ADVANCED VERTICAL ROBOTICS

CLEAR THE BEACH

2025 GAME MANUAL

1 – Introduction

The 2025 Clear the Beach Challenge is an exciting opportunity to test your technology, teamwork, collaboration, skill sets and strategies. The AVR Competition is committed to carrying on good sportsmanship results from a disciplined effort to respect yourself, your opponents, and the officials. With that in mind, remember our standing mission statement: *"We will be gracious in both victory and defeat. We will uphold the responsibility of sportsmanship by lifting others up, demonstrating leadership and showing respect. We will pursue excellence with passion, integrity, and honor."*

Team Spirit is one of the most powerful aspects of this competition. With seven to twelve students participating in each match, there is extensive collaborative engagement required to compete in the AVR Competition challenge.

One important aspect of competing is showing your unified camaraderie by what you wear to the competition. We urge every team to design your own t-shirts which represent your school, your team and your innovative AVR design! T-shirt designs are one factor of the scoring Presentation Award (Appendix B)

This manual outlines all rules, regulations, and restrictions for this year's competition. Rulings of referees and judges will be based on this manual, but all rulings defer to the final decisions of the Head Referee and their interpretation of both the language and spirit of these rules.

Changelog

Updates to be provided as needed.

2 – Competition Overview

The AVR Competition consists of two components. During a one-day Event, a Team will participate in the "Clear the Beach Challenge" (4 matches) and a Judged Presentation to determine a combined overall score.

2.1 – Clear the Beach Challenge - Summary

After last year's hurricane, the infrastructure was repaired, but there is much more work to be done to bring the coastline back to safety and beauty. The **Clear the Beach Challenge** requires a series of strategic missions including boots on the ground, vehicles on the beach and drones in the air using new technologies,

extensive coordination and a variety of strategies to clear the debris, rescue the stranded and restore the environment.

The **Restoration Team** consists of multi-modal vehicles and ground crews to restore the coastal front and get the beach up and running. The **AVR Drone** scans the Barges and takes on the heavy lifting to deliver **Dumpsters**. The **DEXI Drone** takes on multiple roles: surveys the **Bridge** to identify **Vehicles,** scans the **Ramps** to direct the **Dumpster** locations and scans the **Beach Cabins** to rescue the stranded animals. The **Restoration Team** also includes the **RVR Skid Loader** which collects all the **Debris** (represented by a variety of colored blocks) to fill the **Dumpsters** and the **Sphero Beach Patrollers** who supervise each of the missions.

The strategy for each Match is divided into a series of Missions:

MISSION 1: PREPARATION → At the start of each Match, the Restoration Team goes into full force with three (3) Sphero Beach Patrollers and all the multi-modal vehicles (AVR Drone, DEXI Drone, RVR Skid Loader) to prepare for clearing the beach. The Sphero Beach Patrollers navigate their way through the grass maze to reach their staging points while the DEXI Drone identifies the three Vehicle Images on the mountain bridge by activating LED colors to direct the Sphero's to the correct mountain tunnels. At the same time, the RVR Skid Loader is sorting the scattered variety of debris (colored blocks) to prepare for Mission 2 and lastly the AVR Drone flies over the Mountain to scan the three Barges to prepare for airlifting the Dumpsters on the next mission.

MISSION 2: COASTAL CLEANUP → Once the one (1) minute mark is met, the shoreline cleanup begins with the DEXI Drone scanning the April Tag on one of the Ramps to activate the LED color to start. The AVR Drone collaborates with the DEXI to identify the matching April Tag on one of the Barges and once confirmed, attaches the Dumpster, flies over the mountain and delivers it to the Ramp. The corresponding-colored Sphero heads to the Ramp to inspect the worksite and approve it by activating the Ramp Switch which gives clearance for the RVR Skid Loader to start loading the matching colored-Debris up the ramp and into the Dumpster. The cleanup process continues throughout the Match and as the Dumpsters are filled, the AVR Drone can ferry them back to the Barges.

MISSION 3: CABIN CLEAROUT → Once the 3-minute mark is met, the Restoration Team can begin rescuing the animals from the Beach Cabins. The DEXI Drone identifies the stranded animals in three of the four Beach Cabins by activating LED colors to direct the corresponding-colored Sphero's to activate a Rescue Switch at each of the Cabins. Once the process is completed, all three animals are identified and safely secured by the Beach Patrol.

MISSION 4: BRING THE TEAM HOME! → For the last 1 minute of the match, the Restoration Team has the opportunity to earn extra points by having the loaded Dumpsters returned to the Barges, the Beach Patrol Sphero's returned back through the maze and the AVR, DEXI & RVR Skid Loader returned to their starting locations.

2.2 – Judged Presentation

Throughout the day of the competition, each team will have a scheduled time to deliver a presentation to the judges. Presentations will be limited to 12 minutes and consist of two parts, as described in Section 6.

## 2.3 – Callouts and/or Signaling for Mission Tasks

Volunteer referees are essential to ensuring our qualifiers and competitions run smoothly and fairly. To assist referees (who may have limited time to learn every task and scoring detail) and to help maintain fairness across all teams, competitors are asked to signal when they are beginning a task and upon completion.

For example, in this year's competition, a team might call out "DEXI scanning April Tag" so the referee knows which aircraft and where to look.

To ensure inclusivity, teams with communication impairments or other limitations may establish an alternative signaling method (like hand signals) with the Head Referee prior to their matches.

3 – Field Overview

The Infrastructure Restoration Challenge is played on a 15' wide x 14' tall x 40' long netted Field as depicted in the figures below and throughout this Game Manual.
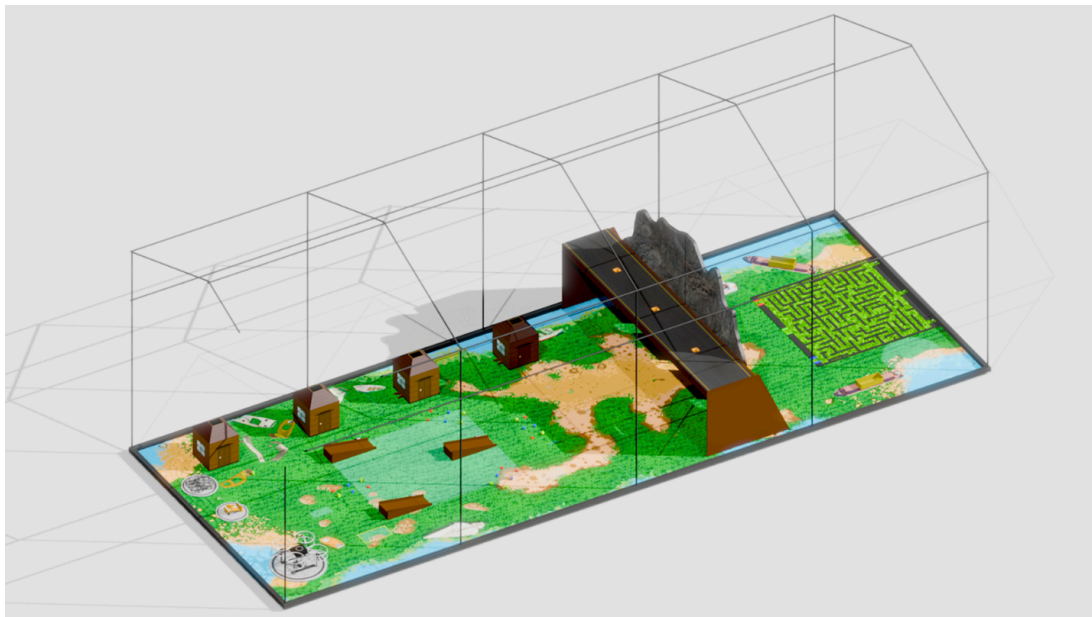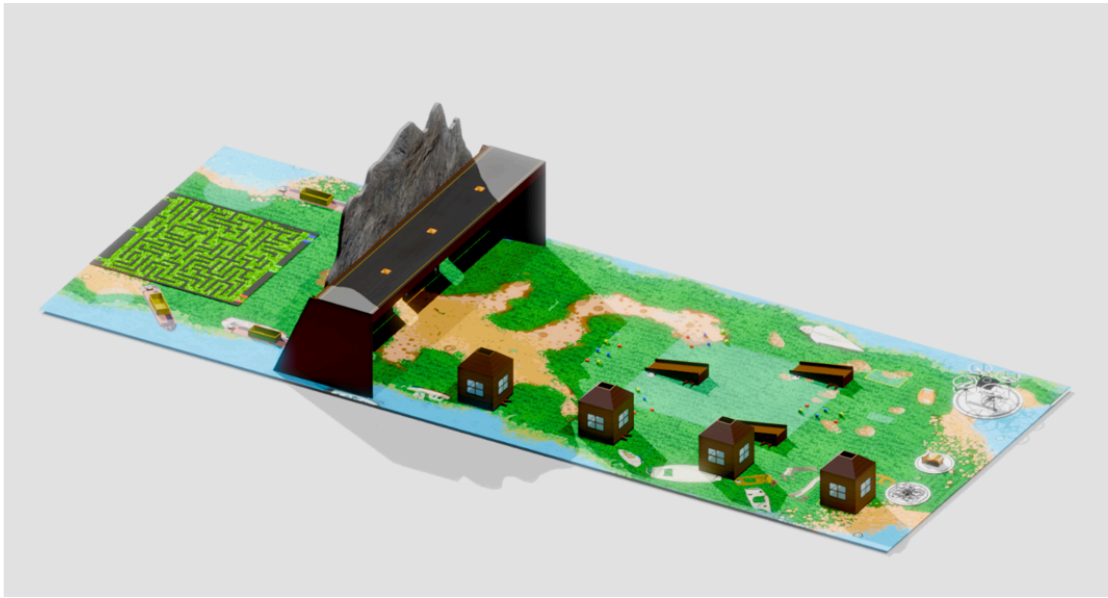
Figures 1 and 2: Isometric and top-down views of the Field.

