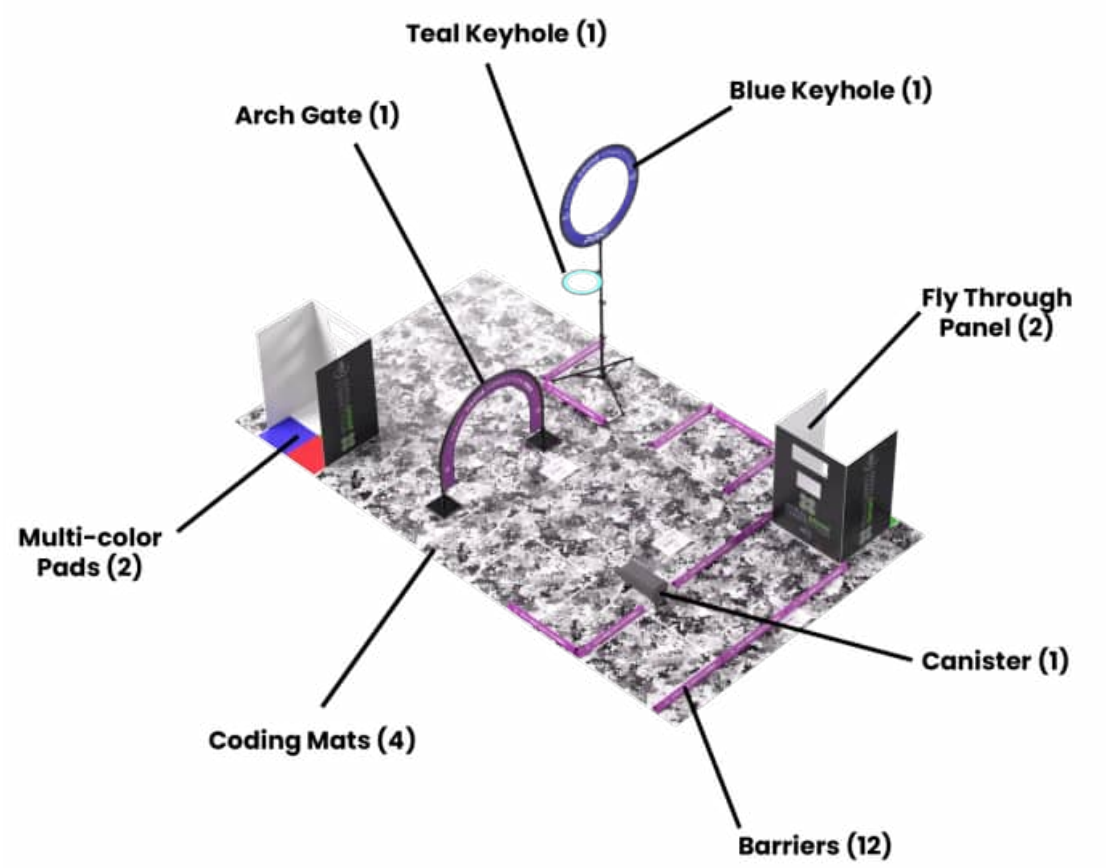

Figure 3.0: Solo mission field layout

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3.1 Scoring and scoring criteria

Scoring Task	Points	Max per Match
Cleared Panel 1: Large Hole	5 points	1
Cleared Panel 1: Small Hole	10 points	1
Cleared Arch Gate	5 points	1
Cleared Blue Keyhole	5 points	1
Cleared Teal Keyhole	5 points	1
Score Canister in Zone 1	5 points	The canister can be scored in one of the three zones
Score Canister in Zone 2	10 points	
Score Canister in Zone 3	15 points	
Cleared Panel 2: Large Hole	5 points	1
Cleared Panel 2: Small Hole	10 points	1
Parked Vehicle	5 points	2
Docked Drone	10 points	1
Solo Piloting Stop Time	1 point per second	Even numbers only

3.1.1 Matches are scored in real time

The referee will actively score during the match. It is recommended that the referee verbally confirm each task as it is successfully completed (e.g., “through the keyhole” or “under the arch”). To assist with accurate scoring, a mission crew member may stand near the referee to help confirm tasks as they occur.

3.1.1.1 All scoring ends when the match timer reaches 0.

3.1.1.2 Points scored after the timer reaches 0 will be deducted before the score is submitted.

3.1.1.3 In cases where a vehicle’s or scoring object’s position is uncertain or requires a judgment call, the head referees should give teams the higher point value of the two options. Head referees are not expected or required to check imperceptibly small measurements.

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3.1.3 Clearing the fly-through panel holes

A drone is considered to have cleared a large or small fly-through panel hole when it has flown completely through the panel from front to back.



Figure 3.1.3: Fly-through panel locations

3.1.4 *This rule was deleted in the update on November 10, 2026*

3.1.5 Clearing the arch gate

A drone is considered to have cleared the arch gate when it has flown completely through the 2D plane bounded by the inner edges of the arch gate and the tension screen, and completely passed through the gate in either direction.

3.1.6 Clearing a keyhole gate

A drone is considered to have cleared a keyhole gate when it has flown completely through the gate in either direction.

3.1.7 Scoring the canister in a decontamination zone

The canister earns points for ending the match in a decontamination zone if it meets the following criteria and they've been confirmed by the referee. If the canister does not meet one or more of criteria 1-4, it will not be considered scored.

1. The canister maintains contact with the coding mat at all times.
2. The robot does not contact the staging area or decontamination zones, and does not contact the canister after it moves into a decontamination zone.
3. The canister moves through the 1' passageway between the barriers.
4. The canister contacts the staging area before contacting a decontamination zone.
5. The robot and drone do not significantly move the barrier segments.

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6. The canister is in contact with or is overhanging one or more decontamination zones. If the canister is in contact with or overhanging multiple decontamination zones, it should earn the highest scoring value.

Foul Notes for 3.1.7

- If a vehicle moves one or more barrier segments (criteria #5) less than approximately 6” in any direction, it should be recorded as a foul but the canister may still be scored if it meets all other criteria.
- If a vehicle moves one or more barrier segments (criteria #5) a longer distance or in a way that the referee determines was intentional or strategic, it should be recorded as a foul and the canister cannot be scored. For cases where the referee isn’t certain how far the barrier moved, the lesser penalty should be used.



Figure 3.1.7.1: Staging area location

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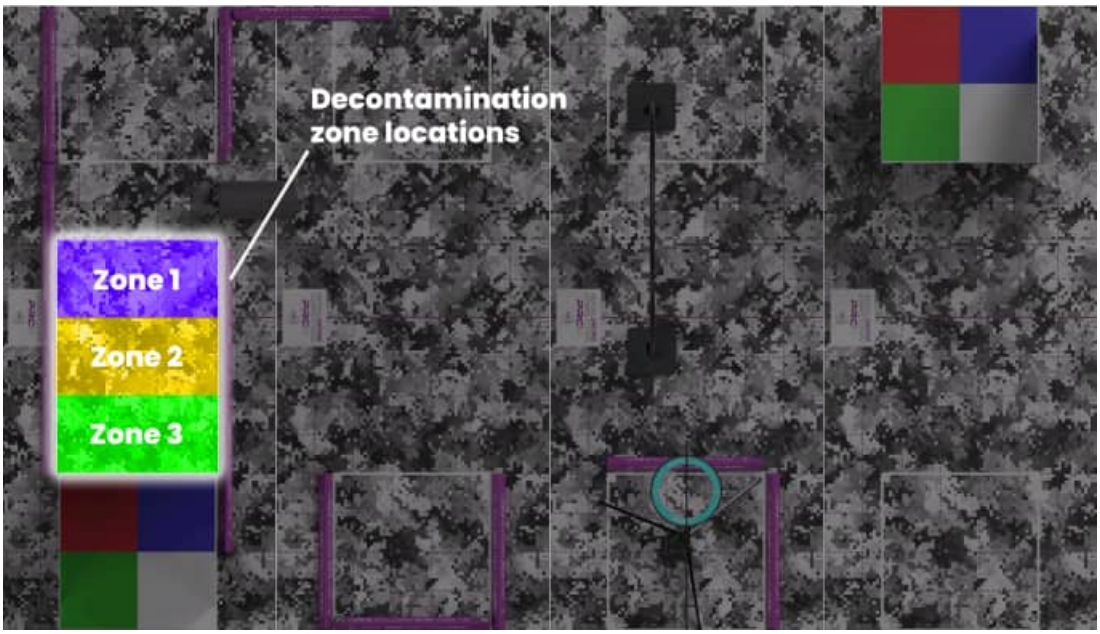

Figure 3.1.7.2: Decontamination zone locations

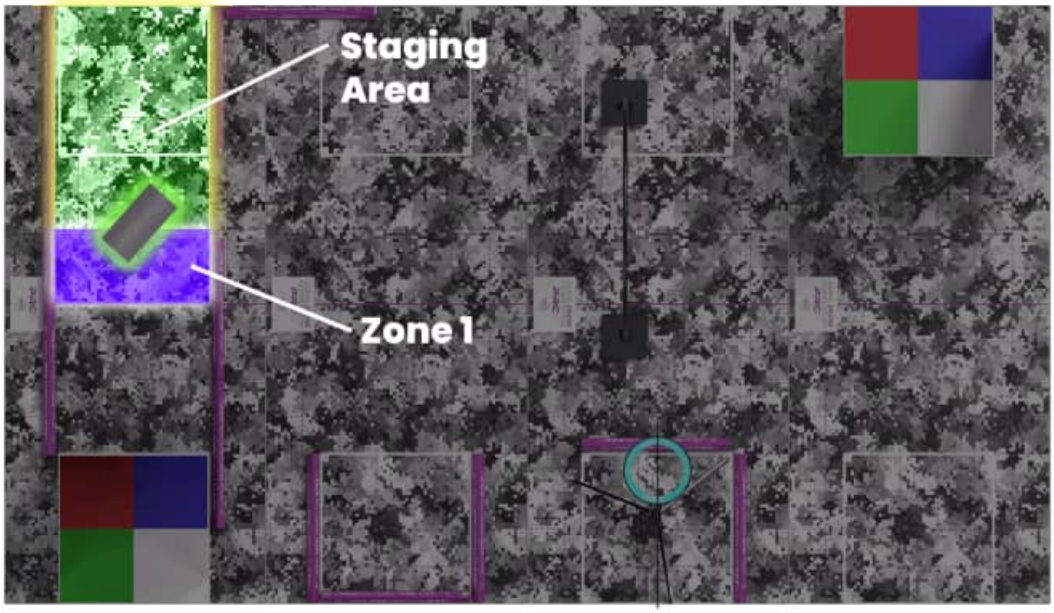

Figure 3.1.7.3: Example of canister scored in decontamination zone 1. The canister is in contact with the staging area and decontamination zone 1, so it would be considered scored in the higher zone, which would be zone 1.

