

2021 Season TKO Robotics Drone Competition

Sponsored by FRC Team #1351: TKO



Overall Game Objective

Score as many points as possible by having your drone pick up our chosen game piece (a cone), deliver it safely to a variety of different locations, and display maneuverability control within the allotted time of 4.5 minutes. The team that earns the most points wins!

Rules

You may only be in control of one cone at a time.
Penalty: 5 points per cone.

Except on the figure eight landing pad, your drone must not touch the ground for the duration of the match. Penalty 2 points per instance and an addition 2 points for every following 10 seconds.

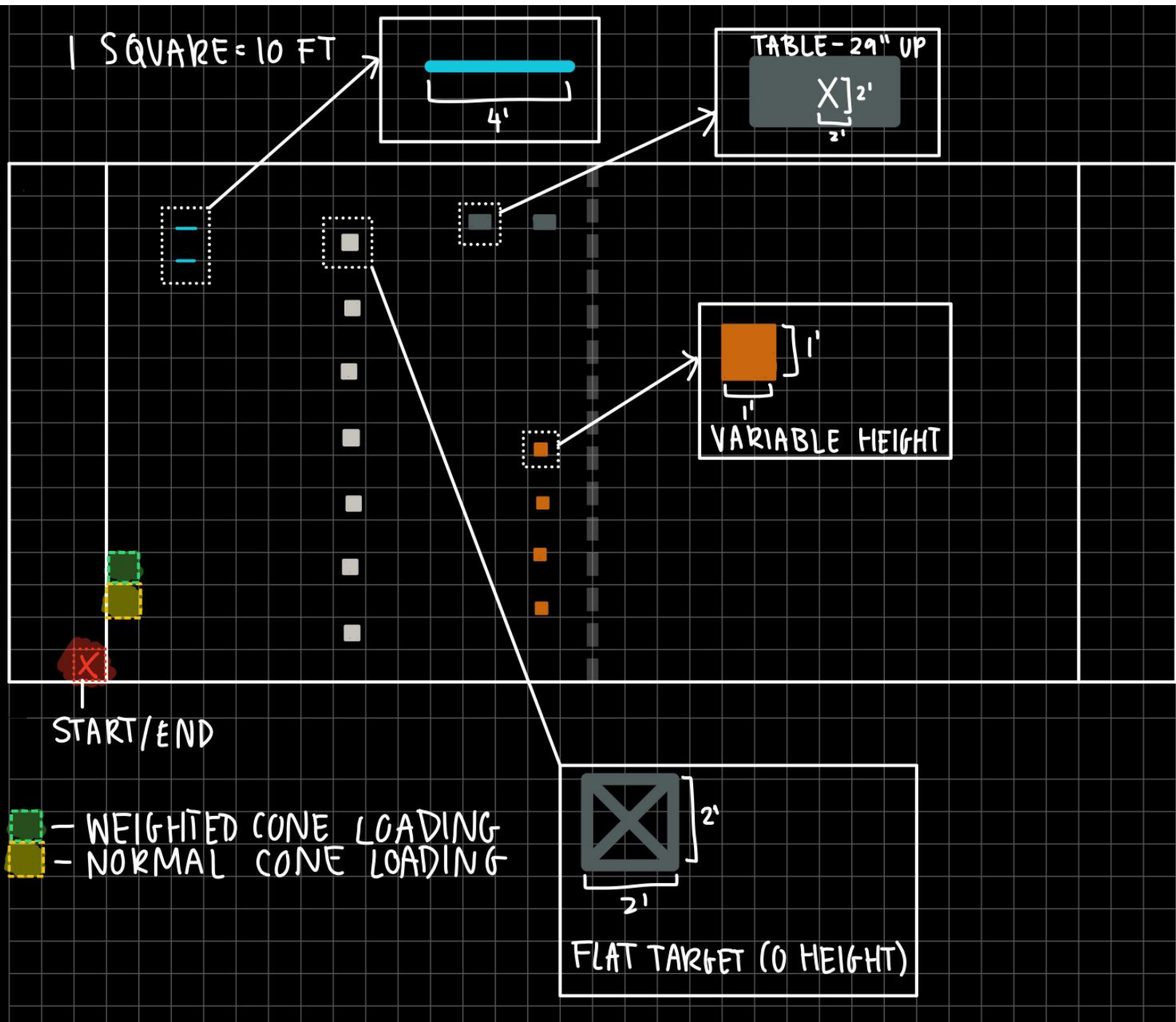
You must remain on your side of the football field within the bounds of the football field. Penalty emergency drone shutdown. Failure to pass initial drone safety checks will result in disqualification prior to the match starting.