Figure 3: Front View of the Field.

Figures 4: Back View of the Field.

4 – Definitions

4.1 – General Definitions

April Tag – A visual fiducial system popular in robotics. The April Tag is an image which will be found on each of the Barges and the Ramps that can be recognized by both the AVR Drone and the DEXI Drone. There are only three (3) types of April Tags being used for this competition. **See Figure 5**
Each of the three Barges will have different April Tags (Id:1, 2 and 3) and each of the three Ramps will have the same different April Tags (Id:1 ,2 and 3). Between every Match, the April Tags will be changed on each of the Barges and Ramps.

The use of April Tags for this year's competition is:
1. The DEXI Drone scans the April Tag on each Ramp to activate one of the DEXI LED colors (Red, Blue or Green). Each color is used to direct the team to each of the Ramps.
2. The AVR Drone scans the April Tag on each Barge to activate one of the AVR LED colors (Red, Blue or Green). **IMPORTANT NOTE:** The color identified on a Barge defines the color for the Dumpster that is on that Barge.

Figure 5: Three (3) different April Tags used to activate LED colors on the DEXI and AVR Drones needed for Mission 1 & 2.

Armed – The state of an AVR Drone's flight controller being in the "Armed" mode (i.e., Switch A is in the "down" position), which allows motors to begin spinning. **See Section 9.2.2**.

AVR Drone – The primary unmanned aerial vehicle platform which is built and operated by the Team. The AVR Drone's role is to perform the heavy lifting, delivering the Dumpsters to and from the Ramps and Barges. The AVR Drone is also used to scan April Tags to activate LED colors for communication with the DEXI Drone. To achieve these challenges the Teams will need to add these features to the AVR Drone:

- For Mission 1, Mission 2 & Mission 4, the AVR Drone must add features to be able to connect, lift, fly, land and disconnect the Dumpsters.

- In addition, the AVR Drone must be able to scan April Tags to activate LED colors (Red, Blue or Green). The LED strip must be mounted on the upper area of the Drone.

- The AVR Drone communicates with the DEXI Drone during Mission 2 by activating matching LED colors which allows the AVR Drone to deliver the Dumpster over the Mountain and on to the Ramp..

- See **Section 8** and all the details for assembling, coding and operating the AVR Drone in the Assembly Guide at theavr.org/resouces.

- **DEXI Drone** – The secondary unmanned aerial vehicle platform which is built and operated by the Team. The DEXI Drone's role is to provide Object Recognition along with scanning April Tags to activate LED colors (Red, Blue or Green). To achieve these challenges the Teams will need to add these features to the DEXI Drone:

  - For Missions 1 & 3, the DEXI Drone must be able to provide Object Recognition using Computer Vision (Visual Camera included in the DEXI kit). The Mission 1 requires the DEXI Drone to identify Vehicle Images along the Mountain Bridge and Mission 3 has Animal Images inside each of the Beach Cabins. For both missions, the Visual Camera must be mounted downward facing to identify the Vehicle and Animal Images.

  - For Mission 2, the DEXI must be able to scan April Tags to activate LED colors (Red, Blue or Green). Each color is used to match with the colored Sphero, the RVR Skid Loader pushing colored Debris Blocks and the colored Dumpster connected to the AVR Drone, all of which directs them to the Ramp.

- The DEXI Drone also communicates with the AVR Drone and the ground vehicles to complete the missions via the LED colors that the DEXI Drone signals.

- See all the details for assembling, coding and operating the DEXI Drone in the build guide at theavr.org/resouces

Disqualification – A penalty applied to a Team for a rule violation. A Team that receives a Disqualification receives zero points for the Match in question. At the Head Referee's discretion, repeated Violations and/or Disqualifications for a single Team may lead to its Disqualification for the entire tournament.

Drive Team Member – A Student who stands in the Driver Station during a Match.

Driver Station – The area next to the Field where Drive Team Members may stand during a Match. See Figure 6.
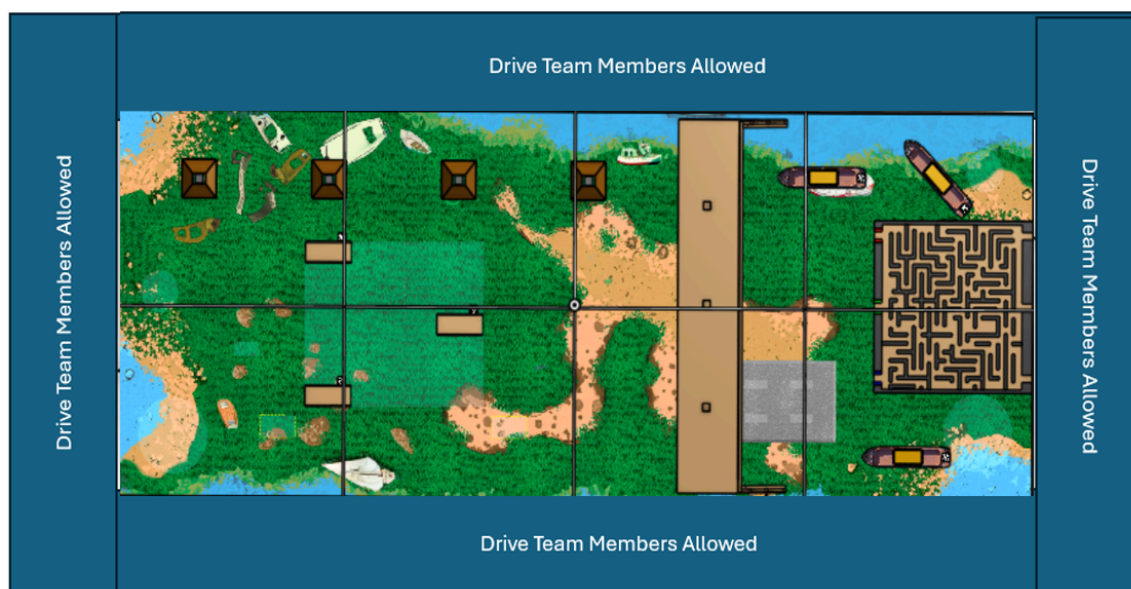
Figure 6: A top-down view of the Field, with the blue highlighted area showing where the Team Drivers are allowed during a Match.

Event Coordinator – The overall manager for the volunteers, venue, event management, and other event considerations. The Event Coordinator does not interpret rules for the teams, but may be consulted by the Head Referee at the Head Referee's discretion.

Flight Controller (FC) - The AVR Drone's Pixhawk 6C that includes onboard sensors to report the movement of the drone to the Raspberry Pi Companion Computer, interfaces with the Drive Team Member's transmitter via the drone's receiver and controls the motor speeds via the Electronic Speed Controller (ESC). See the Assembly Guide for more Information. (theavr.org/resouces)

Head Referee – The impartial volunteer responsible for enforcing the rules in this manual as written. Head Referees are the only individuals who may discuss ruling interpretations or scoring questions with Teams at an Event.

Event – A one-day competition, consisting of Matches and judged Presentations.

Field – The entire 15' wide x 14' tall x 40' long netted space in which Teams play Matches.

Field Elements – All elements that make up the Field, including the flooring, netting, game structures and all supporting structures and accessories.

Match – A set time period during which Teams play a single round consisting of four (4) missions for the Clear the Beach Challenge during a Match Cycle.

Match Cycle – The entire time spent by a Team at the Field for a given Match. Match Cycles are ten (10) minutes long, and consist of three periods:

- Setup – 3:00 minutes
- Match – 5:00 minutes
- Reset – 2:00 minutes

Object Detection – A computer vision technique used to identify and locate objects within an image. Images are used during Mission 1 and Mission 3 as follows:

- **Vehicle Images** are mounted inside three locations along the Mountain Bridge and each Vehicle Image changes between every Match. During Mission 1, the DEXI Drone uses Object Recognition to identify each of the three (3) Vehicles. One of your programming tasks will be to use DEXI's ROS2 object recognition node to activate the appropriate LED color as follows:
  - o **Red LED for Car image**
  - o **Blue LED for Truck image**
  - o **Green LED for Motorcycle image**
- **Animal Images** are mounted inside the four Beach Cabins along the coastal front, and each Animal Image changes between every Match. During Mission 3, the DEXI Drone uses Object Recognition to identify each of the three (3) Animals. Coding on the DEXI Drone needs to be set to activate the appropriate LED color as follows:
  - o **Red LED for Dog image**
  - o **Blue LED for Cat image**
  - o **Green LED for Bird image**
- **See Figure 7**
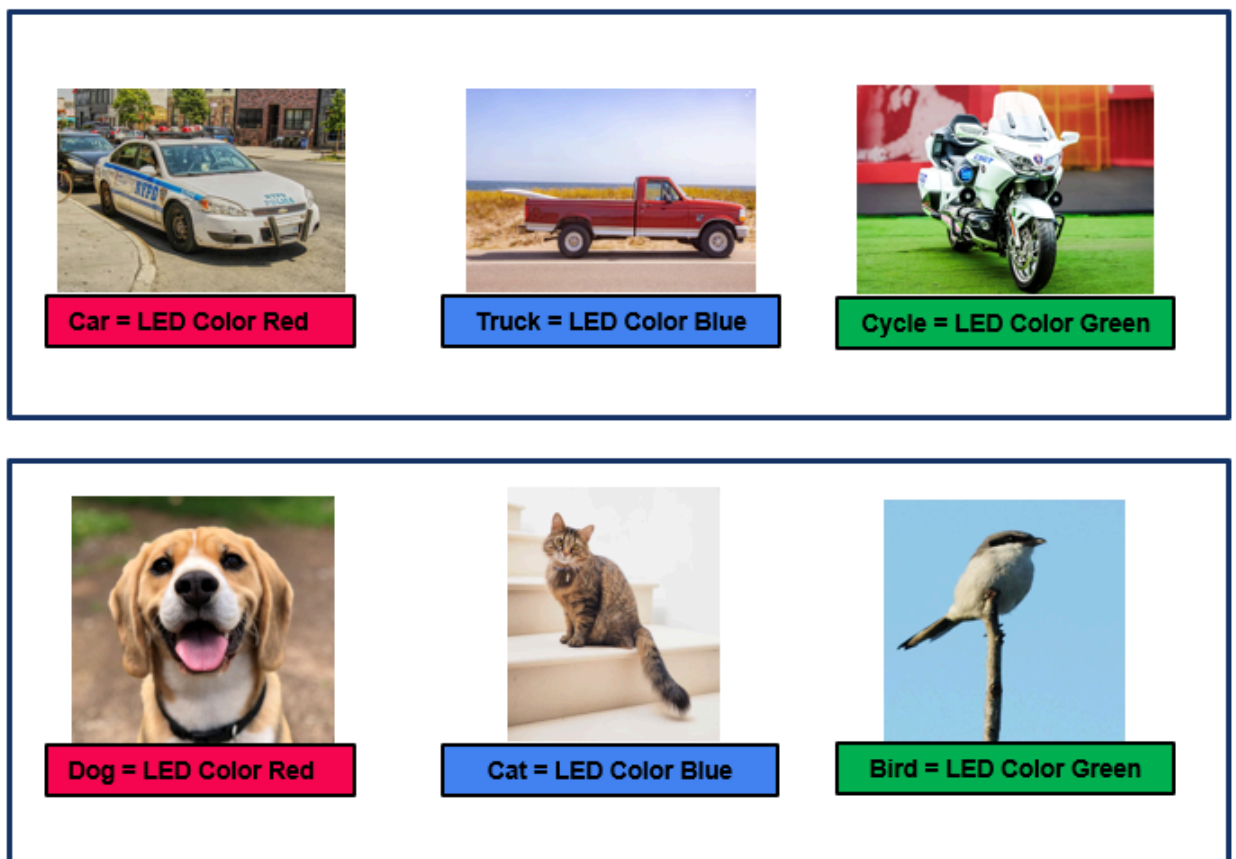
- Figure 7: Coding for six (6) different Images used to activate LED colors on the DEXI Drone needed for Mission 1 & 3.

Raspberry Pi Hat - The Pi Hat developed by the DroneBlocks team enables communication with Pixhawk, LED control, servo control, and interfacing with GPIO. The hat also includes an M.2 connector, which allows for AI acceleration and will be something AVR leverages in the future.

Restoration Team – An **AVR Drone** (heavy lifting unit), **DEXI Drone** (object recognition), **RVR Skid Loader** (ground support unit to load Debris) and **Sphero Beach Patrol** (Supervisors).

RVR Skid Loader - The RVR tracked vehicle serves as a ground support unit which loads the Debris (colored blocks) onto the Ramp and into the Dumpsters during Phase 1 & 2. Teams must custom design, fabricate and integrate a skid loader bucket or blade in order to push the Debris blocks up the ramp and into the Dumpsters during Mission 2.

Sphero Beach Patrollers – Three Sphero Minis who represent Beach Patrollers who supervise the missions and secure the worksites. *Every Team needs to make sure that you have a Red, Blue and Green Sphero.* If you have Sphero's that don't have those colors, the Team must modify the Sphero's to have Red, Blue and Green colors using spray paint, permanent markers or any other methods.

Starting and Ending Locations – The Mission 1 starting locations and Mission 4 ending locations designated on the field floor for each of the Restoration Team. See Figure 8.
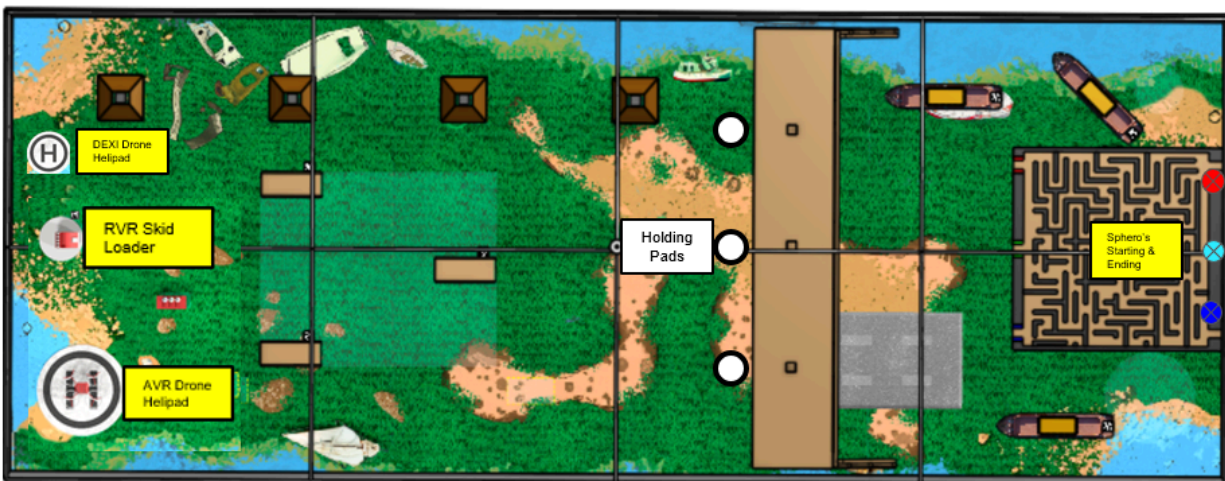

Figure 8: A view of the designated Starting and Ending Positions for all Vehicles and the Sphero Beach Patrollers

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Team – A group of students representing a single high school or club, who coordinate efforts to prepare for and participate in Matches.

Raspberry Pi Companion Computer - The AVR Drone's Raspberry Pi Companion Computer that is used to interface with external sensors, connect to the Ground Control Operator laptop, and run Team code. See the AVR Assembly Guide for more information. (theavr.org/resouces)

4.2 – Game Specific Definitions

Barge – There are three (3) Barges located on the coastal edge of the beach with a Dumpster loaded on each of the Barges to start the Match. Each Barge has an April Tag on the back deck of the Barge. When the AVR Drone scans the April Tag on the back of the Barge, the color identified on the Barge defines the color for the Dumpster.
See Figure 9

Figure 9: A view of the Barge with Dumpster loaded and April Tag on the deck.

Beach Structures – There are six (6) structures along the beach which are part of Clearing the Beach: **Maze, Barges, Mountain, Bridge, Ramps and Cabins**. See Figure 10.
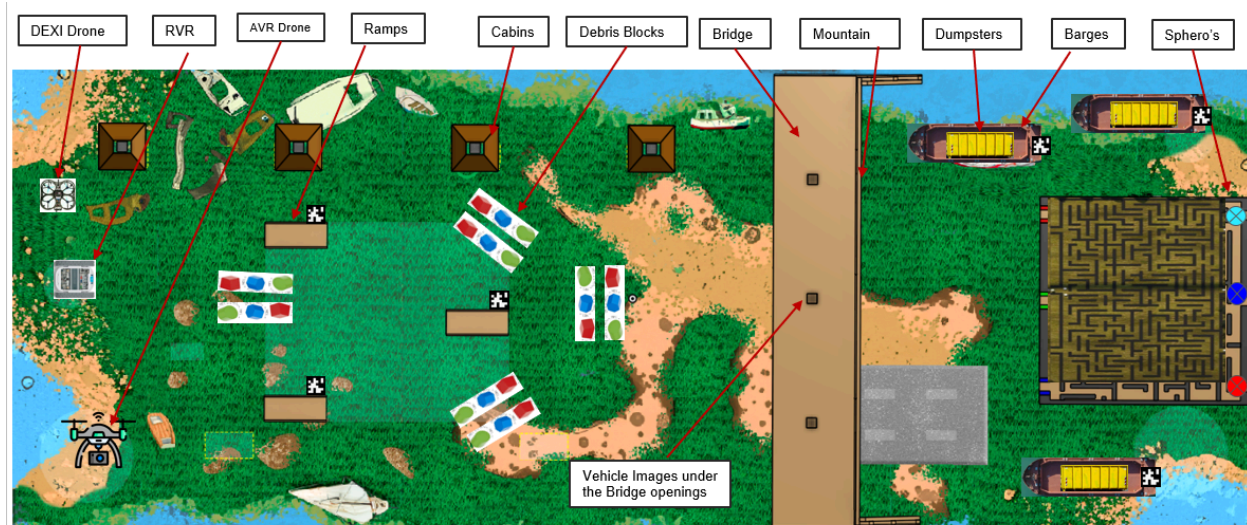

Figure 10: A view of the Field, identifying six (6) Structures -

Maze, Barges, Mountain, Bridge, Ramps and Cabins

Bridge – The Bridge is located alongside the Mountain. There are three (3) openings (4"x4") along the bridge which have **Vehicle Images** mounted inside the openings for the DEXI Drone to identify each of the three (3) Vehicles.   **See Figure 11**.

Figure 11: Downward Bridge View showing three Openings and one of the Vehicle Images

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Cabins – A series of Beach Cabins which have stranded animals inside.   Each Cabin have openings on the top of the roof which allow the DEXI Drone to access the Animal Images inside the Cabin using Object Recognition to identify three Animals inside four of the Cabins.