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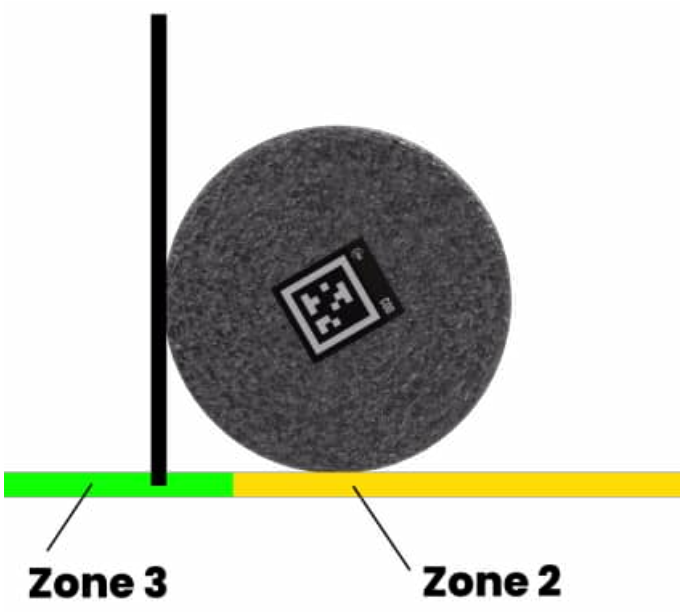

Figure 3.1.7.4: Example of canister scored in decontamination zone 3.
This side view shows the canister is in contact with zone 2 and overhanging zone 3, so it would be considered scored in the higher zone, which would be zone 3.

3.1.8 Parking in the containment bay

A drone or robot is considered to have parked at the end of the match if it meets the criteria and for the vehicle type and they've been confirmed by the referee.

3.1.8.1 Parking a drone

- The drone has taken off and flown during the match
- The drone is contacting the containment bay or is docked on a parked robot
- The drone is not contacting any portion of the floor or coding mat beyond the containment bay
- The drone has not significantly moved the barrier segments surrounding the containment bay

3.1.8.2 Parking a robot

- The robot is contacting the containment bay
- The robot is not contacting any portion of the floor or coding mat beyond the containment bay
- The robot has not significantly moved the barrier segments surrounding the containment bay

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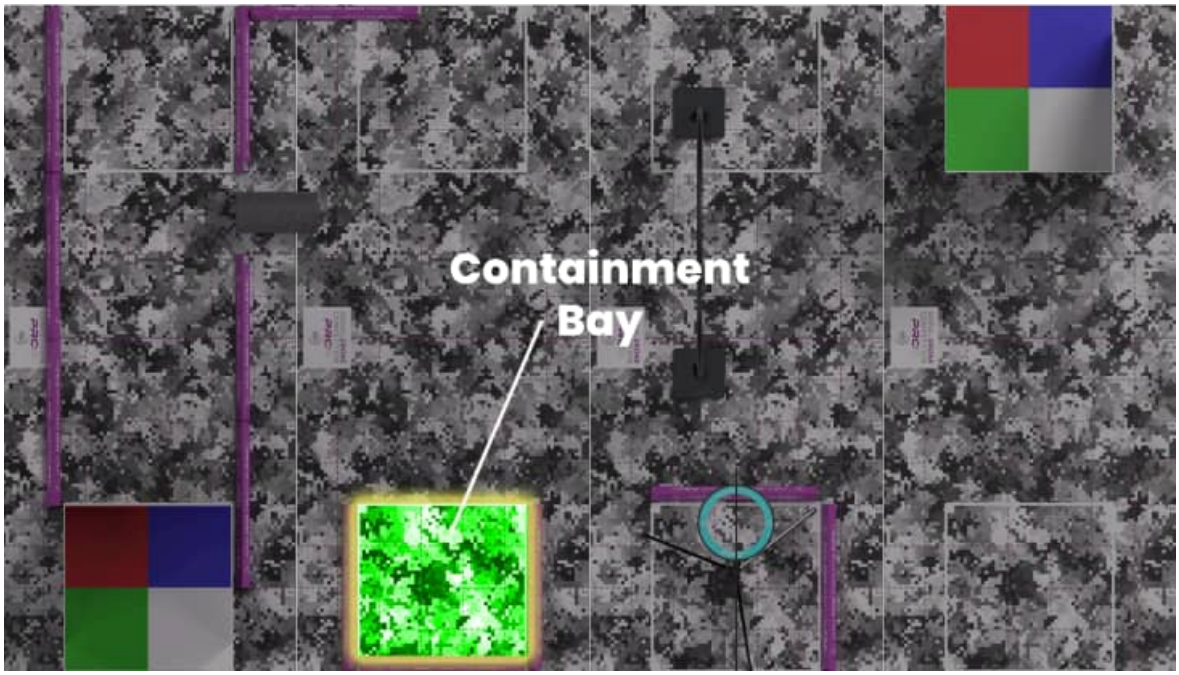

Figure 3.1.8: Containment bay location

3.1.9 Docking a drone

A drone is considered to have docked at the end of the match if it meets the criteria below and they've been confirmed by the referee. Note that a drone can qualify as docked on an un-parked robot.

- The drone has taken off and flown during the match
- The drone is contacting the the robot
- The drone is not contacting any portion of the floor or coding mat beyond the containment bay
- The drone is not contacting any field objects or scoring objects

3.1.10 Earning a solo piloting stop time

Once a team has successfully completed all prior tasks in the match, they become eligible to end their match early and record a solo piloting stop time. If a team fails to earn points for any of the other scoring tasks or does not end the match early, the default stop time of 0 will be used.

If a mission crew wants to end a match early, they should stop their vehicles, put their controllers on the floor, and give a clear signal such as "Stop Time!" For improved accuracy, mission crew members may notify the referee before the match or provide a countdown before the stop signal.

Points earned depend on the time remaining when the team ends the match early by placing their drone and robot controllers on the floor. The time remaining is then rounded down to the nearest even number. For example, if a team puts their controllers down when the displayed time is 11 seconds, the solo piloting stop time will be recorded as 10 seconds.

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3.2 Starting Positions

3.2.1 Mission crew member positions and roles

Up to three student team members (the mission crew) can come to the field for each solo piloting match.

Mission crew members can't wear headphones or communicate with anyone beyond the field during the match, and spectators or non-mission crew students can't coach the mission crew or approach the field.

Sitting or standing on chairs/stools for support or elevation is only allowed if approved by the RECF through an accommodation request.

Entering the field or intentionally contacting scoring objects, field elements, drones, or robots before the referee gives the all-clear signal is not allowed unless permitted by specific rules.

3.2.1.1 Pilot and driver

The pilot and driver must remain within the mission crew station, as shown in figure 3.2.1, unless briefly stepping out for safety. They may move freely within the boundaries of this station to operate equipment, communicate, and collaborate. Only the pilot and driver can operate the drone and robot during the match.

3.2.1.2 Mission specialist

The mission specialist may move freely along the outer perimeter of the field to communicate with the pilot and driver, observe vehicle performance, and retrieve vehicles in case of an emergency stop.

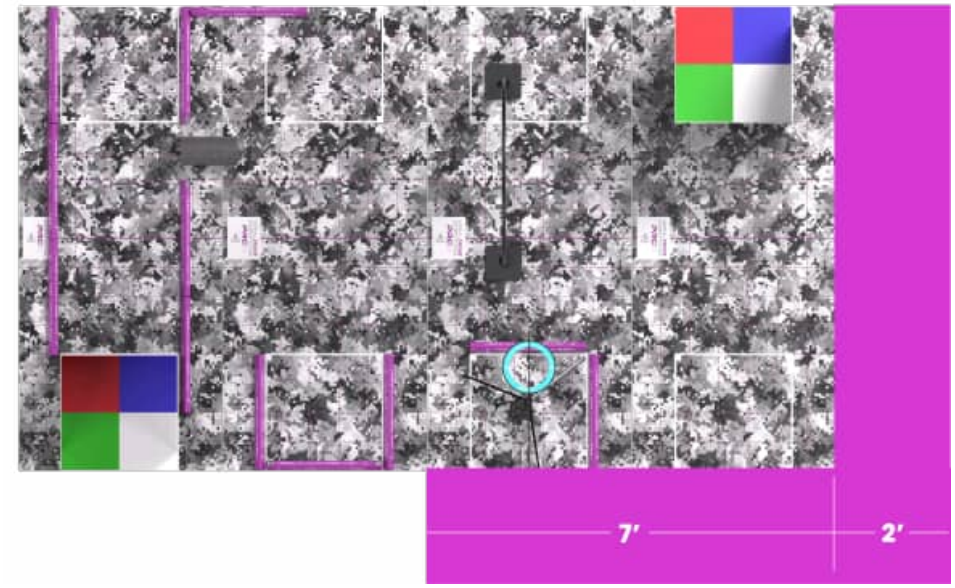

Figure 3.2.1: Solo match mission crew station highlighted in pink

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3.2.2 Drone starting position

Only one drone may be used on the field per match. The drone must begin the match in contact with the take off zone and/or the robot, and cannot be in contact with the floor beyond the take off zone. The drone's propellers may be in motion before the match begins, but the drone must remain on the ground until the match begins.

3.2.3 Robot starting position

Only one robot may be used on the field per match. The drone must begin the match in contact with the take off zone, and cannot be in contact with the floor beyond the take off zone.