Field Overview

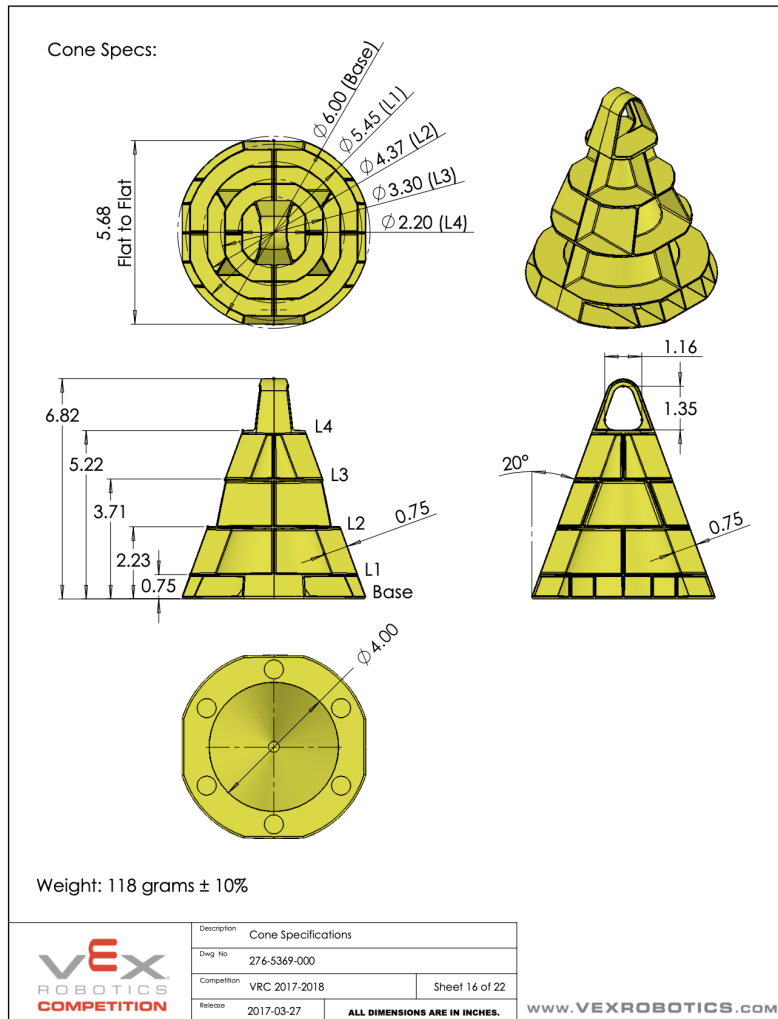
Your matches will be played on one half of the football field. There will be a few field components to keep in mind:

- One plastic folding table, with a 2'x2' target underneath it. Placing cones here will earn you points.
- Two poles, 4 feet apart. Performing 2 figure eights around the poles and landing on a 2'x2' landing pad will give you a multiplier bonus.
- Multiple 2'x2' targets directly on the field. Placing cones here will also earn you points.
- Multiple 1'x1' boxes placed around the field. Placing cones here will earn you points.

Diagram of Field:



Cone Specs (game pieces):



*Weighted cones will have 1.5 lb of extra mass inside the cone cavity

https://drive.google.com/file/d/12fbG54Z4ZJRcJ41X8IPwBQL_VxtjjkUe/view?usp=sharing

^^ ^^ Link to field cad

Scoring Points

There are multiple ways to score points in matches:

- Placing a cone down in any of the 3 locations above will earn you an automatic +1 point. If the cone is stacking onto another cone, this is a +2 point. If it is a weighted cone it is +2 points.
 - You will earn an additional number of points depending on the location the cone is placed/stacked.
 - In standard target: +1
 - On box: +2
 - Under table: +3
- Completing two successful figure 8's around the poles and landing on the pad between them will multiply all the points you by 1.5

Point Summary:

Ways to earn points	Multipliers	Point Value - Normal Cone	Point Value - Weighted Cone
Placing a cone at Location #1 (target on the grass)	n/a	+1	+2
Placing a cone at Location #2 (target on boxes)	n/a	+2	+3
Placing a cone at Location #3 (target under table)	n/a	+3	+4
Stacking secondary cones (mix of either)	n/a	+2 additional points (anywhere)	+2 additional points (anywhere)
Completing 2 Figure 8s and landing on the pad between them after	1.5 multiple of final points	n/a	n/a

Awards (Not Real Sponsors!)