Debris Blocks– A variety of four colored blocks (Red, Blue, Green, White) which represent four different types of Debris which need to be cleared from the beach. The RVR Skid Loader is used to separate the Debris Blocks into separate colors to load them up the Ramps and into the Dumpster. The type, color, quantity and shape of the Debris Blocks are shown below in Figure 12. NOTE: The Colored Blocks can be purchased using the link available under '2025 Game Resources', then 'Purchase Links' at theavr.org/resources
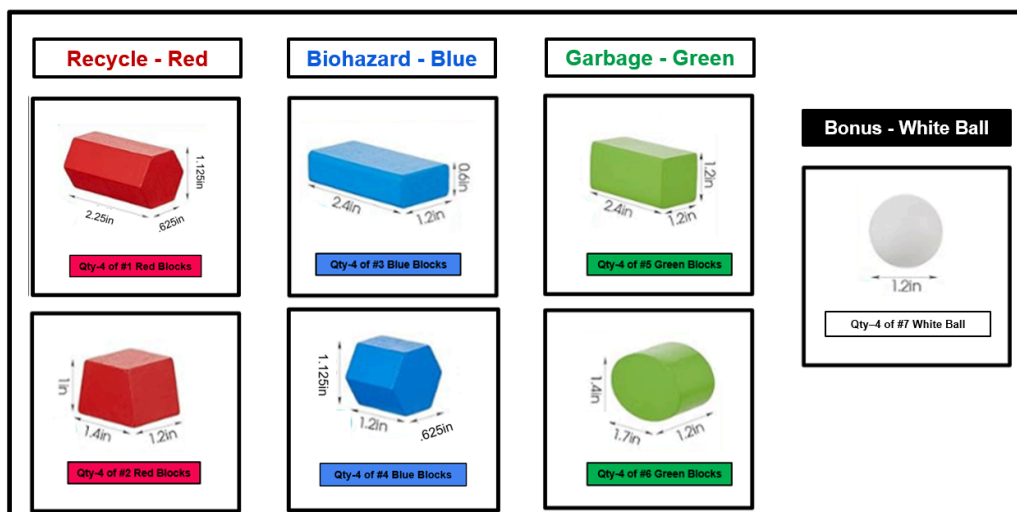

Figure 12: Variety of Debris Blocks which get cleared off the beach, up the Ramp and into the Dumpsters

Dumpster – A component of the competition which Teams are required to custom build. A total of three (3) Dumpsters are required for each team to bring to the competition. There is a 3D-Print structural frame model which Teams can use as options for their starting point for a Dumpster design. The CAD model is under '2025 Game Resources' here: theavr.org/resources

Teams are required to custom design their Dumpster with the following guidance:

1) The recommended dimensions for the Dumpsters are in the realm of 4" tall x 7" wide x 15" long. Teams need to build their own ramp for both practice and for making sure their Dumpster design, attachment mechanisms and landing gear all align properly with the ramp. The Ramp dimensions are available on the On-Shape (Appendix A) so that Teams can replicate the competition Ramp.

2) The Dumpster can be made of any material or combinations of materials (3D-Prints, balsa wood, aluminum, carbon fiber, etc.)

3) Custom design features to connect and disconnect the Dumpsters to the AVR Drone are open ended. The core structure should consider the dimensions stated above, but the additions of mechanisms, hooks, magnets, vacuums, etc. which are attached to the core structure on the AVR Drone or the Dumpster are allowed.

4) For Teams planning to pursue extra points on Mission 4 by stacking two or three Dumpsters on top of each other, the same features stated on (3) above are allowed.

5) Each of the Dumpsters built by each Team must be painted to represent your Team as a company, a school or whatever look you want to go with, but each of the three (3) Dumpsters need to look the same (as if they have a company color, name or logo on the three Dumpsters).

6) Realistic details for the Dumpster design will be considered as part of the scoring in the Best Overall Design Award (Section 10.2). See Figure 13.

Figure 13: Dumpster

Flooring – The entire ground surface within the 15ft x 40ft court which will be covered by vinyl flooring with graphics.

Helipads – A set of two defined areas for the drones to take-off and return: 1) AVR Drone Helipad, 2) DEXI Drone Helipad.   See Figure 8.

Holding Pads – Three circular pads which are located under the Bridge in front of each of the Mountain Tunnels. The Sphero's are required to park on the Holding Pad once they go through the Tunnel and wait for actions in Mission 2.   See Figure 8.

Maze –   The Maze is located behind the Mountain at the very back of the court. The Sphero Beach Patrollers start at the back of the Maze and must find their way to the exit which matches their color - Red, Blue or Green. At the beginning of each Match, the Sphero's will be placed in different starting points to provide new challenges going through the Maze.

Mountain – The Mountain separates the Beach into two subdivided lands causing a challenge to communicate between the Restoration Team. During Mission 2, the AVR Drone and the DEXI Drone require communication over the top of the Mountain to confirm the delivery path for each of the Dumpsters.

Mountain Tunnels – The three (3) tunnels along the Mountain provide a path for the three Sphero Beach Patrollers to travel through the Mountain.   The pathway for each Sphero to go through a Tunnel is determined by the DEXI Drone recognizing a Vehicle Image, activating an LED color and directing the Sphero to the correct mountain tunnel.

Parked – The desired locations for the Restoration Team at the end of the Match (for extra points). See Figure 8. To be considered Parked, a Vehicle, Dumpster or Sphero must meet the following criteria:

Vehicle	Parking Criteria
AVR & DEXI Drones	Landed and fully inside the designated Helipads
RVR Skid Loader	Fully inside Parking Spot
Dumpster	Parked inside the circumference of the Barge
Sphero Beach Patrollers	Each Sphero parked separately at any of the Maze starting locations

Ramps – The three (3) Ramps are located on the Beach in front of the Mountain. These Ramps will stay in the same location for every Match. Each Ramp has an April Tag on the side of the Ramp for the DEXI Drone to activate the LED color which identifies the Dumpster to be delivered to the Ramp. FYI - The April Tag on the side of each Ramp will be changed in between every Match.   NOTE: The Ramp dimensions are available on the On-Shape (Appendix A) so that Teams can build the Ramp for practice.

Switch Button – The Sphero Beach Patrollers activate the Ramp Switch (on the side of each Ramp) and the Rescue Switch (on the side of each Beach Cabin) by contacting the Switch Button which turns on a light. The Ramp Switches are used to signal that the RVR Skid Loader

is cleared to start loading the Blocks on to the Ramp. The Rescue Switches are used to signal that the Animal inside the Cabin is safe and secured. **See Figure 14.**
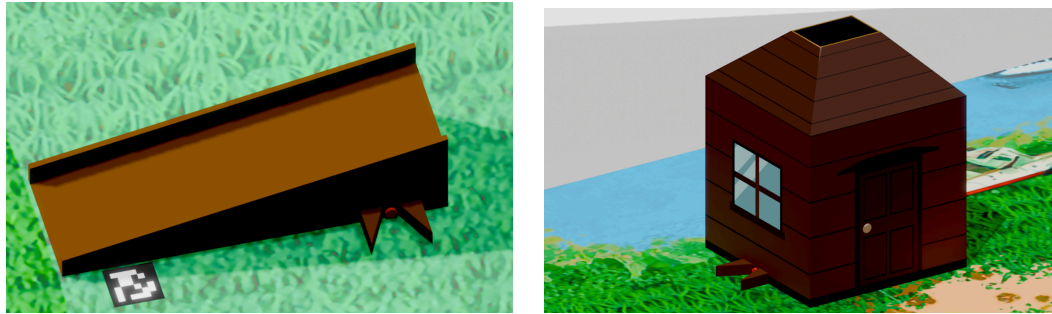

Figure 14: Sphero Beach Patroller activating a Ramp Switch and a Rescue Switch

Taxiing – The AVR Drone is allowed to taxi on the ground under specific circumstances stated in the **Gameplay Rules 5.3.4.**

5 – The Game

5.1 – Scoring

A Team's score at the end of the Match is determined by adding all of the points from Phase 1, 2, 3 and 4.

Mission 1 – Preparation Scoring	Points, Basic Operations	Points for Extra Operations
Dexi Drone - Recognizes Vehicle Images on the Bridge and Activates correct Color LED's	3 (per Correct Color LED)	N/A
AVR Drone - Scans April Tags on Barges and Activates correct Color LED's	2 (per April Tag)	N/A
Sphero Beach Patrollers - Travel thru Maze and to the correct color Exit	2 (per Sphero)	N/A
Sphero Beach Patrollers - Travel from the Maze Exit through the correct Tunnel	2 (per Sphero)	N/A

TOTAL MAX POINTS	27	0

Mission 2 – Coastal Cleanup Scoring	Points, Basic Operation	Points for Extra Operations
Dexi Drone - Scans April Tag on Ramp, Activates and Holds the correct Color LED until the AVR Drone Hovers above the Mountain with the Matching Color LED	3 (per April Tag/LED Color)	+2 extra pts for flashing LEDs for Communication
AVR Drone - Hovers above the Mountain (either with or without the Dumpster) to show the referee the matching Color LED with the DEXI Color LED	3 (per April Tag/LED Color)	+2 extra pts for flashing LEDs for Communication
AVR Drone – Attaches and Delivers correct Color Dumpster to the Matching Color Ramp. Dumpster must contact the back of the Ramp (AVR Drone Taxing is allowed)	3 (per Dumpster landing at the Ramp)	+2 (per Dumpster contacting on the back of the Ramp)
Sphero Beach Patrollers - Activate the Ramp Switch by contacting the Switch Button to turn on the light.	1 (per Sphero)	N/A
RVR Skid Loader – Moving correctly Colored Blocks up the Ramp and into the Dumpster	1 (per correct Color Block loaded into Dumpster)	N/A
RVR Skid Loader – Moving Bonus White Balls up the Ramp and into any of the Dumpsters	2 (per Bonus White Balls loaded into any Dumpster mixed with any correct Color Blocks)	+3 (per Bonus White Balls loaded INDIVIDUALLY into any Dumpster)
TOTAL MAX POINTS	62	30

Mission 3 – Cabin Clear-Out Scoring	Points, Basic Operations	Points for Auton. & Extra Operations
Dexi Drone - Recognizes Animal Images on the Cabins and Activates correct Color LED's	3 (per Correct Color LED)	N/A
Sphero Beach Patrollers - Activate the Rescue Switch by contacting the Switch Button to turn on the light.	1 (per Sphero)	N/A
TOTAL MAX POINTS	12	0

Mission 4 – Bring the Team Home Scoring	Points, Basic Operations	Points for Auton. & Extra Operations
RVR Skid Loader Parked	3	N/A
Sphero Beach Patrollers Parked separately at any of the Maze starting locations	2 (per Sphero)	N/A
DEXI Drone Parked	3	N/A
AVR Drone Parked	3	N/A
Dumpsters – Returned to any of the Barges	2 (per Dumpster – has to land inside the Barge)	+2 for 2 box stacks +4 for 3 box stacks
TOTAL MAX POINTS	**21**	**4**

MAX POINTS & MAX BONUS   **122**   **34**

GRAND TOTAL = 156

5.2 – Mission Details

5.2.1 Introduction

Each Match follows the Mission progression as follows:

MISSION 1: PREPARATION → Starts with an audible sound and after one (1) minute, ends with an audible sound. If needed, Mission 1 actions can continue throughout the remainder of the Match.

