ROBOT DRONE LEAGUE

2025 Official Challenge Manual

MOONBASE

2025 MOONBASE - Official Field

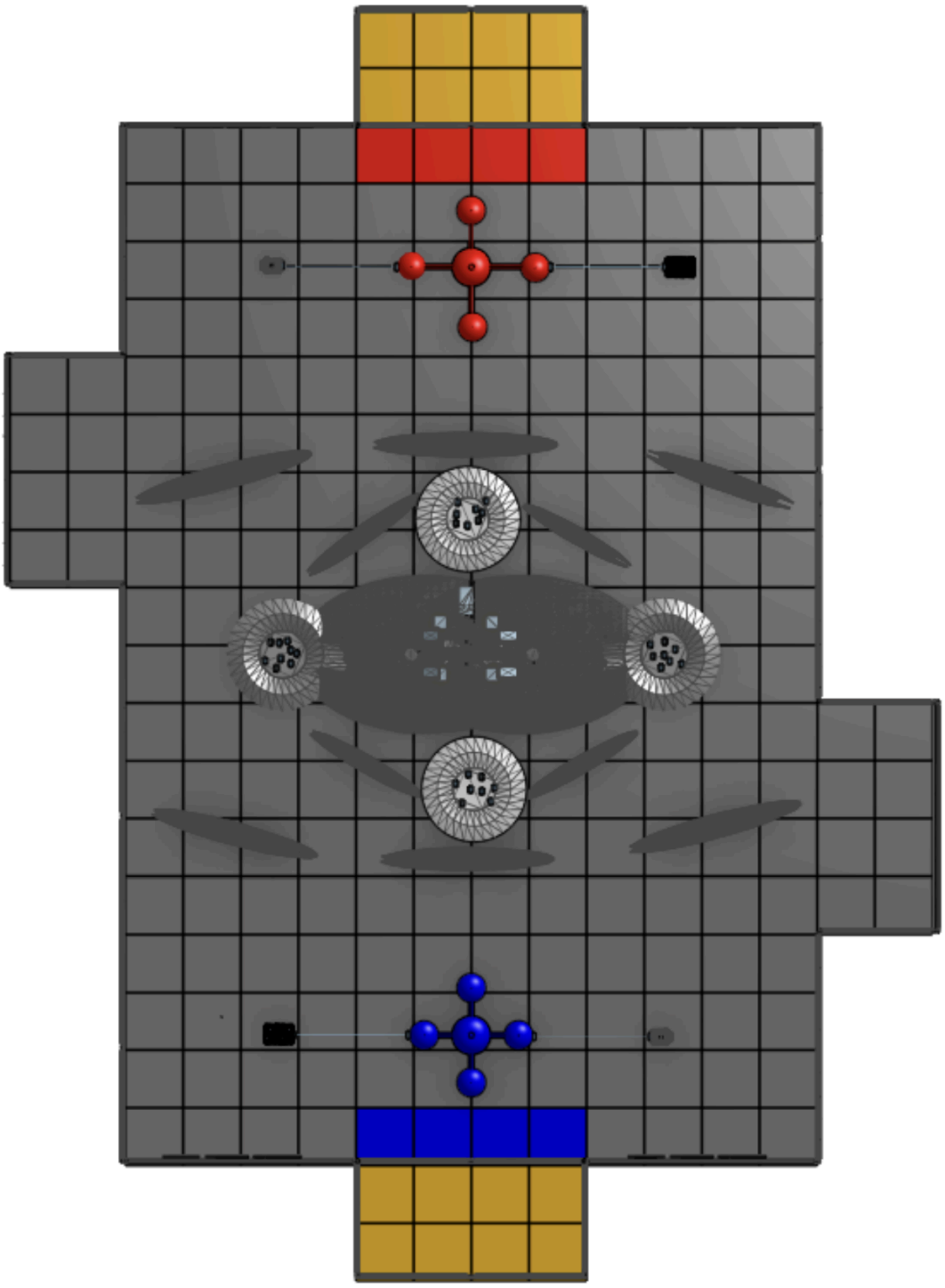

Fig. #1 RDL MOONBASE Field

Three Laws of Robotics

1. *A robot may not injure a human being or, through inaction, allow a human being to come to harm.*

2. *A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.*

3. *A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.*

~Isaac Asimov

And one more….

