FOR THE WIN ROBOTICS

SHARKS & HUMANS: LET'S COHABITATE!

LESSON PLAN | VERSION 1

LESSON OVERVIEW

Prerequisite Knowledge

- Build Essentials
- Fly Essentials
- Code Essentials
- Cardinal directions
- Basic properties of angles

Materials Needed

- Hopper(s)
- safety glasses
- FTW CODE device(s) with Bluetooth capabilities (such as iPads or laptops)
- tape (for the floor)
- measuring tape (up to 20')
- landing pads
- writing utensils
- Wifi capable device(s) – **extension only** (such as iPads or laptops)

Time Allotment

Lesson: 1 hour and 15 minutes (or 2 class periods), Setup: 25 minutes

Documents

- Shark Week 2025 Slide Deck
- Shark Week 2025 Student Pages

In this Lesson...

Students learn about sharks and how drones are used to monitor them for safety. Then, they code Hopper to fly along a coastline in a simulation given a set of directions.

Learning Objectives

- Learn about sharks and how humans can stay safe around them.
- Participate in a group discussion about the advantages and disadvantages of using drones to monitor sharks.
- Using properties of angles, accurately code Hopper to fly along a coastline in a simulation given a set of directions.
- Use the Engineering Design Process (EDP) and STEM practices to redesign Hopper's code as needed.

LESSON STRUCTURE

Read through the following table before starting the lesson. Approximate times have been given for each section to help with scheduling and time management.

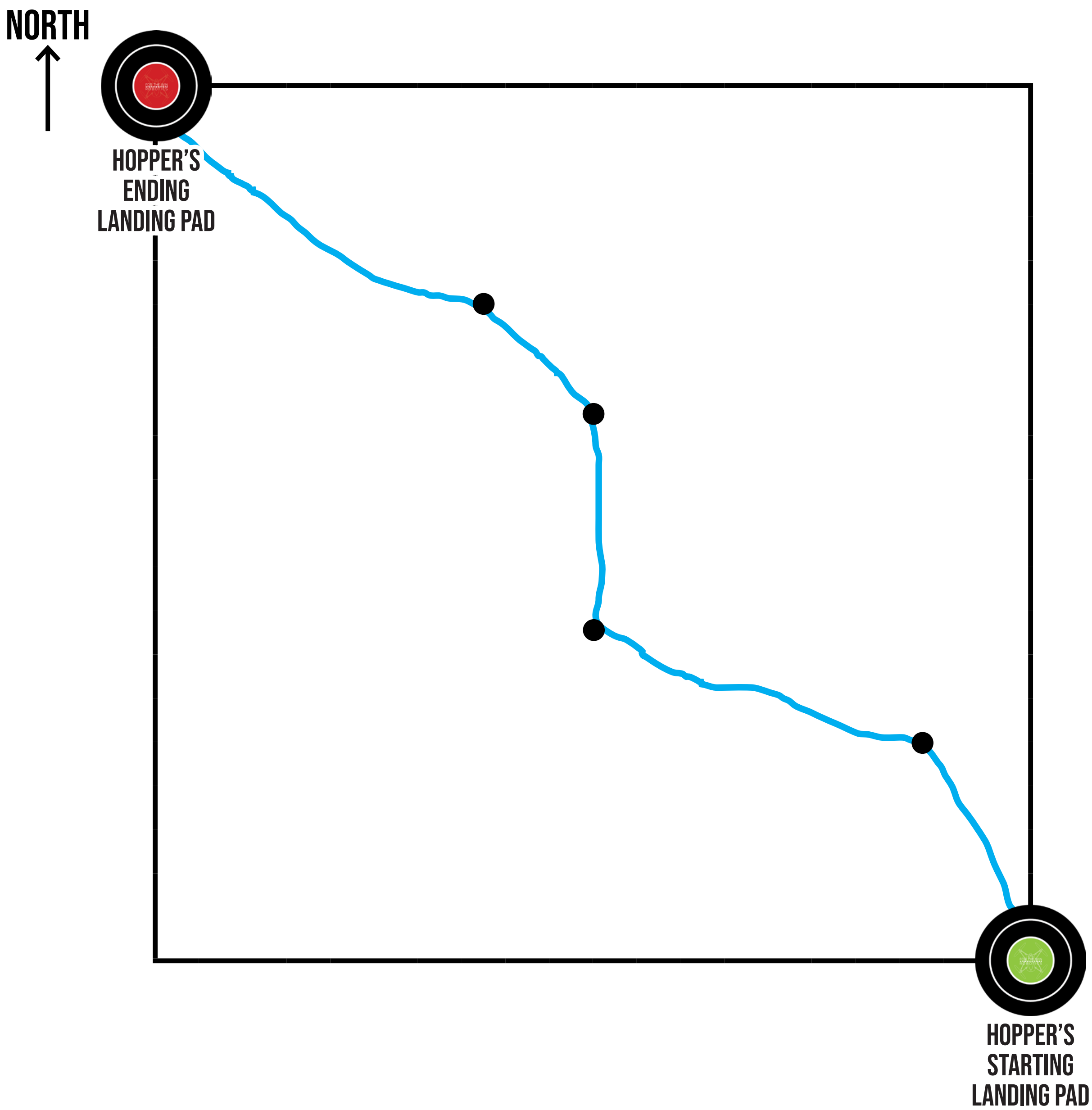
Lesson Section	Description	Approximate Time
Direct Teaching	Open the slide deck titled Shark Week 2025 Slide Deck and have the first slide up as the students walk in. Encourage students to think about the bell ringer question: "Have you ever watched any Shark Week television programming?" Go through the rest of the slides of the slide deck with the students. Play any videos directly from the slides if possible (as opposed to going to the external website). Reference any presenter's notes as needed for each slide. The last slide presents the scenario of the Sharks & Humans: Let's Cohabitate! activity to the students.	30 minutes
Discussion & Activity	Ensure the activity is set up prior to the beginning of the lesson. Allow for up to 25 minutes to set up. Separate students into small teams. Choose team sizes based on how many students there are and how many drones are available. Ideally, there would be no more than 3 – 4 students per team. Encourage the use of the steps of the Engineering Design Process, and computer programming terms such as algorithm, command, and bug as students write code. Implement the extension if time permits. Use the questions provided on page 7 to lead a group discussion with the students. An example of what a student's code could look like can be found on page 8.	45 minutes