MISSION 2: COASTAL CLEANUP → Starts at the one (1) minute audible sound at the end of Mission 1, and continues for 2 minutes (3 minutes total elapsed time, ending with an audible sound). If needed, Mission 2 actions can continue throughout the remainder of the Match.

MISSION 3: CABIN CLEAN-UP → Starts at the 3 minutes audible sound and continues for one (1) minute. If needed, Mission 3 actions can continue throughout the remainder of the Match.

MISSION 4: BRING THE TEAM HOME! → If a Team has completely finished Mission 1, 2 & 3 OR at the 4 minute audible sound, points are given for the Restoration Team (AVR & DEXI Drones, RVR and Sphero Beach Patrollers) to return and park back to their starting point.

Bonus points are added during the final minute by the first Dumpster parking inside one of the Barges and the other two (2) Dumpsters are stacked on top of the first Dumpster. These bonus points continue until the end of the Match.

5.2.2 Mission 1 – Preparation (1 Minute)

- At the start of the Match, the Restoration Team - AVR Drone, DEXI Drone, RVR Skid Loader and three (3) Sphero Beach Patrollers are placed in the Starting Locations. See Figure 8.

- At the start of each Match, the Restoration Team goes into full force with the Beach Patrol navigating through the Maze, the DEXI Drone surveying the Bridge to identify vehicles, the AVR Drone crossing over the Mountain to scan the Barges and the RVR Skid Loader sorting the Debris.

At the start of Mission 1, the Restoration Team will launch into the following actions:

Sphero Beach Patrollers - Maze Actions:

    a. All three (3) of the Sphero Beach Patrollers begin at the starting point to navigate their way through the grass maze.
    b. Once the Sphero's arrive at their exit opening (Red, Blue & Green), they remain at that location until the DEXI Drone sends a signal (via the LED color displayed on the DEXI)
    c. When the DEXI signal is sent (see Bridge Action below), the Sphero's travel from the exit opening through the identified Tunnel and on to the aligned Holding Pad just past the Bridge. See Figure 8
    d. The Sphero's remain on their Holding Pads until signals are sent by the RVR Skid Loader during Mission 2.

DEXI Drone - Bridge Actions:

    a. In parallel to the Sphero actions, the DEXI Drone takes off from the DEXI Helipad to survey the Bridge.

    b. With the Visual Camera mounted downward facing, the capability for Object Recognition allows the DEXI Drone to scan the three (3) openings along the Mountain Bridge to identify the Vehicle Images.

    c. As each Vehicle Image is identified, the DEXI communicates to the Sphero's (via the LED color displayed on the DEXI) to indicate which colored Sphero should travel from the exit opening to the Tunnel and on to the Holding Pad which is aligned with the DEXI hovering.

    d. The same process is followed for the other two Vehicle Images and the two Sphero's which will travel through the identified Tunnel and on to the Holding Pads.

    e. Once the identified Vehicle Images are completed, the DEXI Drone lands on the Bridge and waits until Mission 2 begins.

AVR Drone - Barge Actions:

    a. The AVR Drone's role is to perform the heavy lifting to deliver the Dumpsters to and from the Ramp and Barges. In addition, the AVR Drone scans April Tags to activate LED colors (Red, Blue or Green).

    b. The AVR Drone takes off from the AVR Helipad to fly over the Mountain and on to the Barges to scan each of the April Tags on the back deck of the Barges.

    c. Once the AVR Drone has identified the three (3) LED colors for each of the Barges, the Pilot can land and wait to be ready to select and attach the appropriate Dumpster based on what Ramp and LED color the DEXI Drone selects at the beginning of Mission 2.

RVR Skid Loader – Debris Blocks Actions:

    a. The RVR Skid Loader begins at the Parking Spot and heads to the Debris Blocks which are scattered about the Beach. See Figure 10.

    b. During the first minute, the RVR has the opportunity to separate the different Blocks into piles of the same colored Blocks (Red, Blue, Green, White).

    c. The RVR will not know until Mission 2 which colored Blocks will be going up which Ramp and into the Dumpster, but organizing the Blocks will help with loading them in Mission 2.

NOTE: Mission 2 begins at the 1-minute marker but if needed, teams (at their discretion) will be allowed to continue Mission 1.

5.2.3 Mission 2 – Coastal Cleanup (Starts at the 1 minute mark)

- Once Mission 1 expires, the entire Restoration Team has two (2) minutes before Mission 3 begins.
- As the second mission begins, the focus shifts to cleaning the shoreline. The DEXI Drone starts the process by scanning the April Tag on one of the Ramps to activate an LED color which initiates the Teams actions during the two (2) minute mission.

At the start of Mission 2, all of the Restoration Team will launch into the following actions:

DEXI Drone - Ramp Actions:

    a. The DEXI Drone takes off from the Mountain Bridge to head to one of the Ramps.
    b. Once the DEXI scans the April Tag on a Ramp, the LED Color is activated to direct the Restoration Team to begin cleaning the Beach.
    c. The DEXI will communicate to the Restoration Team (via the LED color displayed on the DEXI) to indicate which colored Dumpster is needed at the Ramp, which color Sphero is needed at the Ramp Switch and which color Blocks are needed for the RVR Skid Loader to load up the Ramp into the Dumpster.

AVR Drone - Dumpster Actions:

    a. The AVR Drone should be located close to the Barges at the beginning of Mission 2.
    b. Once the DEXI has activated the LED color at one of the Ramps, the AVR Drone needs to select the Dumpster on the Barge which matches the DEXI LED color.
    c. Once the Dumpster is selected, the AVR Drone attaches the Dumpster, lifts off from the Barge, hovers above the Mountain, confirms with the DEXI that both drones have the same LED color turned on, flies over the Mountain and on to the Ramp to deliver the Dumpster to the Ramp.

> **NOTE 1:** To confirm that the AVR Drone (with the Dumpster attached) is cleared to fly over the Mountain to the Ramp, teams need to call out to the Referee to show that both drones are hovering above the mountain and have the same LED color turned on.
> **NOTE 2:** For additional points, Teams can program both drones to **FLASH** their matching LED color to show to the Referee a stronger communication signal. This can be triggered by April Tag detection or manually from a Node-RED Dashboard.

    d. Once the first Dumpster is delivered, the AVR Drone goes back to the Barges to repeat the process to deliver the other two Dumpsters.

Sphero Beach Patrollers - Ramp Actions:

    a. At the beginning of Mission 2, the Sphero Beach Patrollers should be parked on the Holding Pads prepared to travel to each of the Ramps.
    b. As the DEXI Drone activates the LED Color at the first Ramp the Sphero which matches that Color can leave from the Holding Pad and head to the Ramp Switch to turn on the light (signaling that the RVR can begin loading the Ramp).

c. Once the Ramp Switch light is turned on, the Sphero needs to stay parked along either side of their Ramp to wait for the Mission 3 actions.

d. Once the first Ramp logistics are covered, the DEXI Drone repeats the step (b) process for the remaining Ramps.

RVR Skid Loader – Debris Blocks Actions:

a. Once the first Ramp has the Ramp Switch turned ON, the RVR Skid Loader is cleared to start loading Debris Blocks onto the Ramp.

b. The RVR Skid Loader will have to locate the Colored Debris Blocks which match the color of the Ramp (as identified by the DEXI LED Color).   The RVR then begins pushing the Colored Debris Blocks up the Ramp and into the Dumpster.

c. Once completed for the first Ramp, the RVR moves on to the other two Ramps.

d. Note that extra points are given if the Bonus White Balls are INDIVIDUALLY loaded into any of the Dumpsters.

At the end of Mission 2:
● The DEXI Drone can move on to the Cabins for Mission 3
● The AVR Drone can begin returning the full Dumpsters back to the Barges
● The RVR Skid Loader can continue loading Debris Blocks if needed, or head back to park at the starting point.
● The Sphero Beach Patrollers stay alongside their Ramp until the Mission 3 actions start.

NOTE: Mission 3 begins at the 3 minute marker but if needed, teams (at their discretion) will be allowed to continue with Mission 2 actions in parallel with Missions 3 & 4 until the 5-minute match ends.

5.2.4 Mission 3 – Cabin Clear-Out (Starts at the 3-minute mark)

● Once the 3 minute mark is met, the Cabin Clear-Out mission has 1 minute before the Mission 4 begins.
● The goal for Mission 3 is to survey the Beach Cabins to locate any animals that are stranded inside the Cabins. The DEXI Drone goes to work to identify the Animal Images and the Sphero Beach Patrollers go to secure the stranded animals to safety.

At the start of Mission 3, the DEXI Drone and the Sphero Beach Patrollers launch into the following actions:

DEXI Drone – Beach Cabin Actions:

a. The DEXI Drone takes off from the Ramp area to head to the Beach Cabins.

b. With the capability for Object Recognition, the DEXI Drone scans the top of the roof openings on the four (4) Cabins to identify the three (3) Animal Images.

c. As each Animal Image is identified, the DEXI communicates to the Sphero's (via the LED color displayed on the DEXI) to indicate which colored Sphero should travel from their Ramp to that Beach Cabin.

d. Once the first Animal Image is confirmed, the DEXI Drone repeats the step (c) process to scan the remaining Beach Cabins.