4. *A robot may not intentionally injure another robot unless the action or inaction conflicts with the First, Second, or Third Laws.*

~ Scooter Willis (Creator of RDL)

Sponsors

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Revisions Date	Page	Notes
Change #1; 08012025	**Pg 16, 17, 19**	**Task #5 and #6 Score tabulations, autonomous and teleop**

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Introduction

Creativity and innovation are key elements to advancing the fields of science, technology, engineering, and mathematics (STEM) into the future. Robot Drone League (RDL) has been designed to provide students with open-ended challenges that allow for creation and innovation by engaging in hands-on design, engineering, and programming of interactive robots and drones. Students are presented with the opportunity to develop real-world connections to classroom learning. Working with robots in a collaborative game format can be a very powerful tool to engage students and enhance math and science skills through hands-on, student-centered learning. Through participation in RDL, students can develop the essential life skills of teamwork and collaboration, as well as critical thinking, project management, and communication required to become the next generation of innovators and problem-solvers in our global society. The 2025 RDL "MOONBASE" Challenge, presented by STREAMWORKS, is designed to inspire students to develop a lifelong passion for learning and pursuing educational and career opportunities in STEM fields by implementing real-world STEM-related problems that require innovative and critical thinking to find solutions.

For additional information, please contact:

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STREAMWORKS

Challenge Overview

RDL 2025 Challenge: MOONBASE

Establishing the Next Frontier

Dear Robot Drone League Competitors,

Welcome to the 2025 Robot Drone League Challenge: MOONBASE! This year's competition is inspired by one of the most ambitious missions in human history—the Artemis program. NASA is leading the charge to return humans to the Moon, not just to visit, but to stay. Through Artemis, astronauts will establish a permanent lunar presence that will serve as the foundation for future space exploration, including the ultimate goal: Mars.

Your challenge this season will simulate key mission tasks required to establish and sustain a functional lunar base. In the near future, Artemis astronauts will live and work on the Moon, conducting groundbreaking research, harvesting lunar resources, and testing technologies essential for deep space travel. Your team will step into their boots—using robots and drones to complete critical MOONBASE operations in a simulated lunar environment.

The Artemis Connection

NASA's Artemis program is not just about reaching the Moon—it's about staying. The lessons learned from Artemis will pave the way for future human missions to Mars, creating a blueprint for sustainable space exploration. The Gateway station, orbiting the Moon, will serve as a critical hub for lunar operations, and your challenge will include drone and robotic tasks tied directly to Gateway's functionality.

Your Mission Starts Now!

It's time to test your engineering, teamwork, and problem-solving skills. Just like NASA's Artemis engineers, you'll need to design, build, and refine your robotic and drone systems to accomplish mission-critical tasks in this simulated lunar environment. The future of space exploration depends on innovation, precision, and collaboration—qualities that will define your team's success.

We challenge you to push the limits of technology and strategy as we take one small step for RDL… and one giant leap for the future of space robotics.

Good luck, teams! The MOONBASE challenge begins now!

Sincerely,

Dennis M. Courtney

Dennis Courtney
Executive Producer RDL | RDL Jr.
CEO STREAMWORKS Education

Game Rules

Object of the Game

The object of the game is to successfully complete as many of these tasks as possible within a ten-minute match, with the first sixty seconds being the autonomous period. RDL - MOONBASE is played on a 7.3 m by 11.0 m indoor enclosed field, surrounded and separated into equal halves by a combination of game elements designed for the current RDL challenge. The two field sides are mirror images of each other. Two teams make up an alliance, and compete against two other teams, making up an opposing alliance. The goal: score higher than the opposing alliance. In the last two minutes of the match, all game elements are considered neutral, meaning teams are allowed to cross the field into the opposing alliance side and score elements once brought to the alliance side.

Alliances & Matches

Alliance Selection and Point System:

- There will be two alliances competing against each other: the Red Alliance and the Blue Alliance.
- Each alliance will consist of two teams. The teams will be assigned to alliances after random selection at the start of the competition, during round-robin matches, alliances will change.
- The competition will consist of several matches, with each alliance competing against another alliance.
- After the initial qualification matches, the top-ranked teams with the highest **cumulative match scores** will be allowed to select an alliance partner from the top teams ranked in order. The team with the highest alliance score (based on qualification scores) will be chosen to select first, followed by the team with the second-highest alliance score, and so on. Top teams must select alliance partners outside of the top ranked teams for an established number that will provide an equal amount of matches for finals play. For example, the number #1 ranked team may select the #9 ranked teams as their alliance partner for finals.

- Once all teams have been assigned to alliances, the alliances will compete against each other in an elimination-style tournament.

- Points will be awarded to each alliance based on their performance in each round.

- After the completion of each match, the winning alliance will continue on in the tournament, with the losing alliance (both teams) being eliminated from the bracket.

- At the end of the tournament, there will remain one undefeated alliance that will be announced “RDL Alliance Champions”

MOONBASE Mission Tasks

To support this mission, your team's robot and drone systems must work together to:

🚀 Deploy and Assemble Base Structures – Simulate the deployment of essential lunar habitats, solar power arrays, and communications structures.