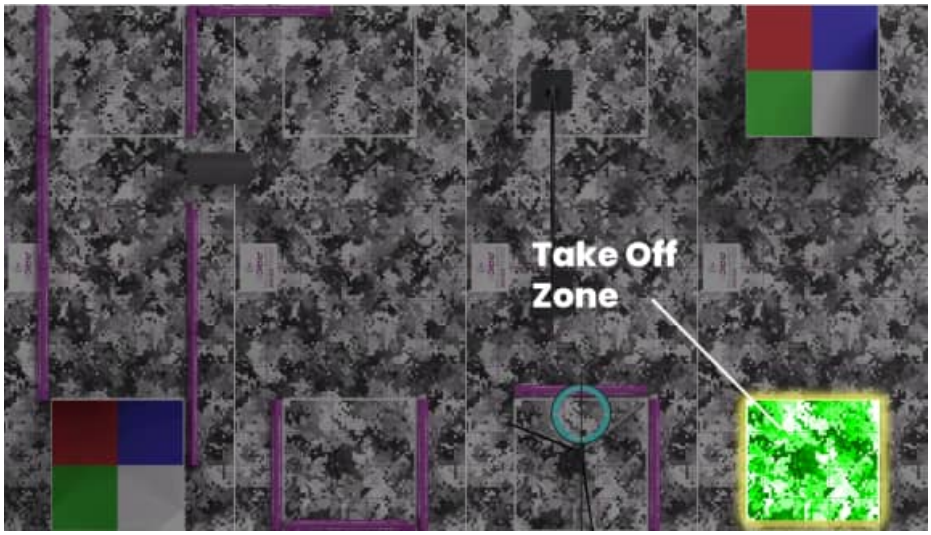

Figure 3.2.3: Solo match take off zone

3.3 Match Play

3.3.1 Mission crew members must control the vehicles

During solo piloting matches, both vehicles are controlled by the pilot and driver using controllers. Teams may use pre-programmed routines as long as they are initiated using their controllers.

3.3.2 Solo match tasks

Most solo match tasks can be completed in any order, and each task can be completed for points one time (see the table in section 3.1) in each match. As described in rule 3.1.10, a team can only earn points for a solo piloting stop time if they've already completed all other tasks.

3.3.3 Vehicles have to stay in the flight zone

Drones must remain in the flight zone (see rule 2.5.2), and robots must remain in contact with the coding mat. Slight or momentary departures from the flight zone and/or coding mat may result in fouls. Significant departures that raise safety concerns may result in grounding for the remainder of the match.

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3.4 What Happens When Things Go Wrong

3.4.1 Pre-takeoff troubleshooting

If the drone has not taken off or the robot has not moved at all after the match begins, mission crew members may briefly reach into the flight zone to retrieve and troubleshoot it (e.g., power, battery, pairing) but may not step inside the netted enclosure. The vehicle must be returned to a legal starting position before resuming. The match timer will not stop. Mission crew members cannot assist the drone if it crashes during a match.

3.4.2 Match replay

The head referee and event partner may decide to replay a match due to technical issues outside of the team's control that affect the score. Teams should be prepared for other vehicles to also be controlled wirelessly, and use equipment that will minimize lost/poor connections; lost connections are not eligible for replays.

3.4.3 Safety issue

If a drone or robot presents a safety risk, it may be grounded by the head referee for the rest of the match. Note that only the grounded vehicle is affected, and the other vehicle in the match can continue to score points. If the head referee decides that damage or injury caused by a student, drone, or robot during a match is intentional, the team may earn a red card foul and a zero score for the match.

3.4.4 Appealing a decision

If the mission crew members disagree with a decision made or score recorded by a referee, they should remain at the field and notify the referee immediately. Mission crew members and referees should be prepared to show specific rules and/or Q&A answers that back up their opinions, and should remember that referees can only make rulings based on the game manual and their own observations and perspectives of the match. Referees and mission crew members may never view video or photos from the match while at the field or during discussions that affect match outcomes or scoring, and team members who were not at the field for the match are not allowed to approach the field. The head referee will determine when the discussion is over, and will announce their final and binding decision.

3.5 Solo Match Ranking and Tiebreakers

Teams will be ranked for solo matches using the total points from their best solo piloting and solo autonomous match at the event.

Tiebreakers:

1. Highest solo autonomous match score
2. Highest solo piloting match score
3. Highest solo piloting match stop time in highest scoring solo driving match

If teams are still tied, the 2nd highest of each in category 1-3 will be used, followed by 3rd highest.

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Section 4: Off Grid Solo Autonomous Mission

In Off Grid solo autonomous matches, teams have 60 seconds to score as many points as possible using only pre-written code to operate their drone and robot. Solo matches aren't pre-scheduled, and each team will have up to five total solo match attempts per competition that can be allocated across the two solo match types however the team likes. Some awards consider a team's solo autonomous mission score, so it is advised that teams complete at least one solo autonomous mission..

In Off Grid solo autonomous matches, the drone must autonomously identify hidden color markers placed behind panels that simulate coded hazard alerts within the plant. Success in this trial depends on reliable autonomous programming, accurate sensing, and tight coordination between drone and robot systems.

Rules from Section 3: Solo Piloting Mission apply unless they're specifically changed by a rule in this section.

4.1 Changes From the Solo Piloting Mission

4.1.1 Mission crew members can enter the field when needed

Mission crew members can reach or step into the flight zone to retrieve and reset their drone and/or robot during a solo autonomous match as described in rule 4.1.3.

4.1.2 Limited human interaction

During solo autonomous matches, the drone and robot must operate entirely based on pre-programmed instructions. Mission crews are prohibited from interacting with the controllers to directly control vehicles during solo autonomous matches.

Mission crew members may start their programs using their coding device, but cannot interact with the vehicles, controllers, or coding device in any other way, except to reset a vehicle, end a program early, and/or to perform an emergency stop. If a mission crew member interacts with a vehicle, controller, or coding device the robot and/or drone must be reset as described in 4.1.3 before additional points can be earned.

4.1.3 Vehicles can be reset as a strategy

The mission crew members can reset their drone and/or robot to a legal starting position as many times as needed/desired during solo autonomous matches. The match timer will continue to run during the reset. Hand catching the drone to perform a reset is permitted, provided no other safety or competition rules are violated. If a drone or robot is out of control, mission crew members can perform an emergency stop and reset the vehicle.

4.1.3.1 Actions permitted during a reset

While resetting their drone or robot, the mission crew can make necessary repairs, replace batteries, and/or revise code as desired. They are not permitted to switch drones or robots during the match.

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4.1.3.2 Completing a reset

If any field or game elements are displaced during the reset, they must be returned to their proper positions before continuing the match. After handling, the drone or robot must return to a legal starting position and the mission crew members can start another program.

4.2 Solo Autonomous Mission Scoring & Revised Scoring Criteria

Scoring Task	Points	Max per Match
Cleared Panel 1: Large Hole	10 points	1
Cleared Panel 1: Small Hole	20 points	1
Color Match: Pad 1	20 points	1
Cleared Arch Gate	10 points	1
Cleared Blue Keyhole	10 points	1
Cleared Teal Keyhole	10 points	1
Score Canister in Zone 1	10 points	The canister can be scored in one of the three zones
Score Canister in Zone 2	20 points	
Score Canister in Zone 3	30 points	
Cleared Panel 2: Large Hole	10 points	1
Cleared Panel 2: Small Hole	20 points	1
Color Match: Pad 2	20 points	1
Parked Vehicle	10 points	2
Docked Drone	20 points	1
Solo Piloting Stop Time	N/A	Not available

4.2.1 Completing a color match on a multi-color pad

A drone has completed a color match in a solo autonomous match when it has completed the following steps and they've been confirmed by the referee:

1. Approach the multi-color pad with the LED turned off or set to a color other than red, blue, green, or white.
2. Land on the multi-color pad while using the drone's color sensor.
3. Display a color (red, blue, green, or white) that is directly below the fuselage or part of the fuselage.

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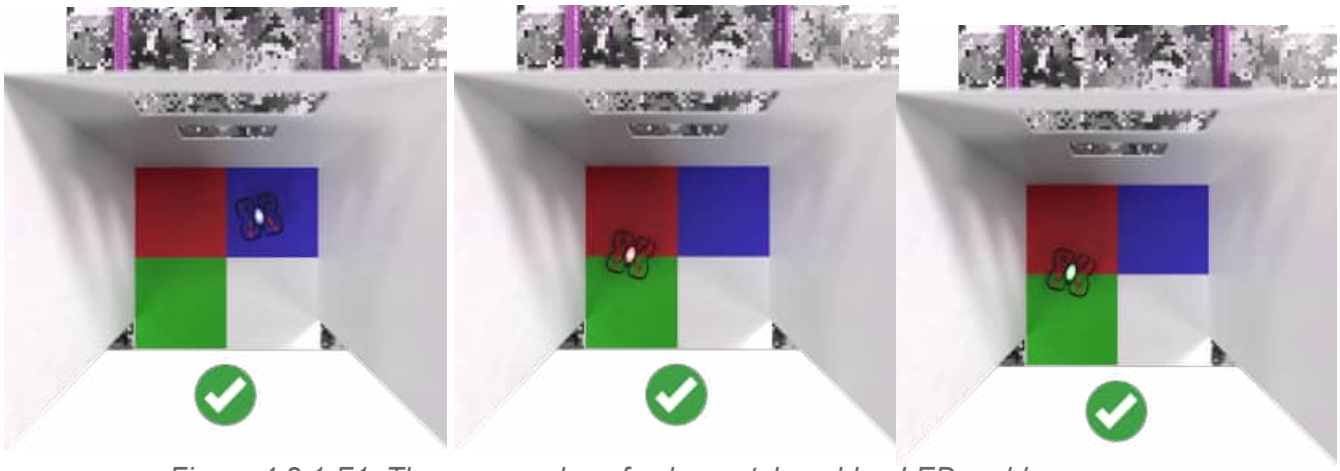

Figure 4.2.1-F1: Three examples of color matches: blue LED on blue square, red LED on red & green squares, and green LED on red & green squares