Sphero Beach Patrollers – Beach Cabin Actions:

    a. At the beginning of Mission 3, the Sphero Beach Patrollers should be parked on either side of their Ramp and be prepared to travel to their Cabin Rescue Switch.

    b. As the DEXI Drone activates the LED Color at the first Cabin which has a stranded animal, the Sphero which matches that Color can leave from their Ramp and head to the Cabin to activate the Rescue Switch.

    c. When the Rescue Switch light is turned on, it signals that the stranded animal is safe and secured.

    d. Once the first Cabin has been taken care of, the DEXI and Sphero repeat the step (b) process to scan the remaining Beach Cabins and secure the remaining animals.

At the end of Mission 3:

- The DEXI Drone can head back to park at the DEXI Helipad
- The AVR Drone can continue returning the full Dumpsters back to the Barges, or head back to park at the starting point.
- The RVR Skid Loader can continue loading Debris Blocks if needed, or head back to park at the starting point.
- When the Sphero Beach Patrollers have completed their Cabin Rescue Switch, that Sphero can get a head start for Mission 4 by heading back to the Maze.

NOTE: After the 1 minute expires for Mission 3, teams (at their discretion) will be allowed to continue with Mission 3 – Cabin Clear-Out actions in parallel with Mission 4 until the 5-minute match ends.

5.2.5 Mission 4 – Bring the Team Home! (Starts at 4-minute mark)

For the last 1 minute of the match, the Restoration Team has several opportunities to earn points by:

- The AVR Drone returns the Dumpsters to the Barges.
- Additional bonus points are given for two or three Dumpsters to be stacked on top of each other.   The bottom Dumpster must be parked inside the circumference of the Barge but the other two Dumpsters can be located in any direction on top of the bottom Dumpster but they cannot be touching the ground. The higher the stacks, the higher the points. **NOTE:** Points for stacking Dumpsters can be with any Dumpsters even if they never left the Barge area.
- All of the Restoration Teams (AVR Drone, DEXI Drone, RVR Skid Loader and three (3) Sphero Beach Patrollers) all return to their starting point for bonus points.

NOTE: Points are only given for DEXI and AVR drones if they fly or taxi to return to their starting location (i.e. a drone can't be put into position by RVR pushing it into place). Also, RVRs and Spheros must return to their starting locations under their own power.

The Point values for each of the Mission 4 actions are defined in the 5.1 – Scoring section.

5.3 – Gameplay Rules

Accidental, momentary, or minor violations of the following rules will result in a warning. Intentional, egregious, or score-affecting violations will result in a Disqualification. Repeated warnings may escalate to a Disqualification at the Head Referee's discretion. Rules which refer to setup actions must be met in order for a Match to start.

5.3.1 Drive Team Members must stay in the Driver Station for the duration of the Match.

5.3.2 Drive Team Members may not fulfill more than one of the following roles during any given Match:
   a. Primary AVR Drone pilot – using the radio transmitter
   b. AVR Drone Ground Control Operator – using a laptop with QGroundControl and/or the AVR GUI
   c. DEXI Drone pilot – using a radio transmitter and laptop with the DroneBlocks app or Python Coding
   d. RVR Skid Loader driver – using a laptop or mobile device with the Sphero Edu app
   e. Sphero Beach Patrol drivers – using a laptop or mobile device with the Sphero Edu app

5.3.3 All Vehicles must start the beginning of the Match as designated on Figure 8. 5.3.1

5.3.4 **Dumpster Delivery Rules for Mission 2**
The point values for delivery of the Dumpsters will only be counted if the AVR Drone is "flying" with the Dumpster connected to the AVR Drone and both are "flying" above the ground.
   a. The primary trait that referees will monitor for an AVR Drone to be considered "flying" is whether any aspect of the Drone or the connected Dumpster are contacting the floor.
   b. This contact includes both the main body/landing gear of the AVR Drone, and any additional mechanisms which are attached to the Drone's airframe or the Dumpster structure.
   c. Once the AVR Drone has landed the Dumpster at the back of a Ramp, the AVR Drone pilot is allowed for Taxiing the Drone to move the Dumpster to push up against the Ramp.

6 – Presentations

6.1 – Overview

6.1.1 The presentation portion of the competition is designed to challenge Students to think critically about their lessons learned throughout the competition. The presentation will consist of a description of the team's design process and lessons learned.

6.1.2 Teams are given three minutes to set up and 12 minutes to present.
  a. The first three minutes of set up are not scored.
  b. The 12 minutes of scored time are divided into nine minutes for presentation material and three minutes for Q&A from the judges.
  c. Teams will be cut off from their presentation at nine minutes, although they may end the presentation early. Teams will be cut off again at the 12-minute mark to end the Q-and-A session.

6.1.3 It is expected that at least three students on the team speak during the presentation. Points will be deducted for less than three students taking part in the presentation portion prior to the Q&A.
  a. All members of the team, regardless of whether they are given speaking roles, must be present during the presentation.

6.1.4 Teams must bring the following to their presentation:
  a. AVR Drone, DEXI Drone, RVR Skid Loader and one of the Dumpsters
  b. Engineering Notebook (encouraged but optional for all awards except the Overall Design Award, where a notebook must be submitted.)
  c. Visual aids including PC laptop (with HDMI connection) if showing a slide presentation.
  Note: Engineering Notebooks are optional but add significant point value to the Presentation score. For Teams that have Engineering Notebooks, they are to be submitted at the beginning of the Event Day as part of Team Check-In. Judges will evaluate the notebooks during the day but will provide them back to the Team for the Presentation Session.

6.2 – Details

6.2.1 Each Team can use any visual aids they deem necessary (e.g., PowerPoint, Prezi, videos, collages, etc).
  a. Video shown during a presentation may not exceed two minutes in length.

6.2.2 For Teams keeping an Engineering Notebook, guidelines are provided in Appendix C. Usage of the Engineering Notebook during the Team presentation is encouraged.

6.2.3 The design process portion of the presentation should include any specific design process, communication/planning methods, and project management strategies used (e.g., rapid prototyping, agile, etc.)

6.2.4 Teams should include any winning strategies they devised for the competition.

6.3 – Presentation Scoring

6.3.1   Teams will be scored based on eight categories, which cover a number of aspects of the presentation, including content and style. More points will be awarded for extra research, truly innovative thinking, and synthesis between competition experiences and professional engineering skills.

6.3.2   Judges will be instructed to score subjectively on a 0-22 point scale for the first seven categories in the rubric and a 0-46 point scale for the Engineering Notebook category.

6.3.3   The full rubric for presentations is shown in Appendix B.

7 – Tournament Logistics

7.1   Teams will compete in four (4) Matches over the course of a one-day Event.

7.2   Teams will be ranked based on the sum of their Match scores and Presentation score (i.e. the Presentation can be thought of as an additional "Match", in terms of rankings).

    a.   If there are any ties based on this sum, the first tiebreaker will be the Team with the highest Presentation score, followed by the highest single Match score.

7.3   The Team's lowest Match score will be excluded from the rankings total.

    a.   The Presentation score cannot be excluded.

    b.   For example, in the set of scores listed below, the score for Match 3 would be excluded from the rankings.

Match 1	130
Match 2	110
Match 3	90
Match 4	125
Presentation	150

7.4   The Head Referee has ultimate authority on all rule decisions.

    a.   The Head Referee may not review any photo or video match recordings to determine a score or ruling.

    b.   The Head Referee is the only individual permitted to explain a rule, Disqualification, or warning to the teams.

    c.   The Head Referee must give the rule number of the rule violated when issuing a Disqualification or warning to a Team.

7.5   Any Team is permitted to immediately appeal the Head Referee's ruling after the Match. The appeal must be made by a single designated team captain to dispute a score or ruling, and they must do so prior to their next Match.

7.6   Match replays, i.e. playing a Match over again from its start, are at the discretion of the Event Coordinator and Head Referee and will only be issued in the most extreme

circumstances. Some example situations that may warrant a Match replay are as follows:

    a. Game Elements not starting in the correct positions.

    b. Game Elements detaching or moving beyond normal tolerances (not as a result of vehicle interactions).

    c. The Field is reset before a score is determined.

7.7   Teams must be ready to play when they arrive at the field and set up their equipment within the allotted setup time. Failure to do so promptly may result in a Disqualification at the Head Referee's discretion.

7.8   When a team finishes the match, after clearing and resetting the court they must remain nearby to go over scoring with the referees

7.9   Championship Qualification Criteria

    a. The 2025 AVR Championship Event will be held at the Commemorative Air Force NAEC in Dallas Texas on the first or second (TBD) weekend in December. More details will be provided by mid-October and specific event information will be available on the website: theavr.org

    b. Each Qualifying Event held in November will have one (1) qualification spot for the Championship Event. This spot will be awarded to the 1st Place Team at the event, i.e. the Team who has scored the most points towards their rankings, per 7.2 and 7.3.

    c. One additional spot may be allotted to larger events once the number of events have been finalized for the season. The additional spot would be given to the 2nd Place Team. The final number of spots allocated will be posted on the theavr.org website under the 'Yearly Game '>> '2025 Season Results' page.

    d. If a Team has already qualified, the spot will be awarded to the next highest-ranked Team in the following order below. If all of the teams that won these awards have previously qualified, then the additional spot(s) will be filled as follows:

        i. 2nd Place Team

        ii. 3rd Place Team

        iii. Best Overall Design Award

        iv. Exemplary Team Award

        v. Presentation Award

        vi. Judge's Award

    e. Additional open spots for the Championship event may be filled by EduEverything staff using the following Overall Ranking order below. The Overall Ranking results will be posted on theavr.org website.

        i. Highest Total Score at an event

        ii. Presentation score

        iii. High Score from a single match (excluding Presentation scores)

        iv. If there is a tie in the overall ranking covered in 7.8-d that will affect which team will be invited to the Championship event, then EduEverything staff will break the tie and select the team to be invited by considering various factors including on-field performance, awards won, vehicle design, presentation quality, and/or availability.

v. Teams that are available to attend the Championship event and would like to be considered for an invitation should add themselves to the Championship Waitlist no later than November 24, 2025.

