KISS INSTITUTE FOR PRACTICAL ROBOTICS

Aerial Botball Challenges

The Aerial Botball Challenge Program is not a direct competition. At Challenge Day events, teams will be working towards conquering the challenge at hand. These challenges follow the KIPR Aerial Python Curriculum. Students progressing through that material should be able to progressively solve these challenges. Dimensions for all challenge obstacles are listed at the end of this document.

Note: These Challenges were designed to be solvable at the specified difficulty level using the Tello EDU minidrone by DJI.

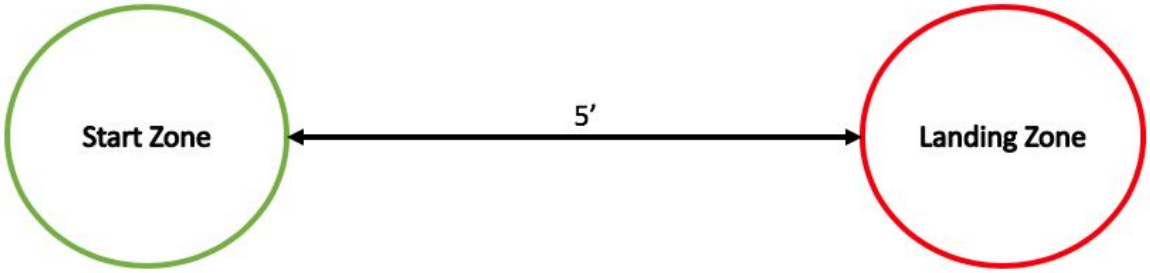
Short Flight

Setup: Start Zone Hula Hoop, Landing Zone Hula Hoop. These hoops will be set up in a straight line with a 5 feet separation from the outer edge of the hoops.
Level: Beginner
Skills: Taking Off, Landing, Flying Specific Distance

Objective:
Drone will takeoff from the starting zone and land in the landing zone.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- Drone must start entirely within the bounds of the starting zone.
- Drone must end entirely within the bounds of the landing zone.



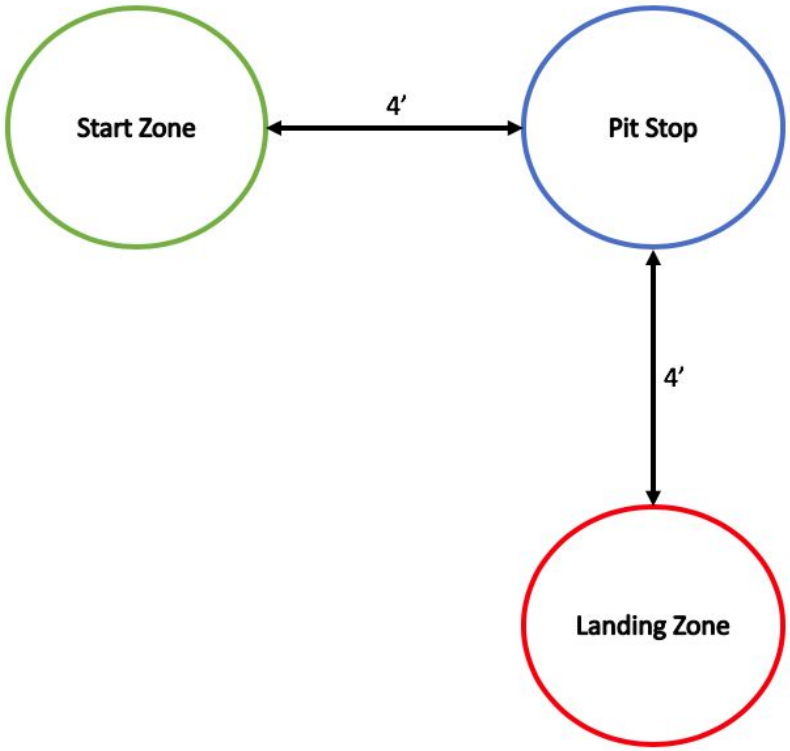
Pit Stop

Setup: Start Zone Hula Hoop, Pit Stop, Landing Zone Hula Hoop. These hoops will be set up in an “L” configuration with a 4 feet separation from the outer edge of the hoops.
Level: Beginner
Skills: Multiple Take Offs, Multiple Landings, Flying Specific Distance, Turning

Objective:
Drone will takeoff from the starting zone, land in the pit stop, then takeoff again and land in the landing zone.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- Drone must start entirely within the bounds of the starting zone.
- Drone must end entirely within the bounds of the landing zone.
- Drone must stay landed in the pit zone for at least 3 seconds.