- Payload Award sponsored by **American Crane and Hoist Corp**
 - **Overview:** This will be awarded to the drone that can pick up the heaviest payload.
 - **Rules:** Attach a payload to the bottom of your drone and lift it at least 1 foot off the ground. Use a scale to weigh the payload. The payload may consist of anything as long as it can be weighed. Submit a video/live demonstration of the drone lifting the weight.
 - **Judging:** The drone with the heaviest payload wins the award.
- Speed Award sponsored by **Toyota Prius**
 - **Overview:** This will be awarded to the drone that can reach the fastest linear speed.
 - **Rules:** Record a video of the drone flying forward. Try to keep the camera perpendicular to the drone's flying direction such that linear speed can be judged using the video. Include a meter stick in the video for scale. Speed will be determined using the VideoPhysics app.
 - **Judging:** The drone with the fastest linear speed wins the award.
- Maneuverability Award sponsored by **John Deere**
 - **Overview:** This will be awarded to the drone that can be maneuvered the best.
 - **Rules:** Submit a video/live demonstration of the drone doing figure eights around two points. The two points can be marked with tape on the ground, and should be 4 meters apart.



- **Judging:** The drone that can do the most amount of figure eights in one minute wins.
- Electronics Award sponsored by **3M**
 - **Overview:** This will be awarded to the drone that has the best wiring and mounting of electronics components.
 - **Rules:** Submit pictures of your drone's wiring and electronics.
 - **Judging:** Judges will be looking at wiring neatness, organization, electronics mounting, and integration with the design (i.e. not thrown onto the drone afterwards).
- Programming Award sponsored by **Ford**
 - **Overview:** This will be awarded to the drone that demonstrates the best programming control system.
 - **Rules:** Submit a written description and optional video of your drone's programming in action.
 - **Judging:** Judges will be looking for well-tuned control loops, innovative integration of sensors, implementation of fail safes, and more.
- Innovation Award sponsored by **Boston Dynamics**
 - **Overview:** This will be awarded to the drone that demonstrates an innovative feature. This feature could be from any department: an innovative mechanical feature, electronics feature, or programming feature.
 - **Rules:** Submit a written description and optional video of your innovative feature.
 - **Judging:** Judges will be looking for features that are out of the box, extraordinary, or unique to other drones. **Note:** The innovative feature does not have to be the best performing feature, it just has to be unique.
- Design Award sponsored by **Adobe**
 - **Overview:** This will be awarded to the drone that demonstrates the best visual AND mechanical design aspects.
 - **Rules:** Submit photos of your drone and/or renders of the CAD model.

- **Judging:** Judges will be looking for a balance between visual design and mechanical design — a balance between form and function. This includes a holistic view of the drone: color scheme, organization, neatness of electronics, and mechanical robustness.
- CAD Award sponsored by **GrabCAD**
 - **Overview:** This will be awarded to the team that displays the best CAD techniques.
 - **Rules:** Submit screenshots of your drone's CAD model, as well as any individual assemblies you would like to show.
 - **Judging:** Judges will be looking for detailed CAD models that demonstrate proper CAD technique and overall well-designed assemblies and parts. Judges will also be looking for well-designed custom parts as well as integrating real parts (such as the electronics) into the CAD model (by either using GrabCAD models or modeling representative bounding boxes).

Technical Requirements

- drones should be easy to manufacture (machining is allowed, but you should try to make it simple to construct, preferably using a majority of 3D printed parts)
- see the CAD presentation for CAD expectation
- see the Drone electronics presentation for links to required electronics
- **Budget:** \$75
 - All standardized electronics (including your choice of motors) does not count towards your budget. Budget only consists of additional resources (materials, hardware, etc) that you purchase for your drone.