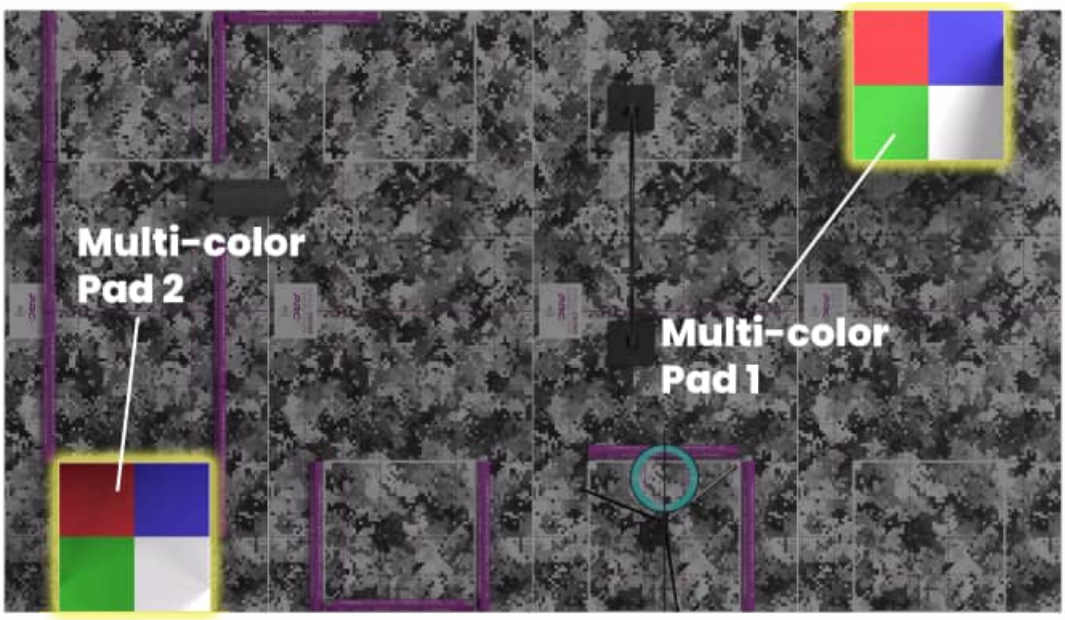

Figure 4.2.1-F2: Multi-color pad locations

4.2.2 Scoring the canister in a decontamination zone

If the robot contacts the staging area, the decontamination zone, or the canister after it moves into a decontamination zone during a solo autonomous match, the canister can be reset to the initial unscored position during a reset of the drone and/or robot, and no foul will be awarded. If the match ends before the canister is reset, the canister cannot count as scored.

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Section 5: Off Grid Alliance/Teamwork Mission

In Off Grid alliance/teamwork matches, teams have 120 seconds to score as many points as possible. Each match includes two teams paired as a red alliance and two teams paired as a blue alliance, and each team brings a drone and a robot to each match. The two teams in an alliance work together to share scored points, and in an effort to outscore the other alliance. Skipping an alliance match will be considered a violation of the RECF Code of Conduct.

You are a member of an elite cybersecurity Hacker Victim Response (HVR - pronounced “Hover”) unit, a specialized team assembled to thwart nefarious actors and restore critical infrastructure. Preparedness and adaptability are your top priorities, and this mission will test both to the limit.

In this high-stakes training exercise, hackers have penetrated the local mainframe and shut off power to the town’s nuclear plant, triggering a small explosion and severing the grid. Your mission: restore power by repairing the plant, disposing of irradiated material, and reestablishing communications with plant operators. To protect against the radiation hazard, your alliance will deploy repair drones and ground disposal unit robots to complete your tasks remotely.

But you’re not alone. A rival HVR alliance has been deployed to the opposite side of the site, competing to complete the same objectives. Their progress may interfere with your own, and only the most efficient and coordinated alliance will succeed in restoring the grid first.

Race against the clock and your rivals to complete the following objectives:

- Use your drone to prime the pumps.
- Use your robot to move irradiated fuel into the cooling pool for disposal.
- Use your drone to flush the irradiated fuel into your alliance’s cooling pool goal.
- Use your robot to optimize power cell locations for drone retrieval.
- Use your drone to store power cells in the supply station, and carefully place a single power cell at the top of the comms tower to reestablish communication with plant operators.
- Safely dock your drone and park your vehicles on the recovery pad.

If your team completes all tasks before time runs out—and before your rivals—you’ll restore the grid and prove your unit’s readiness under pressure.

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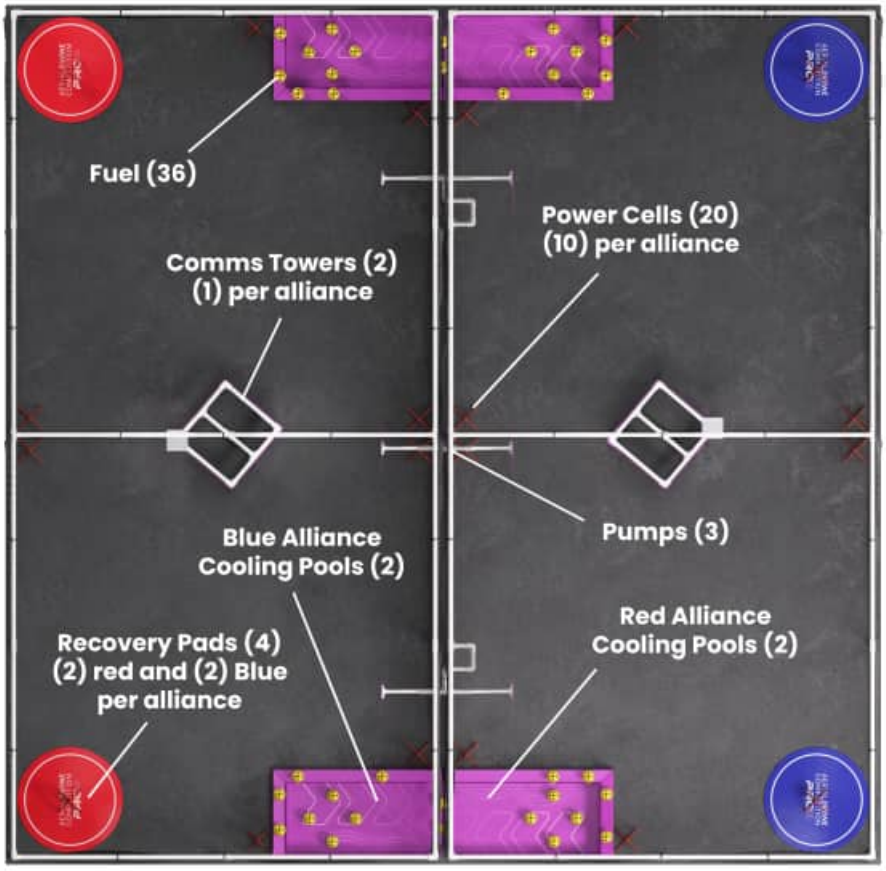

Figure 5.0: Alliance mission field layout

5.1 Alliance Match Scoring & Scoring Criteria

Scoring Task	Points
Scored pump	10 points
Power cell scored on the drop zone	15 points (maximum of 1 per drop zone)
Power cell scored in the supply station	5 points
Fuel scored inside a cooling pool*	1 point
Fuel scored outside the cooling pools*	2 points
Docked drone	5 points
Parked vehicle	1 point

* Points for this scoring task are earned based on fuel located in the opponent's alliance field zone, not the alliance's own field zone. For example, the red alliance earns points for fuel that ends the match on the cooling pool goals and floor in the blue alliance field zone.

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5.1.1 Scored pump

Pumps begin a neutral position and can be individually scored by an alliance for 10 points each. A pump is considered scored by an alliance when the pump is moved so that the red color is visible on the opposing alliance's side. If no red color or only the black bands are showing, then the pump is neutral and not scored for either alliance.

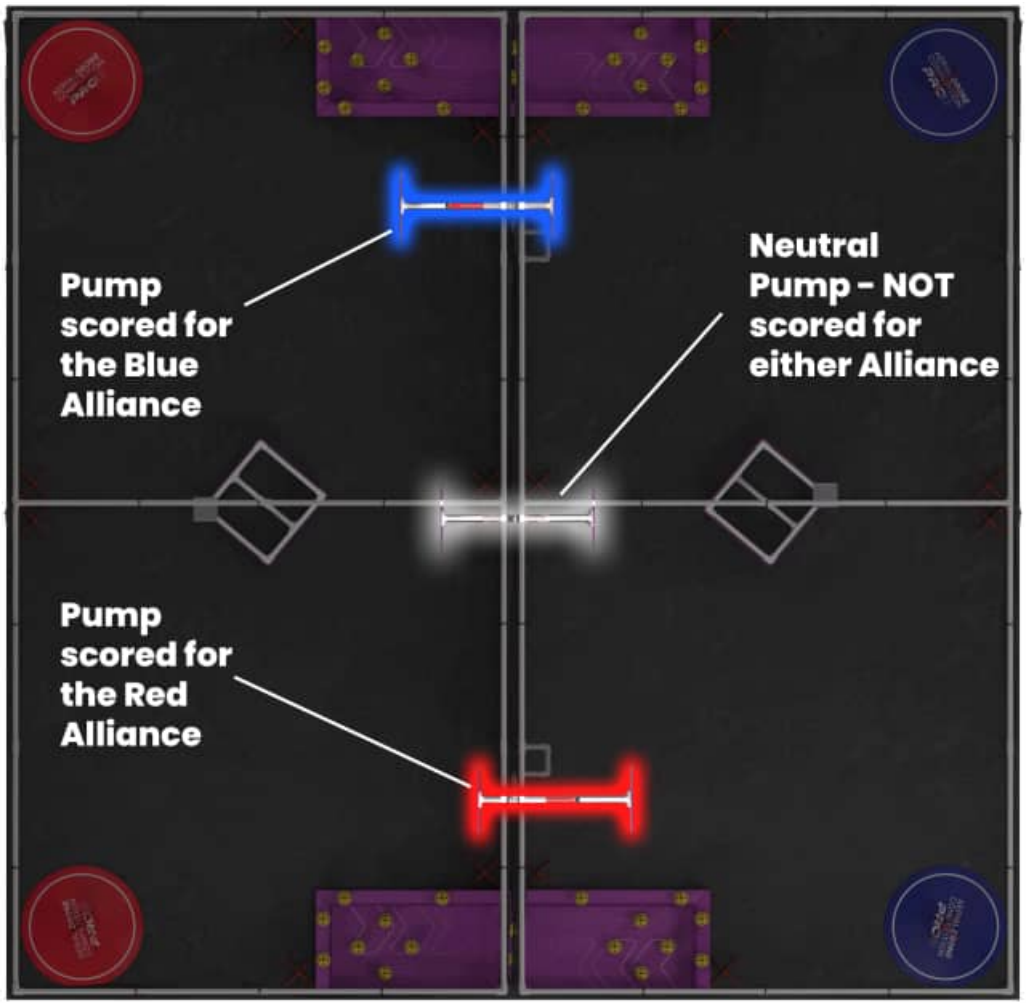

Figure 5.1.1: Pumps in three positions: scored for the blue alliance, neutral/un-scored, and scored for the red alliance

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5.1.2 Power cell scored on the comms tower drop zone

A power cell that is scored on a comms tower drop zone earns 15 points. A power cell counts as scored on the drop zone if it meets all of the following criteria. If more than one power cell counts as scored on a single comms tower, only one will be considered scored.