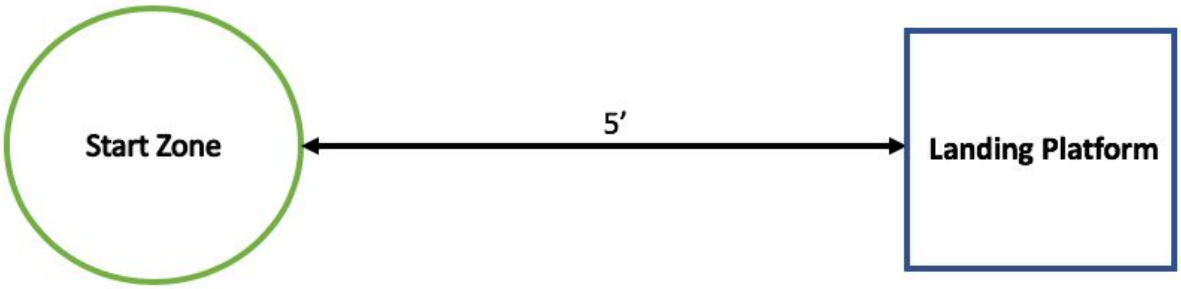
The Landing Zone

Setup: Start Zone Hula Hoop, Landing Zone Platform. These zones will be set up in a straight line with a 5 feet separation from the outer edge of the hoop and the platform. The top of the platform is approximately 24.5” off of the ground.
Level: Beginner
Skills: Taking off, Flying Specific Distance, Adjusting Altitude, Landing

Objective:
Drone will takeoff from the starting zone and land in the landing zone. There must be a change of altitude at some point in the drone’s flight.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- The drone must start entirely within the bounds of the starting zone.
- The drone must end entirely within the bounds of the landing zone.
- The drone must adjust altitude at some point during its flight.



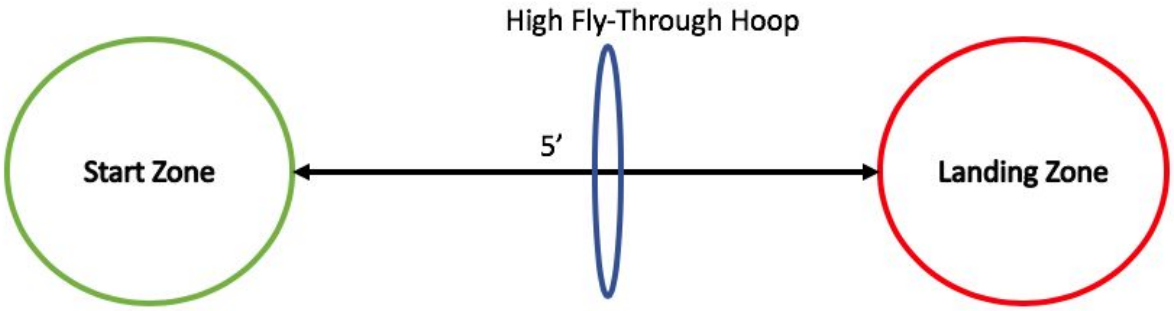
Single Hoop

Setup: Start Zone Hula Hoop, High/Large Fly-Through Hula Hoop, Landing Zone Hula Hoop. The starting zone and landing zone hoops will be set up in a straight line with a 5 feet separation from the outer edge of the hoops. The high fly-through hoop will be placed approximately in the center of the two zones and the center of the hula hoop is 52” off of the ground.
Level: Beginner
Skills: Taking Off, Flying Specific Distance, Adjusting Altitude, Landing

Objective:
Drone will takeoff from the starting zone, fly through the hula hoop, and then land in the landing zone.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- Drone must start entirely within the bounds of the starting zone.
- Drone must end entirely within the bounds of the landing zone.
- Drone must not touch any part of the hula hoop, or the hoop stand.