8 – Vehicle Specification and Build Guidelines

8.1 – General

8.1.1 Vehicles found in violation of one or more of these rules during a Match may be Disabled or Disqualified at the Head Referee's discretion, and will not be permitted to play in any further Matches until they have corrected the violation.

8.1.2 AVR Drones must pass a "wall test". As a general rule of thumb, if the drone approaches a wall from any angle, any other part of the drone (such as propeller guards) should be the first thing to contact the wall.

    a. Similarly, if a drone is flying towards a netted cage, propeller guards must be the first thing to contact the net, mitigating risk of propeller entanglement.

8.1.3 The AVR Drone must clearly and legibly display a Team's number.

8.1.4 There are no dimensional or weight limits for any Vehicle.

    a. The AVR Drone has a recommended maximum flight weight of 3.2 kg. Exceeding this limit may cause unstable flight, shorter battery life, or other unexpected behavior.

8.2 – Electronics & Software

For the following electronic control system components, AVR Drones may only use the items provided in the team registration kit:

Item	Brand/Part #
Batteries	4S 5200mAh Hardcase Battery
Flight Controller(FC)	Pixhawk 6C
Control Computer (PC)	Raspberry Pi Companion Computer with Raspberry Pi Hat developed by DroneBlocks*
Prop Motors	Brother Hobby 2812 900kv BLDC or T-Motor VELOX V2812 925kv or EMAX Pro Series 2812 930kv
Electronic Speed Controllers	Holybro 4-in-1 50A ESC *
Transmitter/Receiver	FlySky FS-i6S *
CSI Camera	Raspberry Pi Camera
VIO Camera	ARC Flow Sensor

FPV Camera	**Not Necessary for 2025 - Clear the Beach** Provided: AKK A3 or Caddx Ant Lite & TBS Unify
5V 650 nm Laser	**Not Necessary for 2025 - Clear the Beach** Provided: AVR PIC KY-008

* Denotes a component custom-manufactured or modified for the AVR Competition.
Contact info@theavr.org for any questions.

8.2.1 Teams may use any additionally commercially available sensors or actuators (e.g. servo motors) for the AVR Drone provided that they abide by the following criteria:

a. Components may only receive power from the onboard battery listed above.

b. Components may only be controlled by/interface with the existing CC or FC as described above.

c. Components must not violate any other rules (e.g. create safety hazards, create wireless interference, etc).

8.2.2 Exposed wiring of any kind is prohibited. All wiring connections must be covered by either heat shrink or electrical tape.

8.2.3 Teams & vehicles may only use the following forms of wireless communication:

a. WiFi between the AVR CC and the Ground Control Operator laptop or wireless router.

b. WiFi between the DEXI Drone and a Drive Team Member's laptop or mobile device.

c. Bluetooth between the RVR Skid Loader and a Drive Team Member's laptop or mobile device.

d. Bluetooth between the Sphero Beach Patrollers and a Drive Team Member's laptops or mobile devices.

e. 5.8GHz radio between the FPV transmitter and receiver.

f. 2.4GHz radio between the FC's receiver and a Drive Team Member's transmitter.

g. 900-915MHz or WiFi between an optional telemetry receiver and transmitter.

h. A second 2.4GHz radio is allowed between a RVR receiver and a Navigation Team Member's transmitter to actuate mechanism(s).

8.2.4 Software created before the current season begins (e.g. from previous seasons) is only permitted if the source code is made publicly available to all Teams via a post on forum.theavr.org, a public Github repository, or something similar.

8.3 – Hardware

8.3.1 The AVR Drone's primary airframe must be built from the carbon fiber components included in the AVR Drone Kit (i.e. configured as a quadcopter).

8.3.2 Carbon fiber frame components included in the AVR Drone Kit may not be modified in any way.

8.3.3 Rules 8.3.1 and 8.3.2 do not apply to assembly hardware (e.g. screws, standoffs) or 3D printed parts. Teams may modify, customize, add, or remove 3D printed parts at will.

8.3.4 There are no material restrictions on additional mechanisms or accessories added to the AVR Drone, DEXI Drone, RVR Skid Loader, or Dumpsters provided that no other rules are violated.

9 – Safety & Conduct

9.1 – General Safety

9.1.1 If Vehicle operation or Team actions are deemed unsafe during a Match, the offending Team may receive a Disablement or Disqualification at the Head Referee's discretion.
   a. If a Team or any of its members (Students or any Adults associated with the Team) are disrespectful or uncivil to event staff, volunteers, or fellow competitors, they may be Disqualified from a current or upcoming Match.
   b. Team conduct pertaining to this rule may also impact a Team's eligibility for judged awards.
9.1.2 Competitors must follow all relevant FAA (Federal Aviation Administration) safety regulations to guarantee the safety of students, spectators, and teachers.
9.1.3 All competitors must wear safety glasses when at the Field. This includes both in the Driver Station, and when interacting with Vehicles inside of the Field.

9.2 – Flight Safety Rules

9.2.1 Unless it is inside of a netted Field, the AVR Drone must never:
   a. Have Propellers mounted
   b. Be Armed
9.2.2 The AVR Drone may only be Armed if all of the following conditions are met:
   a. The AVR Drone is inside of a netted Field
   b. There are no humans inside of the Field
   c. The AVR Drone has legal Propeller Guards attached (see rule 8.1.2). Flying the AVR Drone outside of a netted area is considered to be a violation of rule 9.1 and could result in Disqualification from an event.
   d. There are no exceptions to these rules.
9.2.3 If an AVR or DEXI Drone crashes, is Disabled, or otherwise becomes unresponsive during a Match, no action may be taken by Teams to continue flying. The aircraft should be disarmed immediately to prevent further damage.

10 – Honors and Awards

There are three (3) Competition Awards and four (4) Judge's Awards. Competition Awards are based on a Team's performance during the event. All Teams are eligible for Judge's Awards.

Judge's awards will be evaluated by presentation judges, referees, event staff, and other volunteers.

10.1 – Competition Awards

10.1.1 Competition Awards will be given to the 1st, 2nd, and 3rd place Teams, based on their ranking at the end of the event as described in section 7.3.

10.2 – Best Overall Design Award

10.2.1 The Best Overall Design Award will be given to the Team that demonstrates the best overall combined design for their AVR Drone, DEXI Drone, RVR Skid Loader and Dumpsters.

10.2.2 This award will be evaluated primarily by judges of the presentation event, in conjunction with the referees who observe each Team in competition.

10.2.3 Judges will consider uniqueness of design, aesthetics and form factor of the platform, intentionality of design decisions, functionality of systems and modules, realistic features, innovative controls, and reliability/durability.

10.2.4 Teams must submit an Engineering Notebook in order to be considered for this award.

10.3 – Exemplary Team Award

10.3.1 The AVR Competition prides itself on the simultaneously competitive and collaborative environment it cultivates for participants. Because of this, an award will be given to the Team that best demonstrates professionalism, passion, and respect to both fellow competitors and event staff.

10.3.2 This award will be judged by the behavior of students in the competition arena, pit area, and the venue as a whole. It will be based on a combination of spirit and sportsmanship.

10.3.3 This award will be given to the team most enjoyable to compete against, and will recognize Teams that demonstrate pride, loyalty and cheers, assist and support both competitors and teammates, and demonstrate superior professionalism.

10.4 – Presentation Award

10.5.1 This award will be given independent of on-Field performance, and is instead based solely on the Team's performance in the presentation event and the submittal of their Engineering Notebook for the judges' review.

10.5.2 This award will be evaluated solely by the presentation judges.

10.5.3 This award will recognize the Team with the cleanest presentation, including:
   a. Helpful and well-crafted media
   b. Well-spoken and confident presenters
   c. Camaraderie with team spirit (t-shirt designs and team names)
   d. Clear indication of practice and effort
   e. Clear structure of the presentation

f. Quality and thoroughness of ideas
g. Content and quality of the Engineering Notebook (especially as referenced/included in the presentation)

10.6 – Judge's Choice Award

10.6.1 The Judge's Choice Award will be given to an outstanding Team who doesn't necessarily fit into the category of one of the other three Judge's Awards.

10.6.2 This award will recognize Teams that stand out among their peers, either in superior subject matter expertise, attitude, communication and teamwork ability, or other qualities that the judges deem worthy of recognition.

Appendix A – Field Specifications

Full Game Field

The majority of dimensions and specifications for the **Clear the Beach** Court are provided in the 3D CAD model using OnShape.

Field components may vary slightly from event to event. This is to be expected; Teams will need to adjust accordingly. It is good design practice to create mechanisms capable of accommodating variances in the field elements.

Links to CAD files for the Full Game Field can be found under '2025 Game Resources' and 'CAD Files' [here](#).