🔬 Conduct Science and Resource Exploration – Use robotic and drone technologies to explore for critical lunar resources like ice deposits, which can be converted into oxygen and rocket fuel.

⚡ Maintain Lunar Operations – Perform tasks like solar panel alignment, communications relay setup, and equipment repair in a harsh, low-gravity, and radiation-exposed environment.

🆘 Emergency Supply Delivery – Deliver medical kits and emergency water container pods from the Lunar Gateway to the MOONBASE, ensuring the safety of future astronauts.

🏗️ Lunar Gateway Docking & Payload Transfer – Your drones will interact with sensors (photoelectric or ultrasonic) to activate supply dispensers, demonstrating precision piloting for real-world lunar logistics during the alliance competition. Iindividual teams may also be eligible for awards based on their performance in specific tasks or objectives.

Mission Task #1 : "Assemble MOONBASE Habitat Modules" - **700** Maximum Points Assigned Mission Task - program or operate a robot that can assemble MOONBASE modules designed for science experiments, crew habitats, and mission operations. There are four small exterior modules and one large primary interior module known as the main Biosphere Module.

Specific requirements for the mission include:

1. Biosphere Module (Large) - The robot or drone must have the capability to position and place with precision, the large habitat module at the marked location on the challenge field.
   Autonomous Period + 100 Points
   Teleop Period + 50 Points
   No partial points awarded for partial placement

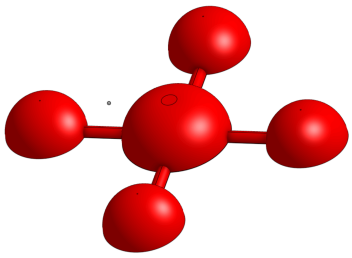

Fig. #2 Biosphere

2. Exterior Biosphere Modules (Smalls) - The robot or drone must have the capability to position and place, with precision, the smaller habitat modules at the marked locations on the challenge field.
   Autonomous Period + 50 Points
   Teleop Period + 25 Points

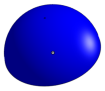

Fig. #3 Small Biosphere

   No partial points awarded for partial placement

3. Solar panels array - The robot or drone must have the capability to position and place, with precision, six individual solar panel pieces at the marked locations on the challenge field.
   Autonomous Period + 50 Points
   Teleop Period + 25 Points
   No partial points awarded for partial placement

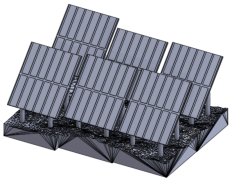

Fig. #4 Ground Solar Panels

4. Communications Satellite - The robot or drone must have the capability to calculate the azimuth, with precision, the communications satellite dish angle on the challenge field. A predetermined satellite dish angle of alignment will need to be calculated (QR code) and the adjusted angle cited prior to communications operations. A successful alignment will illuminate a green LED signal.
   Autonomous Period +100 Points
   Teleop Period + 50 Points
   No partial points awarded for partial placement

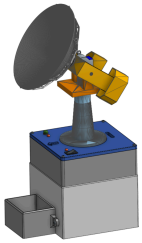

Fig. #5 Communications Satellite

Mission Task #2 : "Establish Electrical Power and Secure Communications Link" - **500** Maximum Points

Assigned Mission Task - program or operate a robot that can connect the power cable from the solar panel array to the MOONBASE Biosphere modules and connect the communications satellite link cable to the Biosphere connection point.

Specific requirements for the mission include:

1. Solar Panels Array Connector - The robot or drone must have the capability to attach with precision, the electrical

power connector located at the solar panel array to the main biosphere connection point at MOONBASE. These connections are magnetic and will automatically connect when within close proximity. A successful connection will complete the circuit and lighting within the biosphere structures will illuminate.

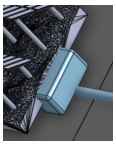

Fig. #6 Solar Array Connector

Autonomous Period + 150 Points
Teleop Period + 75 Points

2. Communications Satellite Connector - The robot or drone must have the capability to attach with precision, the communications link cable connector located at the communications satellite base to the main biosphere communications link connection point at MOONBASE. These connections are magnetic and will automatically connect within close proximity. A successful connection will complete the circuit and lighting within the biosphere structures will illuminate.

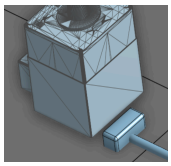

Fig.#7 Satellite Connector

Autonomous Period + 150 Points
Teleop Period + 75 Points

   a. Communications Satellite Encryption - The robot or drone must
   b. have the capability to insert with precision, the encrypted communications microchip into the base cartridge holder located at the communications satellite base. The unencrypted microchips are available at the alliance driver station prior to the
   c. start of all matches and must be encrypted prior to insertion into satellite cartridges. For a successful microchip encryption process, review the “Gateway Lunar Orbiter” mission tasks.