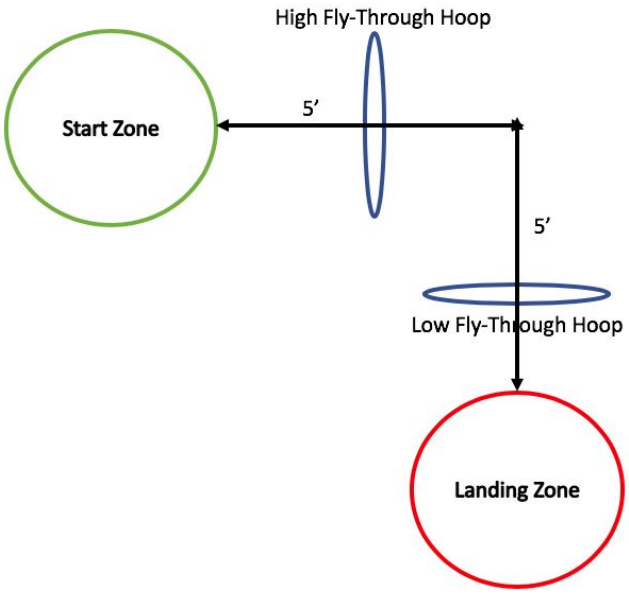
Double Hoop

Setup: Start Zone Hula Hoop, High/Large Fly-Through Hula Hoop, High/Large Fly-Through Hula Hoop, Landing Zone Hula Hoop. The hoops will be set up in an “L” configuration with the dimensions as seen below. The center of the high fly-through hoop is 52” off of the ground and the center of the low fly-through hoop is 21” off of the ground.
Level: Beginner
Skills: Taking Off, Landing, Flying Specific Distance, Adjusting Altitude, Turning

Objective: Drone will takeoff from the starting zone, fly through both of the hula hoops, and then land in the landing zone. There must be a change of altitude at some point in the drone’s flight.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- The drone must start entirely within the bounds of the starting zone.
- The drone must end entirely within the bounds of the landing zone.
- The drone must adjust altitude at some point during its flight.
- Drone must not touch any part of the hula hoop, or the hoop stand.



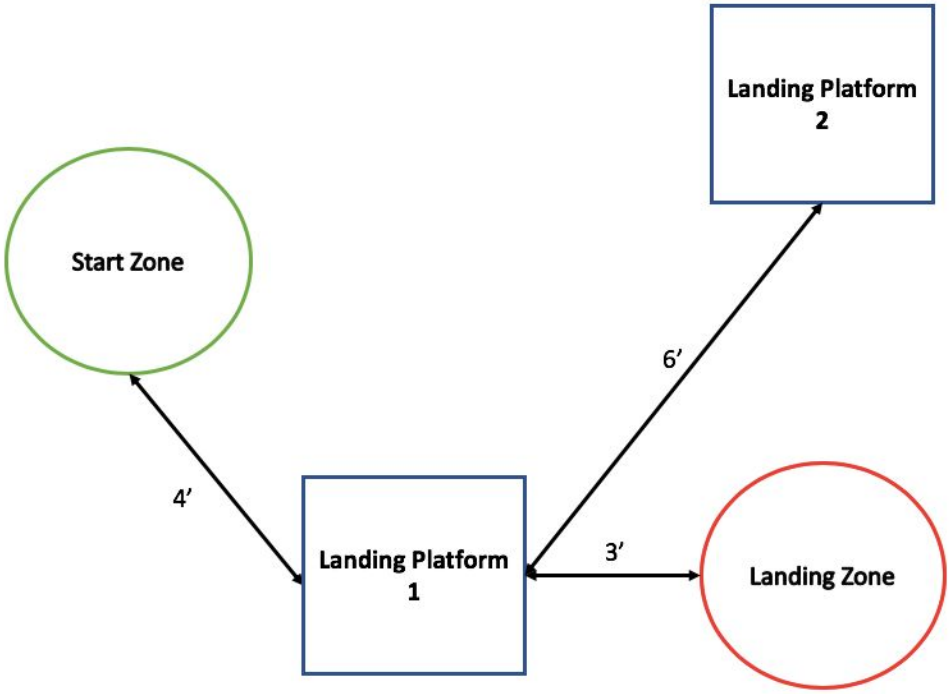
Touch and Go

Setup: One Short/Large Platform and one Tall/Medium Platform. The starting zone and the platforms will be set up in a check-mark configuration as seen below. With the landing zone in-line below the second platform position and in line next to the first platform position.
Level: Beginner
Skills: Taking Off, Landing, Flying Specific Distance, Turning

Objective: Drone will takeoff from the starting zone, first land on the shorter platform, takeoff again, then fly to and land on the small taller platform. After successful landing on both of the platforms, the drone will then navigate to and land inside the landing zone. There must be a change of altitude at some point in the drone's flight.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- The drone must start entirely within the bounds of the starting zone.
- The drone must end entirely within the bounds of the landing zone.
- The drone must adjust altitude at some point during its flight.