- The power cell was placed on the drop zone by a drone (not a robot)
- The power cell is touching the drop zone
- The power cell isn't touching any other power cells
- The power cell isn't touching a robot or drone

5.1.3 Power cell scored in the comms tower supply station

Each power cell that is scored in a comms tower station earns 5 points. A power cell counts as scored in a supply station if it meets all of the following criteria.

- The power cell was placed in the supply station by a drone (not a robot)
- The power cell is at least partially within the supply station
- The power cell isn't touching the floor outside the power station
- The power cell isn't touching a robot or drone



Figure 5.1.3: Three power cells scored in a supply station, and one power cell in contact with the floor outside the supply station and not scored

5.1.4 Fuel scored in a cooling pool goal

An alliance earns points for fuel that ends the match in the cooling pool goals on the other side of the divided field, in their opponent's alliance field zone. To earn points for fuel, it has to end the match on the opponent's side of the divided field. Each piece of fuel that meets the following criteria earns 1 point for being scored in a cooling pool goal.

- The fuel is touching the cooling pool goal
- The fuel is only touching one cooling pool goal
- The fuel is not touching a robot or drone

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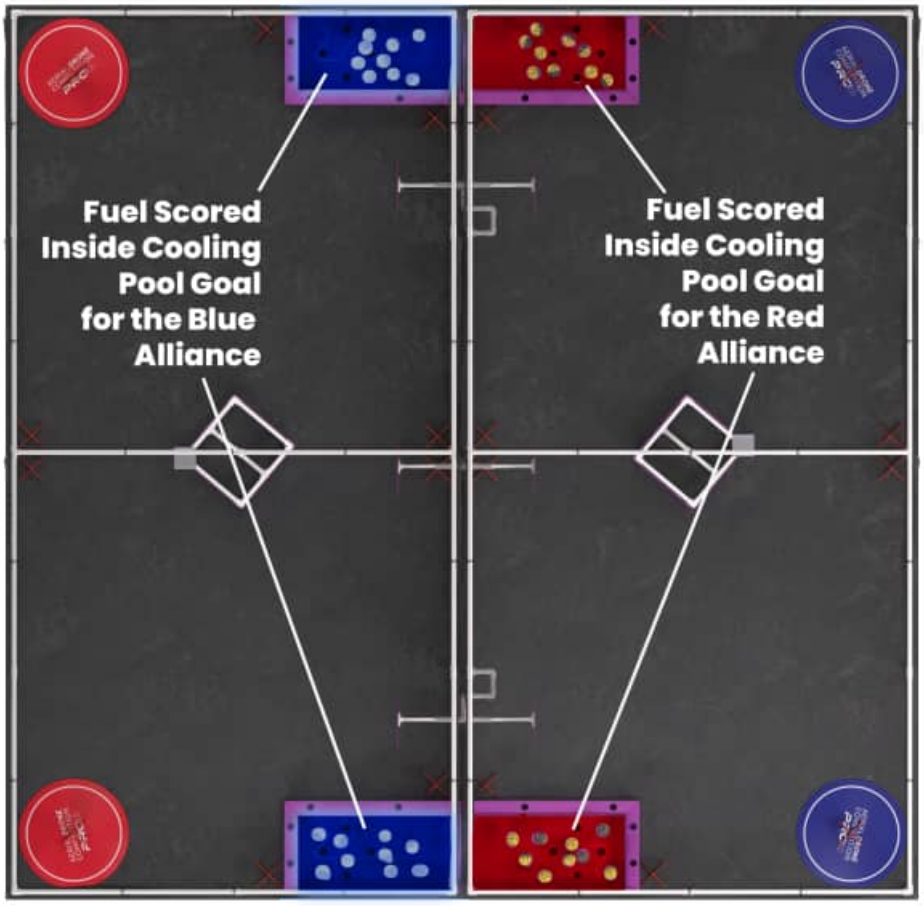

Figure 5.1.4.1: Examples of fuel scored inside cooling pool goals

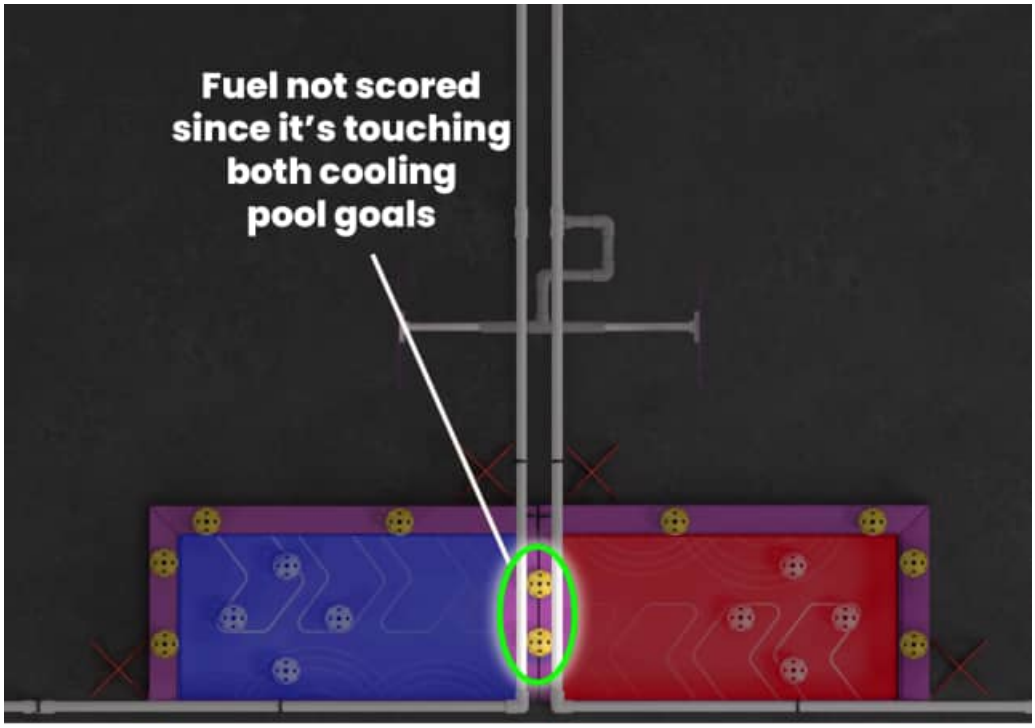

Figure 5.1.4.2: Example of fuel that isn't scored because it's touching two cooling pool goals

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5.1.5 Fuel scored outside of a cooling pool goal

An alliance earns points for fuel that ends the match outside of the cooling pool goals on the other side of the divided field, in their opponent's alliance field zone. To earn points for fuel, it has to end the match on the opponent's side of the divided field. Each piece of fuel that meets the following criteria earns 2 points for being scored outside of a cooling pool goal.

- The fuel is not touching a cooling pool goal
- The fuel is within the 3D volume of the opposing alliance's field zone

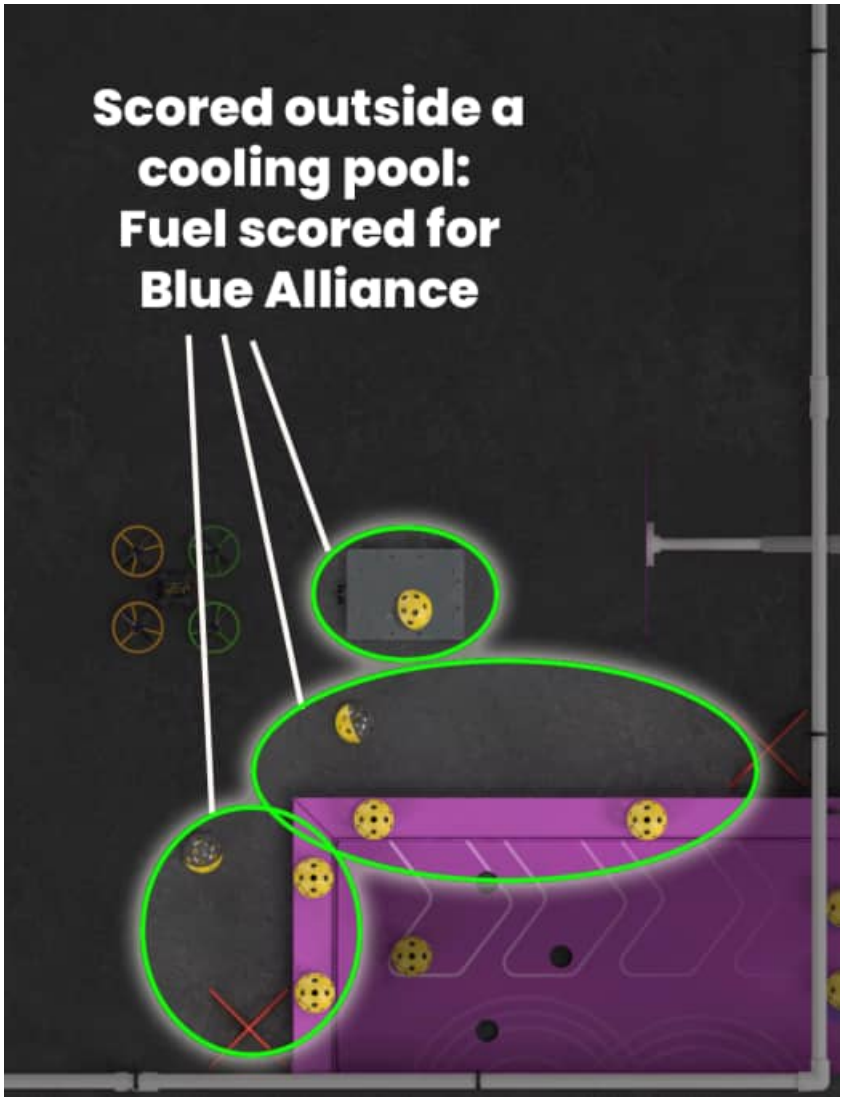

Figure 5.1.5: Examples of fuel in the red alliance field zone that counts as scored outside the cooling pool goal, earning points for the blue alliance

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5.1.6 Drone docked on a robot

A drone is considered to be docked on a robot at the end of the match if the drone is touching a robot and is not touching the floor, field perimeter, recovery pad, or other field element.