Fig. #8 Microchip

Autonomous Period + 200 Points
Teleop Period + 100 Points
No partial points awarded for partial placement

Mission Task #3 : "Aerial Survey and Exploration Site Marking" - **600** Maximum Points
Assigned Mission Task - program or operate a drone that can accurately fly an intended route.

Specific requirements for the mission include:

1. Aerial Survey - Both alliance drones have an opportunity to perform an aerial survey of the challenge field, on a specific course by which specific waypoints and invisible vertical planes are intersected by the flight path. See depicted waypoint markers in the below figure, The path is a rectangular 2 row grid pattern that must pass specific waypoint checks within the alliance challenge field. An altitude of 6 - 8 ft must be maintained throughout the entire flight.
   Autonomous Period + 200 Points
   Teleop Period + 50 Points

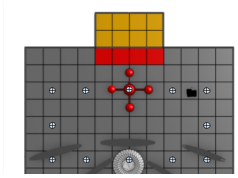

Fig. #9 Waypoints

2. Site Marking - The robot or drone must have the capability to position and place, with precision, two alliance markers at indiscriminate locations within alliance crater regions. Actual drop zones are blind to human observation.
   Autonomous Period + 200 Points (per marker)
   Teleop Period + 50 Points (per marker)

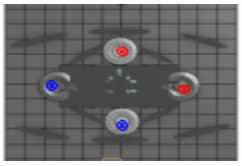

Fig. #10 Site Markers

Mission Task #4 : "Sensor / Tool Deployment" - **800** Maximum Points
Assigned Mission Task - program or operate a robot or drone that can accurately deploy a sensor and a tool.

Specific requirements for the mission include:

1. Sensor Deployment - The robot or drone must have the capability to position and place, with precision, two key sensors (diameter ?, weight ?) within alliance crater regions. Actual deployment points are blind to human observation. Bonus points for sensor devices placed in contact and on site markers previously deployed in previous mission tasks.
   Autonomous Period + 200 Points (each sensor)
   Teleop Period + 50 Points (each sensor)

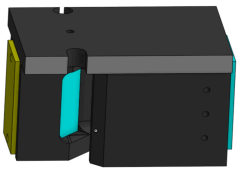

Fig. 11 Mass Spectrometer

2. Tool Deployment - The robot or drone must have the

capability to position and place, with precision, two specific drilling tools within alliance crater regions.
Actual deployment points are blind to human observation.
Bonus points for tool devices placed in contact and on site markers previously deployed in previous mission tasks.
Autonomous Period + 200 Points (each tool)
Teleop Period + 50 Points (each tool)

Fig. 12 Space Drill

Mission Task #5 : "Crater Mining and Lunar Cavern Exploration" - **7,300** Maximum Points
Assigned Mission Task - program or operate a robot or drone that can extract, collect, and return game elements to the alliance driver stations.

Specific requirements for the mission include:

1. Ice - The robot or drone must have the capability to extract, collect, and return ice game elements, qty 20 per alliance field (Diameter 71.89 mm) to the scoring zones of the assigned alliance station. Bonus points awarded to teams collecting ice elements and depositing into three reservoirs located at the alliance station, achieving specific threshold quantities in each container.
   Autonomous Period + 50 Points (each element)
   Teleop Period + 10 Points (each element)

   Bonus points for reaching fill lines:
   H2O - **500 pts**
   O2 - **500 pts**
   RP1 - **500 pts**

Fig.#13 Ice

2. Titanium Moon Rocks - The robot or drone must have the capability to extract, collect, and return titanium moon rock game elements, qty 10 per alliance field (asymmetrical diameter approximately 7.6 cm (L) x 6.35 cm (H) x 5.8 cm (W) to the scoring zones of the assigned alliance station.
   Autonomous Period +300 Points (each element)
   Teleop Period +50 Points (each element)

Fig. #14 Titanium Moon Rock

3. Helium - The robot or drone must have the capability to extract, collect, and return helium game elements two per alliance field (diameter 22.1 cm, weight ?) to the scoring zones of the assigned alliance station.
   Autonomous Period +400 Points (each element
   Teleop Period + 200 Points (each element)

Fig. #15 Helium Tank

4. Gold - The robot or drone must have the capability to extract, collect, and return gold game elements, qty one element per alliance field (diameter 57 mm, weight 168 grams) to the scoring zones of the assigned alliance station.
   Autonomous Period +1000 Points (each element)
   Teleop Period + 500 Points (each element)

Fig. #16 Gold

Mission Task #6 : "Lunar Gateway Spacecraft" (LGS) - **1,100** Maximum Points
Assigned Mission Task - program or operate a robot or drone that can inspect, activate, collect, and return game elements to the alliance driver stations.