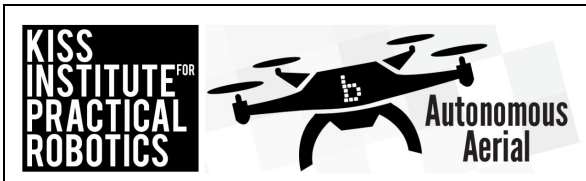
Trailing

Setup: A shape taped to the ground. This shape will be known upon visiting the Aerial Challenge location at GCER.
Level: Intermediate
Skills: Taking Off, Landing, Flying Specific Distance, Turning

Objective: The Drone must takeoff from the starting zone and follow the path of the shape taped on the floor, landing at the landing zone marker. Judge's discretion will be used to determine if drone closely enough follows the pattern of the shape below.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- The drone must start entirely within the bounds of the starting zone.
- The drone must end entirely within the bounds of the landing zone.



Dance Party

Setup: One Tall/Small Hoop, One Tall/Medium Platform. The students can arrange the hoops/platform in whichever arrangement they choose.
Level: Intermediate
Skills: Taking Off, Landing, Flying Specific Distance, Turning

Objective: Drone must takeoff from the start zone and complete a “dance” choreographed by the student. The drone can finish the dance wherever in the fly zone, there is no specified landing zone. This dance is required to include at least:

- 2 Flips, each in two different directions
- An altitude change of any kind (the takeoff and land does not satisfy this)
- Forward Flying Movement
- Backward Flying movement
- Two turns, each at two different angles
- Flight though the hoop
- Landing on the Platform

Constraints:

- There must be no interference with the drone, after starting the flight program.
- The drone must start entirely within the bounds of the starting zone.
- The drone must adjust altitude at some point during its flight.
- Drone must not touch any part of the hula hoop, or the hoop stand.

Seeing Shapes

Setup: Starting “X” marked with tape on the ground.
Level: Intermediate
Skills: Taking Off, Landing, Turning, Gathering User Input, Variables

Objective: The users program will start and ask which shape to fly, *and list the available options*. The program should be able to fly the outline at least 4 shapes. One being a ***triangle***, and one being a ***trapezoid***. The student may choose the other two shapes, as well as the size of the shapes flown. Upon running the program, the judge will enter the name of the shape they would like and the drone must take off from the start zone (X mark on the ground), fly the specified shape, and land back on the start zone.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- The drone must start in the center of the start mark “X”.
- The drone must end back on the starting mark, judges’ discretion.
- The student must demonstrate completion of two consecutive runs, the judges choosing the two shapes of their choice.

KISS INSTITUTE FOR PRACTICAL ROBOTICS Autonomous Aerial	**Initially**

Setup: Start Zone Hoop.
Level: Beginner/Intermediate
Skills: Taking Off, Landing, Flying Specific Distance, Turning

Objective: Drone will take off from the start zone and fly in the formation of the students initials, ex: A.D.F. would fly the shape of A, then D, then F. The student should inform the judge before the run starts what initials the drone is flying.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- The drone must start entirely within the bounds of the starting zone.
- The drone must end entirely within the bounds of the landing zone.
- The drone can finish the flight wherever in the fly zone, there is no specified landing zone.
- Student must inform judge of the letters being flown, and what the upright orientation of letters will be.