This link is view-only, which will still allow teams to get measurements. To download, you must have (or sign up for a free) an OnShape account. While logged in, click the three lines for the menu in the top left and copy the workspace to your account.
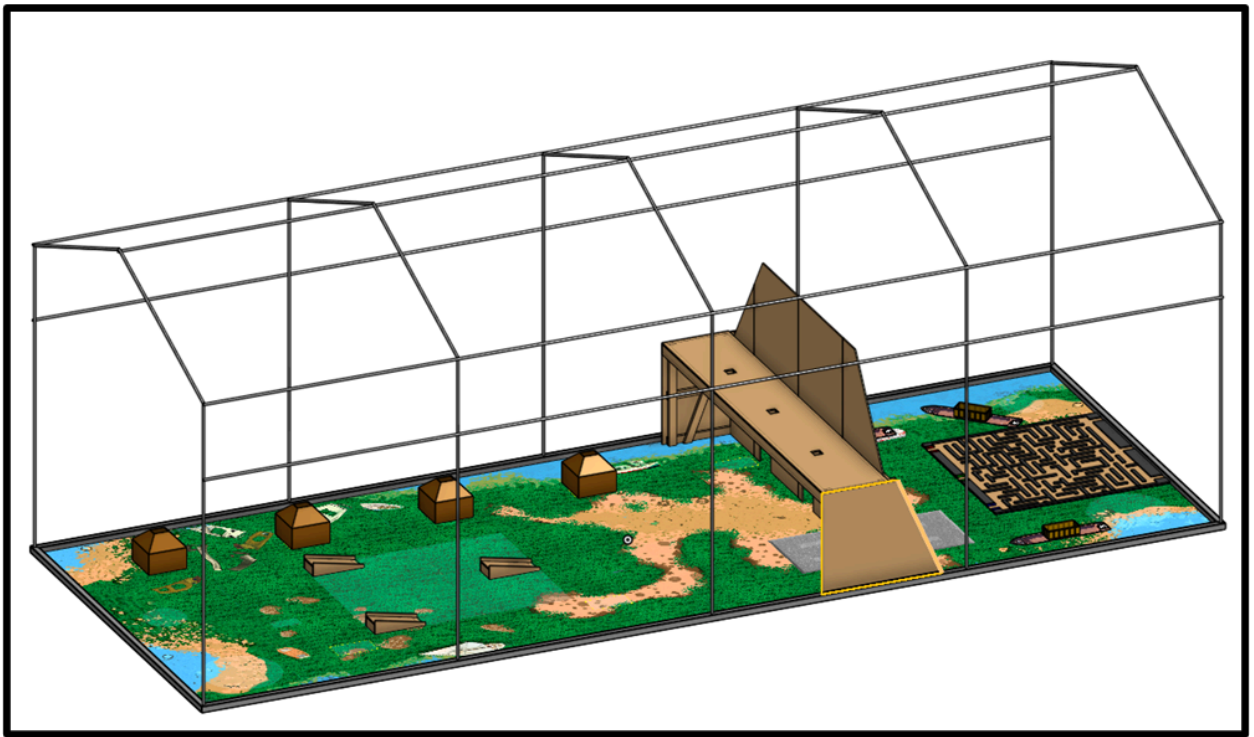
Figure 15 :Clear the Beach Court - Full Game Field CAD File using OnShape

Ramp Design

The design details of the Ramp are needed for Teams to be able to build their own ramp both for practice and for making sure their Dumpster design, attachment mechanisms and AVR Drone landing gear all align properly with the ramp. The dimensions and design of the Ramp is provided in the 3D CAD model using OnShape.

Links to CAD files for the Ramp can be found under '2025 Game Resources' and 'CAD Files' here.

This link is view-only, which will still allow teams to get measurements. To download, you must have an (or sign up for a free) OnShape account. While logged in, click the three lines for the menu in the top left and copy the workspace to your account.
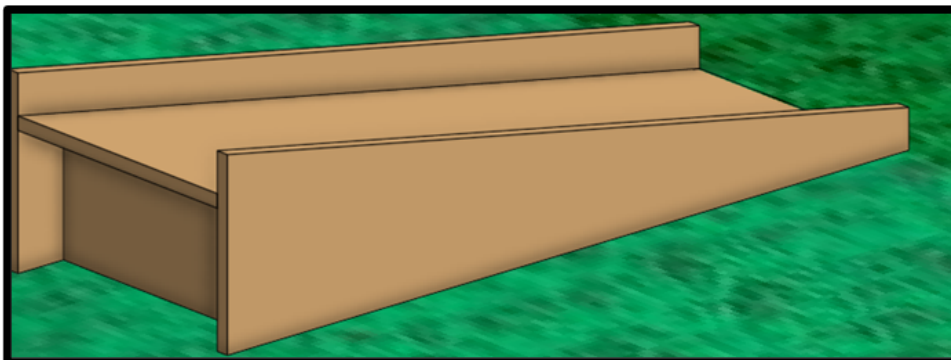
Bridge & Mountain Support Design

The design details of the Bridge & Mountain Supports are provided for Teams who want to build their own Bridge and Mountain. The DEXI Drone will be able to practice on the Bridge for Object Recognition on the Vehicle Images. The AVR Drone with the Dumpster attached will be able to practice flying over the Mountain. The dimensions and design of the Supports are provided in the 3D CAD model using OnShape.

Links to CAD files for the Supports can be found under '2025 Game Resources' and 'CAD Files' here.

This link is view-only, which will still allow teams to get measurements. To download, you must have an (or sign up for a free) OnShape account. While logged in, click the three lines for the menu in the top left and copy the workspace to your account.
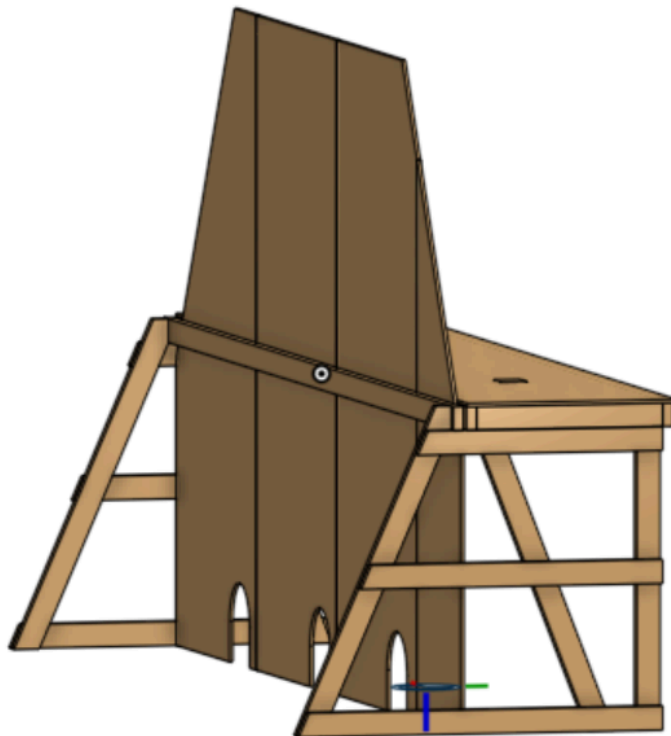

Figure 17 : Bridge & Mountain Support CAD File using OnShape

Appendix B – Presentation Rubric

Team Number: _____ **Judge Name:** _____   Score

Design Approach and Process	
Comments:	/22
Demonstrated Engineering Skills	
Comments:	/22
Game Winning Strategy	
Comments:	/22
Lessons Learned	
Comments:	/22
Teamwork. Communication & Team Spirit	
Comments:	/22
Quality of Materials and Presentation (including T-shirt Designs)	
Comments:	/22
Demonstrated Effort and Research	
Comments:	/22
Quality and Content of Engineering Notebook	
Comments:	/46

Overall Total: /200

Appendix C – Engineering Notebook

The engineering notebook is not mandatory but highly recommended, not just for the point value, but for learning a discipline for future projects.

The engineering notebook is a documentation of the Team, Team plans, and the vehicle and drone designs. This documentation should include sketches, discussions and team meetings, design evolution, processes, obstacles, and each Team member's thoughts throughout the journey for the entire season.

Teams may use either classic pen and paper to create the notebook (Spiral notebooks, lab notebooks, loose pages, or a combination of any or all of these), or they may keep an electronic version on a computer or tablet or on a shared resource such as Google Drive. Notebooks should contain notes of all team meetings, sketches of changes and modifications, any engineering calculations used in the design, and photographs of the build and the team activities.

Notebooks submitted for judging MUST be printed on paper and submitted in a single 3 ring binder with a ring diameter of no more than 3 inches. Handwritten material may be scanned for inclusion in the final notebook. All materials must be fastened to pages, no loose materials will be accepted. The Team Number MUST be printed on the outside of the notebook.

Engineering Notebooks are to be submitted at the beginning of the Event Day as part of Team Check-In. Judges will evaluate the notebooks during the day but will provide them back to the Team for the Presentation Session.

Suggested Guidelines for Engineering Notebooks:

1. Title page
2. Summary page with important pages noted and reasons why they are important (Summary is ONE page only)
3. Table of contents (Labeled tabs for the notebook are nice but not required)
4. Sections:
   A) Team bios including role and contributions to the team (First Names only)
   B) Safety Processes
      i.   Meeting Discussion
      ii. Workshop Safety
      iii. Flight Safety
   C) Vehicle designs – This would be the design and development of elements beyond the basic AVR drone kit and the Sphero kits (RVR and Sphero Minis). This should include initial designs and implementation and then changes over the course of development showing application of the engineering design process.
   D) Game strategies – This would be the determinations of where the team will focus the strategy as they play. This should include any decisions and developments made over time.
   E) Artistic elements – Any extra efforts to make the designs realistic (RVR looking like a Skid Loader or Bulldozer, Dumpsters like construction sites, etc.)
   F) Team meeting/work session documentation – this can include:
      i.   Date, time, and location of meeting/ work session
      ii.   Attendees including coaches and mentors (if any)
      iii. Meeting/ session goals (if defined)
      iv.   Accomplishments – including lessons learned through training, practice, and through failure
      v.   Design decisions made including sketches, calculations, notes, and photos. This will include the design items from above but here they are spread throughout the timeline of work vs. the design section where they are all pulled together.
      vi.   Game strategy planning
      vii. Event and presentation discussions
      viii. Processes followed including safety processes.
      ix.   Issues (if any)
      x.   Reflection

The documentation should include enough detail for another person to look at your notebook and be able to follow in the steps your team took to get to your final designs.