Specific requirements for the mission include:

1. LGS Solar Panels - The drone must perform a visual inspection and determine if any specific solar tiles are damaged on the spacecraft.
   Autonomous Period + 200 Points
   Teleop Period + 100 Points

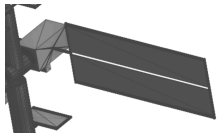

Fig. #17 LGS Solar Panel

2. Docking - The drone must land successfully on the alliance docking station (53.3 x 53.3 cm) and ensure a full stop on all motors is executed for a minimum of 5 seconds. Each alliance drone may dock a maximum of 5 times per match..
   Autonomous Period + 300 Points
   Teleop Period + 50 Points

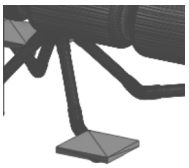

Fig. #18 LGS Docking Platform

3. Encryption - If a drone is equipped with a microchip to be installed in the communications satellite, the encryption process will start automatically upon motor shutdown on the LGS landing dock. A successful encryption will result in a

green LED illumination on the block near the back of the landing platform. Encryption normally takes approximately 30 seconds to complete.
Autonomous Period + 300 Points
Teleop Period + 50 Points

4. Emergency Supply Pods - The drone must activate the emergency supply pods for H2O and Medical Supplies by flying in close proximity to the sensor located at a designated location on the LGS. Drones are allowed to activate the release of the pods, qty 20 per alliance (diameter 40 mm, weight 2.7 grams) from the spacecraft which will free fall to the surface of the challenge field.
Autonomous Period + 300 Points
Teleop Period + 100 Points

Fig. 19 H2O / Emergency Aid

Mission Task #7 : "STEM Questions" **2,500** Maximum Points
Assigned Mission Task - program or operate a drone and utilize the camera to examine STEM questions from the display monitors located on the LGS.

1. STEM Questions - Each alliance drone is permitted to inspect and attempt solving STEM Questions, maximum of 5 questions per match.
Autonomous Period + 500 Points (each question)
Teleop Period + 100 Points (each question)

Mission Task #8: "End Game Flag"
Assigned Mission Task - In collaboration with the assigned match partner alliance, complete all assigned mission tasks #1 through #7

Specific requirements for the mission include:

1. Flag Unfurling - The first alliance to complete all 7 mission tasks will unfurl their alliance flag.
End Game Bonus Points - 500 Points

Fig. 20 Alliance Flags

Autonomous Period

At the beginning of a 10-minute match, the first 60 seconds is considered the autonomous period. Human control of the robot or drone is not allowed. Teams are awarded points for autonomous movement of the robot or drone as depicted in the scoring table below. **NOTE: Drones and robots will not be reset during this time in the event of task failure.** Completing these tasks autonomously results in additional points during the autonomous period.

Teleop Period

Upon completion of the 60-second autonomous period, the remaining 9 minutes are considered a teleop (human control) period. Autonomous functions are not restricted during the teleop period; however, human operators will maintain hands-on control of the robot or drone during the 9-minute period. Regardless if autonomous functionality is used within the 9-minute teleop period, points are scored as teleop and no additional or bonus points awarded.

Team Organization

Teams may consist of an unlimited number of members; however, there is a limit of six players allowed in the driver's station (per team). There are designated team areas in the viewing stands as well as a designated pit area for all teams.

Lab Stations

For each alliance side, there is a designated area for interaction between human players and robots called the lab station. The lab floor is identified by the yellow mats both in the lab and adjacent to the perimeter of the lab. Each team needs to assign a lab technician who is responsible for accepting elements and identifying samples (for a total of two lab technicians per alliance side). Robots and drones either deploy from or bring collected elements to the lab station, where the lab technician can then accept or attach game items. The lab technician may retrieve these elements such as the water sample, methane sensor, etc. The lab technician is only permitted to touch the robot or drone when in the neutral and non-moving configuration and fully in the yellow safety zone. Lab technicians **may not** reach out into the field with anything but their arms. (Reaching in where your head crosses the lab station onto the field will constitute a yellow card. Repeated violations will constitute a red card.)

League Guidelines

League Overview

The Robot Drone League season runs from early fall through early spring . RDL is a multi-week game where a percentage of scoring elements are changed each year, and point values are adjusted to meet the requirements of the game. Teams should benefit from the guidance of teachers or mentors, with the constraint that only the students are the only ones allowed to build the robot and drone and compete. When faced with a challenging problem, students appreciate guidance on different methods the problems can be solved or solutions to improve upon an existing student-driven design.