Figure 5.1.6: A docked drone

5.1.7 Vehicle parked on a recovery pad

A robot or drone is considered to have parked at the end of the match if any part of it is touching the recovery pad. A drone is also considered parked at the end of the match if it is docked on a parked robot, in which case it should earn points for both statuses.



Figure 3.1.7.1: A parked drone and a parked robot

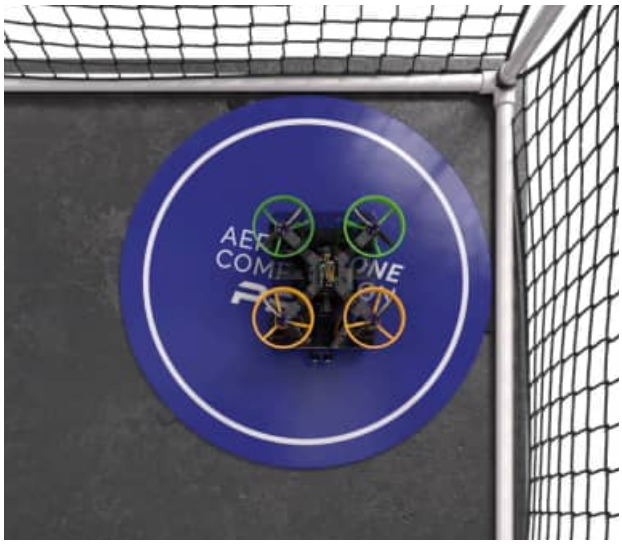

Figure 3.1.7.2: A docked and parked drone, and a parked robot

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5.2 Starting Positions

5.2.1 Mission crew member positions and roles

Up to three student team members (the mission crew) can come to the field for each alliance match. Mission crew members may not enter the field during a match.

Mission crew members can't wear headphones or communicate with anyone beyond the field during the match, and spectators or non-mission crew students can't coach the mission crew or approach the field.

Sitting or standing on chairs/stools for support or elevation is only allowed if approved by the RECF through an accommodation request.

Entering the field or intentionally contacting scoring objects, field elements, drones, or robots before the referee gives the all-clear signal is not allowed unless permitted by specific rules.

5.2.1.1 Pilot and driver

The pilot and driver must remain within their alliance station, as shown in figure 5.2.1. They may move freely within the boundaries of this station to operate vehicles, communicate, and collaborate. Only the pilot and driver can operate the drone and robot during the match.

5.2.1.2 Mission specialist

The mission specialist may move freely along the outer perimeter of their alliance field zone, as shown in figure 5.2.1, to communicate with the pilot and driver and observe vehicle performance.

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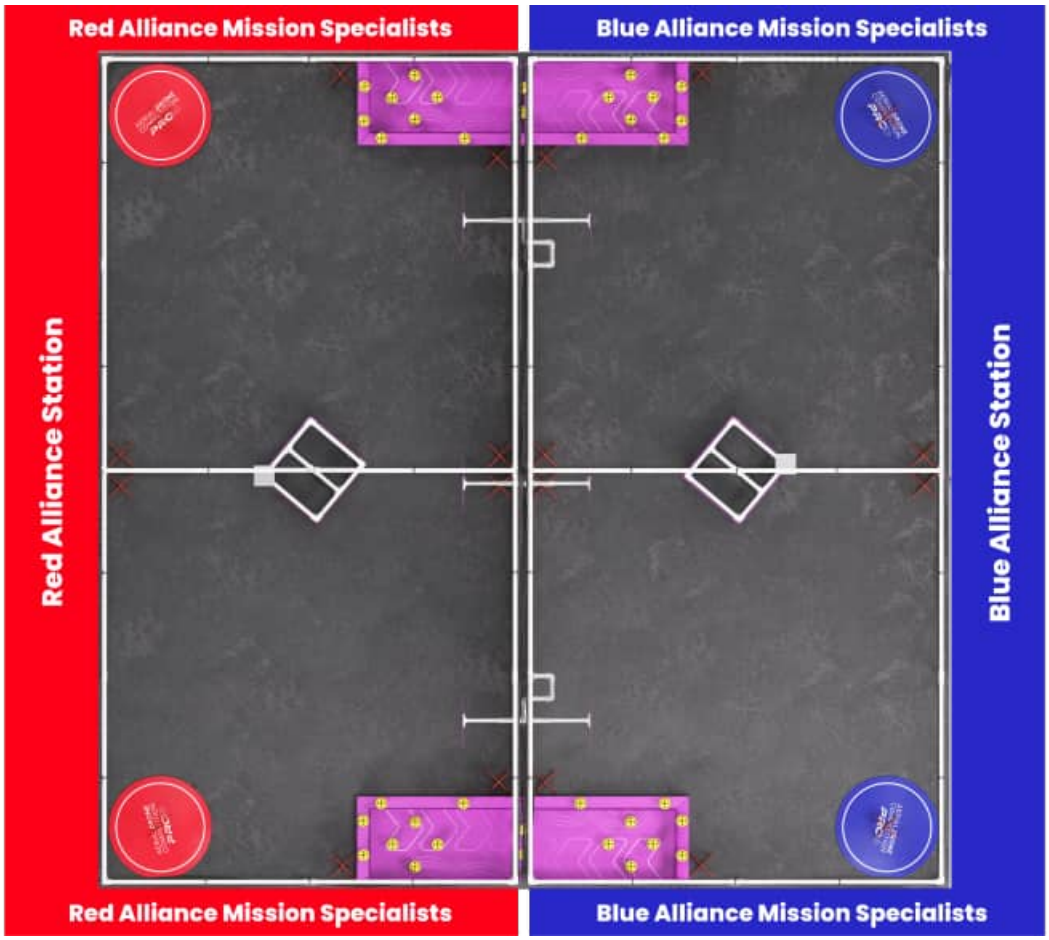

Figure 5.2.1: Alliance stations and areas for mission specialists

5.2.2 Drone and robot starting positions

Only one drone and one robot may be used on the field by each team in a match. Each team's drone and robot must meet all of these criteria at the beginning of the match:

- Not contacting a recovery pad, pump, cooling pool, comms tower, power cell, or fuel
- In one of their alliance's starting quadrants, and not sharing a quadrant with the other robot or drone in the alliance (i.e., one team in each quadrant)
- When the head referee confirms that both alliances are ready to start the match, a pre-match countdown will begin; teams may start their drones' propellers during the countdown, but may not leave the ground until the 2-minute match timer begins

5.2.3 Recovery Pad Power Cell

During their pre-match setup, alliances may elect to move the power cell that begins the match on the recovery pad to any unscored location in their alliance field zone. The power cell cannot begin the match in contact with a drone or robot. No other power cells can be repositioned, and if this power cell is not repositioned it should begin the match on the recovery pad.

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5.3 Match Play

5.3.1 Vehicles can only operate while the match timer is counting down

Vehicles can't be in flight/motion before the match timer begins counting down from 120 seconds, and have to stop when the timer hits 0. Points scored after the timer reaches 0 will be deducted before the score is submitted, and the team will receive a foul.

5.3.2 Keep everything in the field

Any game element that leaves the field during a match will be returned by the nearest field volunteer when and if they're able to safely and reasonably do so, to the alliance field zone closest to where it left the field. If it's unclear which side of the divided field it left from, the object should remain outside the field for the rest of the match. Objects that are removed from the field intentionally or strategically should result in a foul.

5.3.3 Stay in your alliance field zone

Robots and drones must remain inside of their alliance field zones during the match, and cannot intentionally or accidentally extend into their opponent's zone or out of the field. If a drone or robot is leaving its alliance field zone, it may be grounded by the head referee.

5.3.4 Robots can't touch fuel in cooling pool goals

When fuel is in contact with a cooling pool goal, it's off-limit to robots. Momentary contact with fuel while it's being moved into a goal by a robot is allowed, but once the fuel enters the goal the robot can no longer touch it.

For example, a robot can grab fuel from its starting position and move it to the goal, and there may be a brief moment where the fuel is contacting the goal and the robot simultaneously without a foul.

5.3.5 Each alliance in the elimination bracket gets one time out

Time outs are available between matches in the elimination bracket, but can only be used immediately before a match that includes the alliance who calls it. Each time out can be up to three minutes, but can end early if that alliance's teams and head referee agree.

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5.4 What Happens When Things Go Wrong

The guidance in section 3.4 also applies in alliance matches unless specifically revised below.

5.4.1 Missed match or late to a match

If no member of a team is present in the alliance station at the scheduled start time for a match (or, for finals matches and/or when the event is running behind schedule, when the match is otherwise ready to begin), the team will be marked as absent from that match. They will not earn points for that alliance match; the score for their alliance partner is not affected. Missing an alliance match can lead to a Code of Conduct foul.

5.4.2 At the field, but not ready to play

If a team is not ready to play at the scheduled match time (or, for elimination matches and/or when the event is running behind schedule, when the match is otherwise ready to begin), the head referee may ask the team to remove their vehicles from the field. If at least one member of the mission crew remains at the field, they will still receive a score for the match.

5.4.3 Drone or robot tangled in a net

If a drone or robot becomes tangled in a net, mission crew members may briefly attempt to pilot or drive the vehicle out of the net. If they cannot untangle the vehicle, or if the referee believes there's a risk of damage to the net, the head referee will ground the vehicle for the remainder of the match.