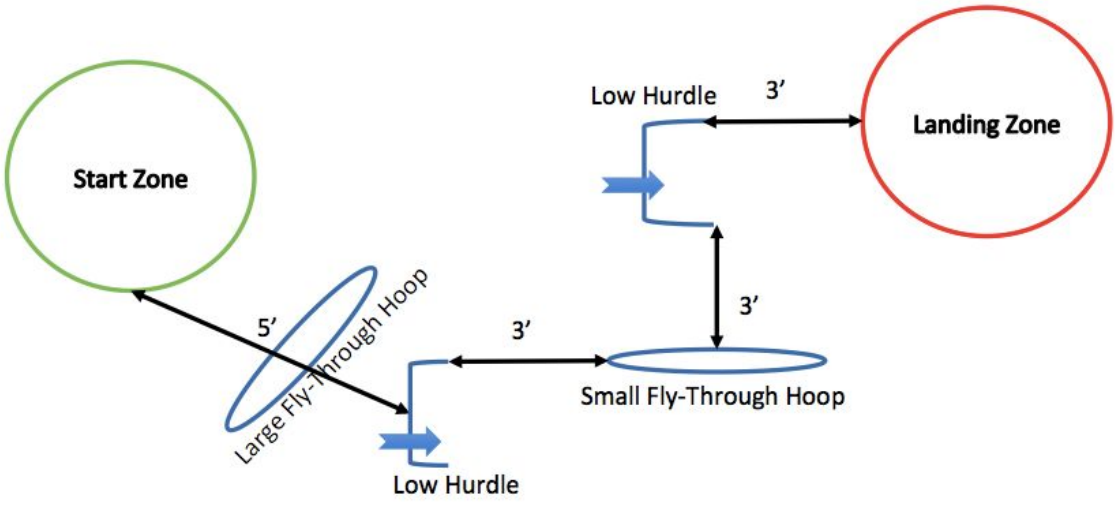
Hurdles and Hoops

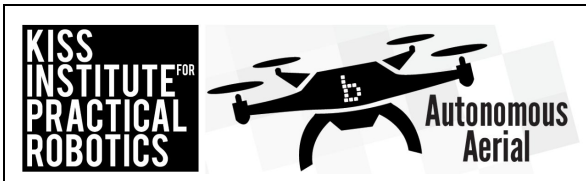
Setup: Low Hurdle, High Hurdle, Tall/Small Hoop, Tall//Large Hoop, Start and End Zone Hoops set up as diagrammed below.
Level: Intermediate
Skills: Precision Flying

Objective: Drone will takeoff from the start zone and navigate through the course in the following order: Large Hoop, Low Hurdle, Small Hoop, High Hurdle. *The cw and ccw turn functions should not be used for this challenge.*

Constraints:

- There must be no interference with the drone, after starting the flight program.
- The drone must start entirely within the bounds of the starting zone.
- The drone must end entirely within the bounds of the landing zone.
- Drone must not touch any part of the hula hoop, or the hoop stand, or hurdle.





N-Shaped Polygon

Setup: Starting “X” marked with tape on the ground.
Skills: Loops, Precision Flying, Conditionals

Objective: Drone will ask the user “How many sides on the polygon?” and the Judge will chose a number between 3 and 6. The drone should fly and equal sided polygon in the horizontal plane according to the number entered by the judge.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- The drone must start entirely on the starting “X” judge’s discretion.
- The drone must end in approximately the same spot on the “X”, judge’s discretion.

N-Shaped Polygon B

Setup: Starting “X” marked with tape on the ground.
Skills: Loops, Precision Flying, Conditionals

Objective: Drone will ask the user “How many sides on the polygon?” and the Judge will choose a number between 3 and 6. The drone should fly and equal sided polygon in the horizontal plane according to the number entered by the judge.

Constraints:

- There must be no interference with the drone, after starting the flight program.
- The drone must start entirely on the starting “X” judge’s discretion.
- The drone must end in approximately the same spot on the “X”, judge’s discretion.

Challenge Course Piece Dimensions

All measurements are approximate and may vary slightly during challenge events.

Hula Hoops:

There are two heights for the hoola hoop setups and two different sized hoops that may be on the stand.

Small Hoop is 27” in diameter
Large Hoop is 33.5: in diameter

Tall/Small Hoop setup is 50” from the ground to the center of the hoop.
Tall/Large Hoop setup is 52” from the ground to the center of the hoop.
Short/Small Hoop setup is 19” from the ground to the center of the hoop.
Short/Large Hoop setup is 21” from the ground to the center of the hoop.

All starting and landing zone hoops are small hoops.

Hurdles:

The high hurdle is 33.5” high by 21.5” wide as measured from the inside edges of the hurdle.
The low hurdle is 23” high by 21.5” wide as measured from the inside edges of the hurdle.

Platforms:

There are two heights for the platforms and three different sized tops that may be on the platform.

Short Platform height is 14”.
Tall Platform height is 25”.

Small Platform top is 9” x 9”.
Medium Platform top is 11” x 11”.
Large Platform top is 12” x 18”.

All landing zone platforms are of the Tall/Medium combination.