RDL Team Showcase

Teams are **required** to submit Team Showcase Video, minimum of five (5) with a maximum of seven (7) minutes at established dates for both Regionals and Nationals. Advancing teams to the 2025 RDL Championship must submit the video in MOV. orMP4 format with applicable permissions afforded to RDL for viewing, distribution, and republication. The following naming convention should be utilized :

[RDL#team]-school=date-MOONBASE2025

In this video, teams will be expected to showcase their robot, drone, and supplemental devices (such as grippers, hooks, etc.). Apart from material aspects, teams will also be expected to discuss different things such as team funding, fundraising, community outreach, team & project management, and anything else teams feel necessary to describe the scope of accomplishments of the team for the competition season.

As an option, teams are allowed to include technical documents (less than 10 pages, i.e. engineering notebook, reports, posters), and published materials / articles to aid the RDL Team Showcase in support of the team's presentation to the judging panel.

Teams are encouraged to take a more in-depth research approach towards the RDL theme and annual challenge as it relates directly to communities, states, etc. i.e. the space mining industry, and address these issues and potential remedies / solutions in the showcase video production. In addition, your team is encouraged to share if AI was utilized to aid in the RDL challenge project and how this technology has added to the learning experience.

Engineering Notebook

An engineer's notebook is a book in which an engineer will formally document, in chronological order, all of the teams work that is associated with a specific design project. For RDL, the engineering notebook serves a unique purpose in recording the teams' actions and discoveries throughout the RDL season. The engineering notebook is required to compete in the annual RDL challenge. The engineering notebook should have your team number, team and school name on the front cover. Engineering notebooks may contain other pertinent information such as community outreach, budgets, sponsorships, mentor notes, goals, and lessons learned. Best practices for notebook recording is to ensure each team session should be recorded in writing with accurate dates and times of meetings. Team members contributing engineering notebook entries must initial all entries responsible for inclusion. Illustrations and CAD diagrams are highly suggested. Only one notebook per team shall be submitted. Teams will leave notebooks upon the judges request and may retrieve prior to the end of the competition.

Driver Station

The primary concern during any RDL event is safety. To ensure the safety of all participants and observers, safety restrictions within the driver station must be followed at all times. The number of team members allowed in the driver station during a match is limited to no more than six student participants.

Team members are not allowed to reach into the field perimeter for any reason, including the lab section access points.

Mentors are never allowed at the driver's stations during match play. All players in the driver's station must wear closed-toe shoes, as well as safety glasses. Long hair must be pulled back and secured. No loose clothing or dangling jewelry is permitted.

SAFETY GLASSES ARE MANDATORY WHEN IN THE VICINITY OF ROBOTS AND DRONES.

Starting Position

Robots and drones need to be placed in the starting position prior to beginning the match. The starting position is marked by a 122 cm x 122 cm square, colored to correspond with the alliance. There will be two different starting positions for each alliance side for each of the two teams making up the alliance. Alliances can choose to have each of their two teams deploy in the starting position in front of their respective driver station or, teams are welcome to deploy in any combination, the drones or robots

on either starting position. What matters is that the drones and robots start within a "starting position mat." Robots and drones may start with a scoring element or sensor preloaded at the base or within the rig. Alignment tools and devices are allowed onto the playing field as long as the tools pass safety inspection and do not interfere with the ability of the opposing alliance to retrieve game elements and score points.

Safety Check

The game has numerous scoring strategies which impact the design and construction of the team robots and the programming of the drones. Following the Four Laws of Robotics, safety is the primary concern for humans, robots, and drones related to inspection. Each robot and drone are required to successfully pass a safety check before competing in the tournament. To pass a safety check, robots and drones need to successfully meet the specifications defined below. If a robot or drone is not deemed safe, it is not allowed to compete. After a robot and drone have passed safety checks, teams will be given a safety card that is required to bring on deck and present to the alliance official when competing in scoring matches. **Please note that when practicing for or competing in an event, safety should always be the priority. Unsafe operations of both robots and drones can result in serious injuries in the occurrence of misuse or malfunctions.**

Robot Specifications

Robots must undergo and pass all of the following criteria in order to pass safety inspection:

- No more than 61.0 cm wide, 61.0 cm long, and 61.0 cm high (in starting configuration)
- Robots are limited to using no more than 20 amps
- Wires should be attached to the frame and/or organized in a safe and secured configuration
- Robots must have **no exposed wires**
- Robots may not use batteries greater than 12V
- All robots **must have an ON/OFF control switch, visibly labeled**
- Robots must not have sharp edges that would allow the robot to intentionally disregard any of the Four Laws of Robotics
- Hydraulic systems **are not allowed**
- Pneumatic systems, while legal, must have a pressure relief valve and be **limited to 50 PSI**

Drone Specifications

Drones must undergo and pass all of the following criteria in order to pass safety inspection:

- Must not exceed 50.0 cm diagonal length from tip of propeller to tip of propeller (Extended to fullest)

- Must not exceed 50.0 cm tall
- Drone propellers must be shrouded with protective devices

Teams can use any means of programming the drone.