5.5 Match Ranking Points

Alliances earn match ranking points for winning or tying a match. Ranking points determine the overall rank of individual teams for alliance selection.

- Alliances earn 2 match ranking points for ending an alliance match with the highest score
- Alliances earn 1 match ranking point for ending an alliance match with a tied score

Rankings and tiebreakers will be determined as follows:

- Average match ranking points
- Average match score
- Highest alliance match score
- Second-highest alliance match score
- Random electronic draw

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Section 6: Communications Mission

At events that offer judging, teams will participate in an interview with judges to answer questions about their team, iterative design process, code, and strategies; each team must be offered an equal opportunity to be interviewed. Teams also submit their competition notebooks for review by judges.

Each team interview lasts about 10 minutes and in-person interviews generally take place between matches. Judges use the Team Interview Rubric and Competition Notebook Rubric to evaluate and rank teams. Teams are encouraged to review these rubrics in advance.

See the RECF Drones Guide to Judging for more information about judging and awards.

6.1 Competition Notebook

A competition notebook is a record-keeping tool that provides students with an opportunity to develop essential skills such as project and time management, brainstorming, and both written and interpersonal communication. Teams are encouraged to document their use of the iterative design process, including details of successes and challenges. All documentation and work related to the competition notebook must be completed by the students, and they can't use AI-generated content. To learn more about competition notebooks and the iterative design process visit the RECF Library.

Teams can maintain their notebooks using either a traditional physical notebook or a range of digital tools, such as software applications or cloud-based platforms. Some events may only accept physical notebooks, while others may require digital submissions. In these cases, physical notebooks can be scanned and submitted electronically, and digital notebooks may be printed for submission. Be sure to check the event details on RECFevents.org to confirm which format is accepted.

6.2 Team Interviews

Team interviews are face-to-face (or virtual) conversations between a team of students and two or more volunteer judges. Interviews are opportunities for teams to share their match strategies, learning experiences, and overall approach to the competition.

6.3 Award Deliberation

Award deliberation is the last step in the judging process. In this step, judges work with the judge advisor and one another to select candidates for each award.

The Competition Notebook Rubric and Team Interview Rubric are tools to assist with deliberations. A team's score, whether a specific line item on a rubric or the overall score, is a data point that the judges can use as a part of the process. It is not a replacement for qualitative judgments in the deliberation process.

Judges will choose winners of each award based on the specific award criteria in the RECF Drones Guide to Judging. No team may receive more than one judged award at an event.

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Section 7: Event Personnel, Processes, & Guidelines

7.1 Event Personnel

7.1.1 Event Partner

An event partner is a certified volunteer who runs an event using the guidelines in RECF's policies and game manuals. RECF event partners must be at least 18 years old, and can't serve as a head referee or judge advisor at their event. Event partners oversee the activities in this section of the game manual, and can add specific rules based on their site and event. Event partners cannot make decisions about match scores or rulings, cannot determine penalties for fouls, and cannot influence who receives judged awards. Event partners have the final decision on non-match and non-drone decisions at an event.

7.1.2 Head Referee

A head referee is a certified volunteer who has been assigned by the event partner to oversee matches using the guidelines in the game manual. ADC Pro head referees must be at least 20 years old. Head referees work with team members to prevent and avoid fouls, and communicate fouls and penalties to teams when they occur. Head referees have the final decision on all match and drone rules, and should train inspectors and scorekeeper referees at events as appropriate.

Every alliance match must be watched by at least one head referee, and a head referee must be available to assist at inspection and solo matches as needed. See this article and related content in the RECF Library for more information.

7.1.3 Scorekeeper Referee

Scorekeeper referees score all varieties of match, and can oversee solo matches independently. ADC Pro scorekeeper referees must be at least 15 years old. Every solo match must be watched by at least one referee. If there's a question about scoring or match play that doesn't have a clear answer in the game manual, scorekeeper referees should consult a head referee before answering. See this article and related content in the RECF Library for more information.

7.1.4 Judge Advisor

A judge advisor is a certified volunteer who trains and oversees volunteer judges at an event using the guidelines in the RECF Drones Guide to Judging. ADC Pro judge advisors must be at least 21 years old. See this article and related content in the RECF Library for more information.

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7.1.5 Judge

A judge is a volunteer who reviews teams' competition notebooks and/or interviews teams about their processes, then deliberates with other judging volunteers to identify award candidates and select award winners. ADC Pro judges must be at least 20 years old. See this article and related content in the RECF Library for more information.

7.1.6 Inspector

An inspector is a volunteer who confirms that teams' equipment meet the requirements in the game manual. If there's a question that doesn't have a clear answer in the game manual, inspectors should consult a head referee.

7.1.7 Field Resetter

A field resetter is a volunteer who ensures that all objects on the field are in the correct positions at the beginning of each match. Field resetters should not begin to reset a field after a match until a referee directs them to do so. See this article and related content in the RECF Library for more information.

7.1.8 Queuer

A queuer is a volunteer who ensures that the correct teams are at the correct alliance matches. If time allows, they can attempt to locate teams who haven't checked in for upcoming matches, but they are not required to do so. See this article and related content in the RECF Library for more information.

7.1.9 Emcee

An emcee is a volunteer who provides play-by-play information for the audience during alliance matches. Emcees should avoid suggesting strategies, and cannot simultaneously serve as referees. See this article and related content in the RECF Library for more information.

7.2 Event Processes

7.2.1 Team Check In

Each team must check in when they arrive at the event, and confirm that at least one adult will remain onsite to supervise team members for the entire event. Some events use team check-in as a way to distribute event hand-outs like nametags, site maps, general schedules, and lunch order forms. Team check-in often occurs at a visible location just inside the main doors of the venue.

7.2.2 Inspection

Each team must pass an inspection before they can participate in any type of match at an event. Volunteer inspectors will confirm that the team's drones and robots meet the requirements in the game manual, and will mark passed inspections in C². Inspection often occurs at a table near the competition fields or in the team pit area.

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7.2.3 Creating the Alliance Match Schedule

If any teams have not checked in, or any teams haven't passed inspection, the event partner should resolve them before creating the alliance match schedule in C². The alliance match schedule should only include teams who will participate in alliance matches. See rule 7.4.2 for more information.

7.2.4 Queueing

Teams should check in at the queuing table(s) before their scheduled alliance match time, and will be routed to the correct field by volunteer queuers. Queueing generally occurs at a set of tables near the alliance match fields, with one table for each named competition field. Providing tables gives teams a safe place to put their drones, robots, & controllers while they wait for upcoming matches. Tables are also recommended at the line for solo matches.

7.2.5 Running Matches

To display a match timer on a connected display, a referee or emcee can select an alliance match by match number in C², or a solo match by team number and match type. The referee or emcee should confirm that the mission crew members are ready, then activate the match timer from a device connected to C².

After the match completes, referees should score the match and confirm object counts for each scoring category with the mission crew members before submitting the match score and moving to the next match.

7.2.6 Alliance Selection / Elimination Bracket

At the end of alliance matches, the event partner should identify any teams that are unavailable or ineligible to participate in alliance selection and mark them in C². Once teams are removed from the list, the event partner can determine the number of alliances that will participate in alliance selection and initiate the alliance selection process. Once alliance selection is complete, the event partner will create the elimination bracket in the C² software. See rules 7.4.4. and 7.4.5 for more information.

7.2.7 Entering Award Winners

After the judging volunteers have selected the winners of all judged awards listed for the event, the judge advisor and event partner should work together to enter winners in C². They should confirm the base number and team letter for each winner, and ensure that no team is marked to receive more than one judged award. Winners of performance awards are automatically marked by C².

7.2.8 Finalizing an Event

After matches and awards conclude, the event partner should finalize and upload the tournament information to RECFevents.org. Some events (e.g., multiple divisions) may need to work with RECF staff to finalize their results.

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7.3 Field Parameters

See the ADC Pro Off Grid Field Assembly & Layout Instructions for field element assembly instructions, setup details, and field measurements.

7.3.1 Equipment

All of the fields used for alliance matches at an event should have the same flooring, and all of the fields used for solo matches at an event should have the same flooring. For example, an event could put all of the alliance match fields on low-pile commercial carpet and all of the solo match fields on laminate flooring. Recommending flooring types include hardwood, laminate, concrete, low-pile commercial carpet, and interlocking foam tiles.

All events must use official ADC Pro field and game elements purchased from Drone Competition Gates unless otherwise noted in this rule.

Qty	SKU	Name	Notes
2	ADCP-201*	ADC Pro 10' x 20' Teamwork Mission Field Perimeter	*PVC can be purchased locally; PVC Pipes & Connectors (½ field)
2	ADCP-TG001	ADC Pro Mission 2026 - 2027 Teamwork Mission Game Element Kit	
1	ADCP-SG001	ADC PRO Mission 2026 - 2027 Skills Mission Game Element Kit	

Some modifications are allowed to the standard field setup, including:

- Using velcro or tape to secure the barrier segments to the coding mats in solo matches

7.3.2 Variances

Although fields and setups should be as identical as possible, teams have to be prepared for some amount of variance. Positions of field elements and boundaries may vary up to ±3” in any direction. Starting locations for game elements may vary up to ±1” in any direction.

7.3.3 Repairs and decorations

Decorations and minor repairs are allowed if they don’t affect game play.

7.4 Match Parameters

7.4.1 Solo Matches

Each team can attempt up to five total solo matches at an event, and can allocate their attempts across the two solo match types however they like. These matches aren’t scheduled,

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and teams can make these attempts whenever their event schedule permits. Solo match fields should open early in the event, and remain open long enough to give each team an opportunity to complete their maximum number of solo matches. As a general rule, solo match fields should remain open until alliance matches have ended. The team with the highest combined sum of their single highest solo piloting and single highest solo autonomous match scores will be named the skills missions champion.

7.4.2 Alliance Matches

Each team should have 5-8 alliance matches at a qualifying event or 8-10 matches at a championship event, which will appear on the match schedule generated by C². Running fewer than 5 alliance matches per team must be approved by the RECF RSM. C² will assign alliance partners, match times, fields, and team colors as needed. Matches can only run early if the head referee and all teams are checked in for the match and ready to play.