When not in use or during transportation, it is advised to remove propellers to ensure safety.

Team Members

During a match, a team cannot use other participants outside of the driver station to guide robots or drones. If the team is viewed as using external participants to gain an advantage, a yellow card can be issued. If the issue persists, the team can be issued a red card. Team members are not allowed on the field during a match and must remain in the driver station or pit at all times, with the exception of the lab technician, who is in the lab station. **Under no circumstances shall a team member (including the lab technician) reach in with any body part onto the field.** The only human interaction with robots is to be from the lab technician and is limited to the safety zone (orange mats). If the robot or drone is not working, an RDL official will place the robot or drone into the lab area for the team to work on. Team members who violate the field access rules are awarded a penalty card at the discretion of the RDL official.

Team Pits

Teams are assigned a designated space during the competition which is referred to as the "Pit Area". Robot and drone testing operations are not allowed in these areas. A designated area for testing and practice will be made available. For specifics on safe testing practices, consult with the regional event coordinator.

Match Scoring

Each team is recommended to designate a scoring captain. The scoring captain is responsible for keeping track of the team's points during the match. If a scoring captain sees a possible error after an RDL official has calculated the final scores for both teams, the scoring captain may challenge the scoring with two different RDL officials. The two RDL officials will reconsider the team's score. Scoring captains will need to present evidence for any scores to be reconsidered, including, but not limited to, video evidence. Any adults affiliated with the team, to include the lead coach or mentor, must not interfere and / or be involved with the scoring challenge process.

Match Setup & Field Reset

Before each match, teams have five minutes to set up the robot and drone. Teams also have a five-minute breakdown period after each match. After each match, RDL officials will reset the field. This reset period lasts approximately five minutes. During this time, teams are required to remove their robots and drones from the field.

Penalties

Definitions

Yellow cards serve as warnings to teams. Red cards result in a fifty (50) point deduction from a team's score **for each occurrence**. Three consecutive red cards constitute the team to whom the red card was issued to forfeit the following match, unless it is the final match for that team wherein that match will be forfeited in its entirety. An individual team member may receive a yellow / red card for intentional and / or repeated safety violations or poor sportsmanship.

1. Following the intent of the Four Laws of Robotics, a robot or a drone may not purposely harm another robot, unless that somehow violates the First Law related to the safety of a human. The field is large, and it is expected that robots from each team might come in proximity to each other. Robots should not intentionally contact another robot to play defense or prevent the other robot from accomplishing a task.
2. Purposely blocking a robot or a drone with another robot to prevent scoring or movement of the robot results in a yellow card.
3. Drones that intentionally crash into a robot as a way to prevent scoring result in a red card for the offending drone pilot. Drones that purposely crash into an opposing robot are not eligible to be rescued during the match. (RDL Officials reserve the right to constitute what is intentional vs. accidental crashing.)
4. If a drone collision occurs, pilots are awarded a yellow card. If, in the opinion of a referee, a drone intentionally crashed into another drone or did not show clear intent to avoid a collision, a red card can be issued for the offending drone's pilot.
5. Intentional electronic interference with a team's robot or drone control systems is cause for immediate event disqualification and permanent ban from future RDL events. Electronic interference is caused by operating robots and drones in close proximity to the field of play. Robots and drones powering up are only allowed in designated practice areas or under the supervision of a RDL official.

Yellow Card

A yellow card serves as a warning for robot or drone behavior that is not in the spirit of the Robot Drone League. Any yellow card that is issued can be reviewed by league officials at the end of the match to determine if the actions of the robot under the control of the driver were intentional to gain an advantage and disregard rules. If the league officials determine that the rule violation was intentional, it can become a red card.

Red Card

A red card issued for poor robot or drone behavior will result in the designated driver's absence in the next match, as well as a fifty (50) point deduction from the offending team's final score. The driver is allowed in the driver's station during the next match. A drone that is awarded a red card requires that the pilot of the drone sit out the following match.

Excessive Mentorship

Mentoring is essential in everything, especially robotics. That said, STREAMWORKS values the sound learning principles of project-based learning and self-directed discovery as it pertains to STEM learning and career interest. It is very simple, teach your students the fundamentals and then get out of the way!

During an RDL event, if mentors, parents, or any adults are seen by an RDL Official or Judge actively working on a team's robot, this will result in a verbal warning from the competition director, possible team disqualification from competition matches and forfeit of any awards related to the competition matches or design of the robots. Additionally, if judges/officials have a suspicion of excessive mentorship which has affected the outcome of the design of the robot, the judges/officials have the right to conduct an investigation into a more thorough understanding of the team's knowledge of their own robot.

Video Replay

If video-captured evidence, by RDL, clearly shows that a yellow card or red card should not have been issued, a team can appeal to the head referee to have the penalty overturned. If in the opinion of RDL officials, the video shows clear evidence that the penalty should not have been awarded, the penalty is removed. If RDL officials conclude the appeal had no merit and the video does not provide any evidence that the penalty should be reversed, an additional yellow card can be issued.

The 2025 RDL MOONBASE game is designed to be a challenging and fun game. In the interest of fairness and clarity, rules may need clarification or additional rules added during the season.

Awards

Professors Champions Award – Awarded to the top team that encompasses the overall best in competition, both on and off the challenge field. Criteria that is weighted in this award pertains to how a team demonstrates the best of community through outreach that helps to promote STEM learning in an individual community. Submission for this award must include specific elements of the community effort and evidenced in the Team Showcase Video. Pictures, articles, and letters of appreciation or acknowledgment are recommended for serious consideration of the award. An engineering notebook and team Showcase video is required for award consideration.

The following factors are taken into consideration for this prestigious award:

Challenge Field Scores

Engineering Design

Team Showcase Presentation

Community Outreach

Tournament Professionalism

Collaborative Spirit

Top Score Award – Awarded to the 1st place team based solely on scores finalized at the end of the challenge field play. An engineering notebook is required for award consideration.

Alliance Champions Award – Awarded to the winning alliance based solely on scores finalized at the end of the challenge field play. A second place alliance award goes to the runner up alliance in the overall finals. An engineering notebook and team Showcase video is required for award consideration.

Engineering Award – Awarded to the team that best demonstrates innovation in design and provides best evidence of documented engineering practices to a panel of SME professionals. An engineering notebook and team Showcase video is required for award consideration.

Judges Award* – Awarded to the team that best demonstrates team grit and tenacity no matter the scoreboard. *Note* (This award is optional and awarded at the discretion of the Head Judge).*

Top Dog Award – Awarded to the team demonstrating the highest competition autonomous scores. An engineering notebook and team Showcase video is required for award consideration.

Top Rookie Award – Awarded to the best of the best Rookie team competing in their first RDL season. An engineering notebook and team Showcase video is required for award consideration.

Scoring rubrics can be found online at www.robotdroneleague.com

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Sample STEM Questions

1) Calculate the amount, in g, of Copper Sulphate produced when 5g of Copper Oxide is reacted with 20 ml of 0.5M of Sulphuric acid.
CuO + H_2SO4 --> $CuSO_4$ + H2O

2) Fluid pressure is always directed?

    a. Up
    b. Down
    c. Sideways
    d. In All Directions

3) It costs $\$\mathbf{2.5}$ MUSD to make each AUV and $\$\mathbf{1.75}$ MUSD to make each drone for exploration on Titan. Which equation represents the cost, $\boldsymbol{C}$, of making $\boldsymbol{x}$ UAVs and $\boldsymbol{y}$ drones?

    A $C = 1.75x - 2.50y$
    B $C = 1.75x + 2.50y$
    C $C = 2.50x - 1.75y$
    D $C = 2.50x + 1.75y$

4) Which best describes an angle?

    A two distinct rays that originate from a common point
    B two parallel lines on a plane
    C the set of all points equidistant from a particular point
    D a line with a starting point that extends to infinity

Sample STEM Questions cont.

1) A magazine reports that a robot sent to Mars drilled on the surface to collect rock samples. What kind of technological instrument is the robot?

   A satellite
   B space observatory
   C space probe
   D spectroscope

2) How do greenhouse gasses in Earth's atmosphere interact with heat from the Sun?

   A. Greenhouse gasses block heat from the Sun by forming clouds.
   B. Greenhouse gasses use heat from the Sun to generate light.
   C. Greenhouse gasses decrease the amount of heat created from the Sun.
   D. Greenhouse gasses trap some of the heat from the Sun.

3) What is the product of $\mathbf{14.7} \times \mathbf{5}.\ \mathbf{32}$?

   A 7.8204
   B 78.204
   C 782.04
   D 7,820.4

4) What is the value of 63 − 12p when p = 2?

   A 12
   B 24
   C 192
   D 202

Robot Drone League Standards Alignment

For a complete listing of state curriculum standards and alignment with the Robot Drone League annual STEM challenge, please visit RDL Curriculum Standards.

Don't see your state curriculum alignment standards?
Email us at dcourtney@streamworkseducation.org for additional information.