If a team is marked with an asterisk (*) for one of the last matches on the schedule, their score for that match won't affect their ranking. This occurs when extra matches are necessary to provide each team with the same minimum number of matches. Teams should remember that the RECF Code of Conduct includes supporting alliance partners, and do their best even though it won't affect their ranking.

7.4.3 Practice Matches

Some events choose to include scheduled practice matches that occur before official alliance matches begin. Practice matches aren't required, and the scores don't affect teams' rankings.

7.4.4 Alliance Selection

Ranking points earned in alliance matches are used to rank teams for alliance selection (see 5.5 for details and tiebreakers). Event partners can decide how many alliances will participate in the elimination bracket, but (if possible) should avoid choosing a number that will result in only one team being excluded from alliance selection. Recommendations for the number of alliances to include are below:

Number of teams at the event	**Recommended number of alliances to form during alliance selection**
Less than 18	• If an even number of teams are at the event, the number of teams divided by 2 • If an odd number of teams are at the event, the number of teams minus 3 then divided by 2
18-25	8
26-32	12
32 or more	16

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Each team at the event must send one student to represent the team for alliance selection. No communication devices are allowed during alliance selection. Any electronics such as phones or tablets must be in airplane mode and disconnected from wi-fi during alliance selection. Decisions related to alliance selection must be made by the students on the team.

Alliance selection will begin with the representative from the highest ranked team inviting any eligible team of their choice to become alliance partners. The invited team's representative then has the opportunity to either accept or decline the offer. If the offer is declined, the invited team cannot be invited to another alliance, and will only be able to be the inviting team if they are ranked highly enough to have that opportunity. Team representatives should be mindful of the number of teams being included in elimination rounds before declining an invitation.

Once the first alliance is formed, the next highest ranked team's representative will be given the opportunity to invite a team to become alliance partners. This process will continue until the number of alliances set by the event partner have been established.

7.4.5 Elimination Bracket

Alliances created during alliance selection compete in a traditional single elimination bracket to determine the tournament winners. Alliances are seeded based on the highest-ranked team in the alliance. There are several rounds of elimination matches; the number of rounds will be based on the number of alliances participating. Higher-ranked alliances may receive byes if there is an unbalanced bracket. The winning alliance from each match will advance to the next round of matches until only two alliances remain. If an elimination match results in a tie, the two teams will play up to two tie-breaker matches; if the 3rd match is also a tie, the higher-seeded alliance will be recorded as the winner.

The figures below show how alliances flow through 16-alliance and 8-alliance brackets, with the winner of each match progressing to the next level.

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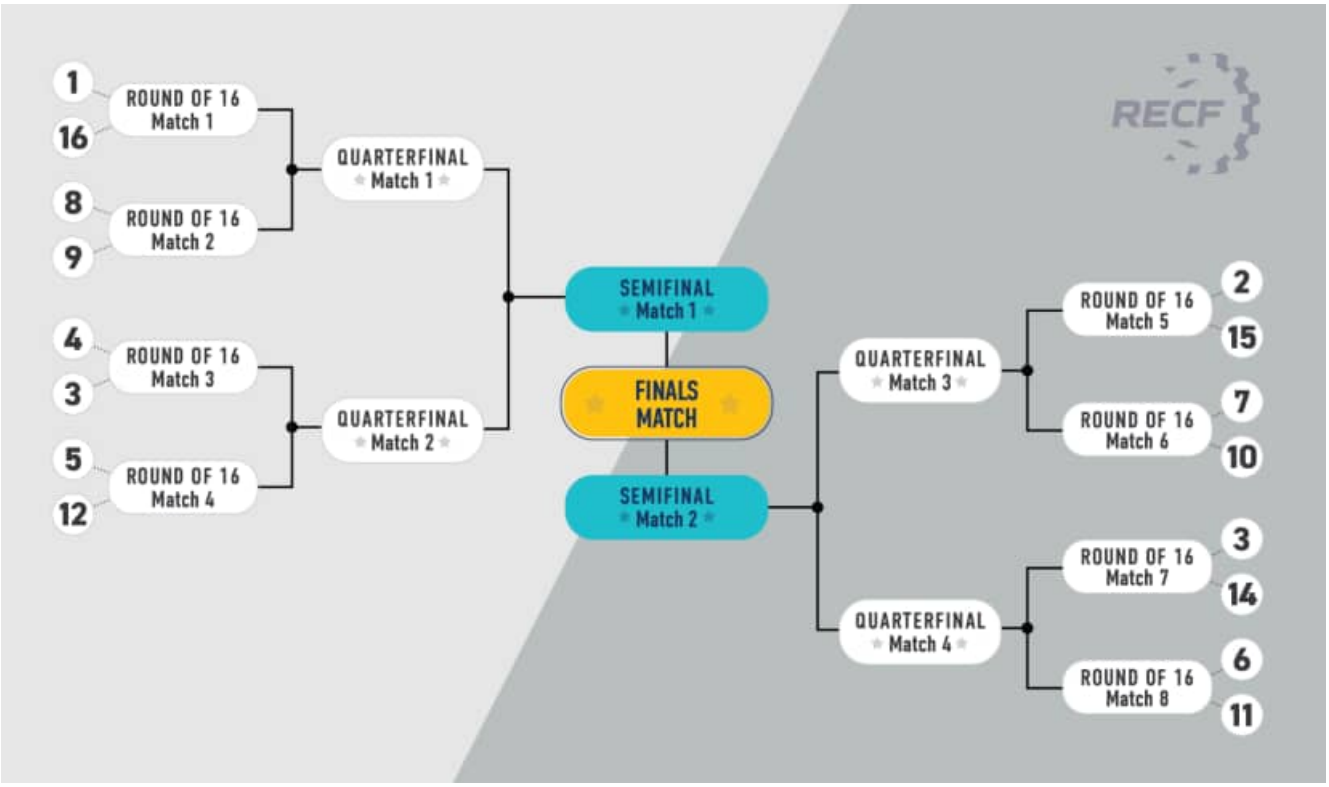

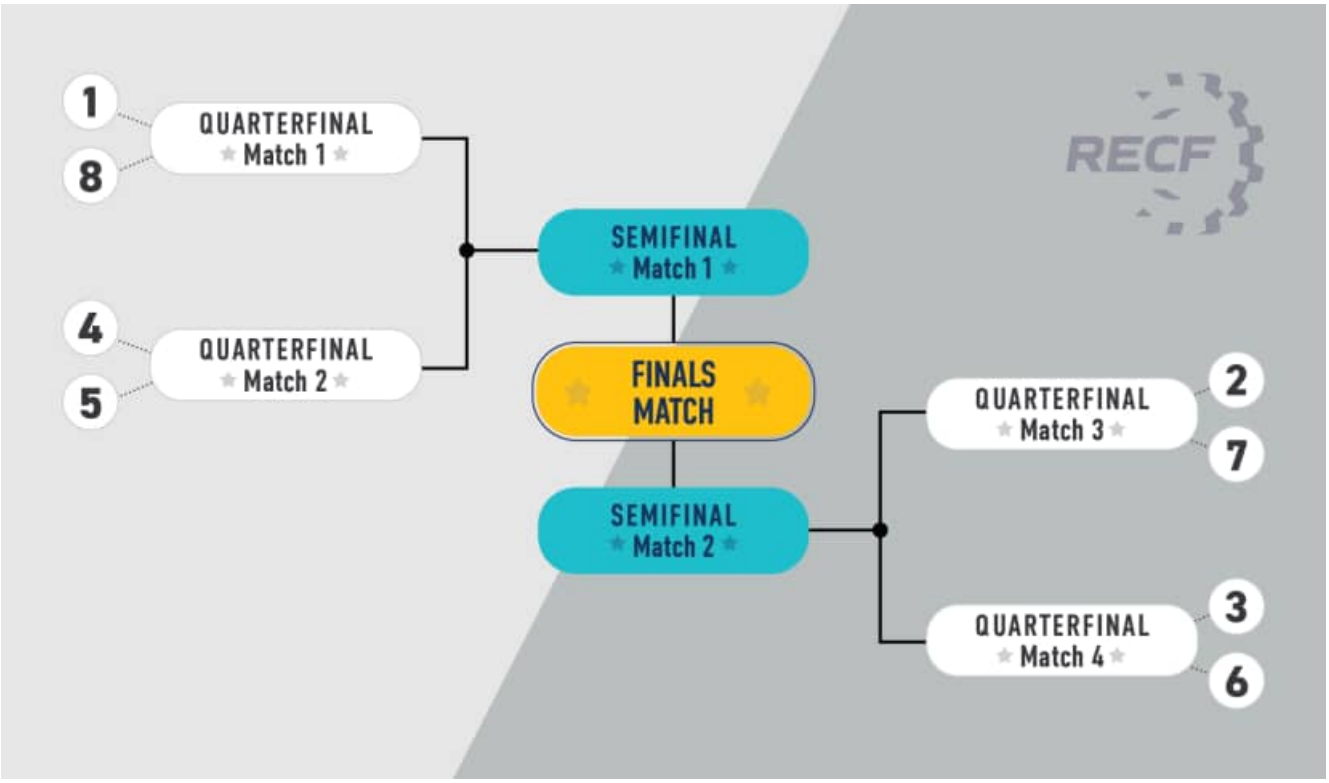

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7.4.6 Finals Matches

When only two alliances remain, they will advance into the finals match(es). For local qualifying events and scrimmages,, a single finals match will determine the tournament champions. For championship and signature events, there will be up to three finals matches; an alliance has to win two matches to be crowned the tournament champions.

7.4.6 League Events

Information on how leagues qualify teams to event region championships or the RECF World Championship can be found in the ADC Qualifying Criteria.

Leagues are events that are scheduled over multiple sessions spread across several weeks, and some match parameters differ for teams competing in leagues.

- **Minimum participation:** A minimum of two alliance matches per team are required at each league session, and teams will be ranked by the number of matches played and their average scores. Teams that play in at least 60% of the sessions will be ranked higher than those who play in fewer sessions.
- **Fouls:** Because a league is considered a single tournament, all fouls and foul cards stay with the team across all league sessions. Any team that receives three or more red cards throughout sessions for a single league cannot be part of alliance selection at the league championship elimination bracket.

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