ACTIVITY SCENARIO

You are working at a beach to assist lifeguards in detecting sharks that are getting too close to shore. You are doing this with the use of Hopper and its camera to ensure the safety of beachgoers.

You and a team will code Hopper to fly along the coastline of the beach with directions on a map given from the lifeguards.

The blue line on the graphic below represents the coastline, while the black dots represent spots where Hopper should change direction by rotating.

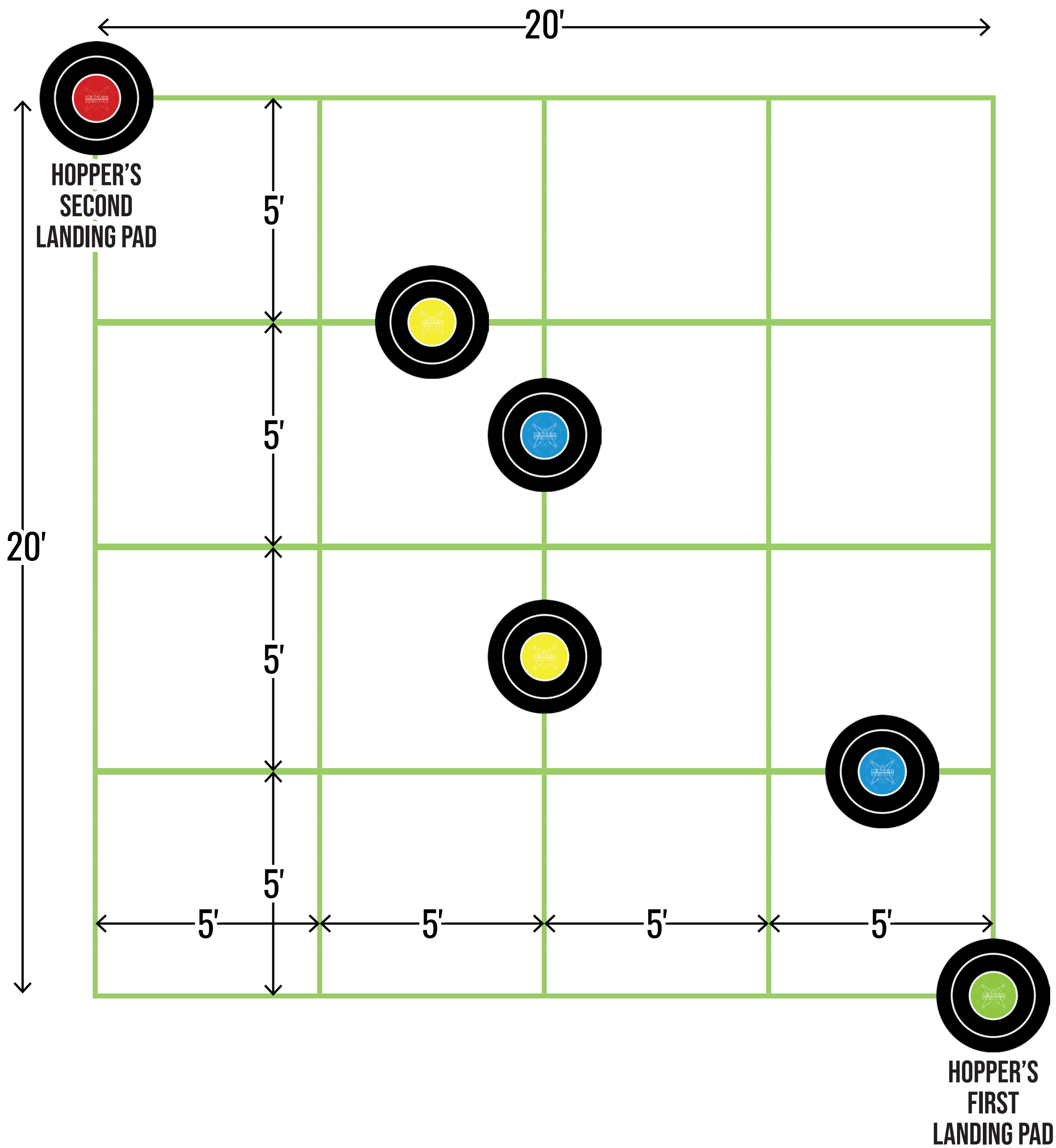


ACTIVITY SETUP

Tape a 20' × 20' square on the ground which represents the fly zone. Tape a 5' × 5' grid in this square. Place two landing pads for Hopper that represent the starting and stopping points at the lower right corner and the upper left corner.

Place four additional landing pads at the locations indicated in the diagram below. These landing pads represent the spots where Hopper must change direction.

An example of the setup is shown below.

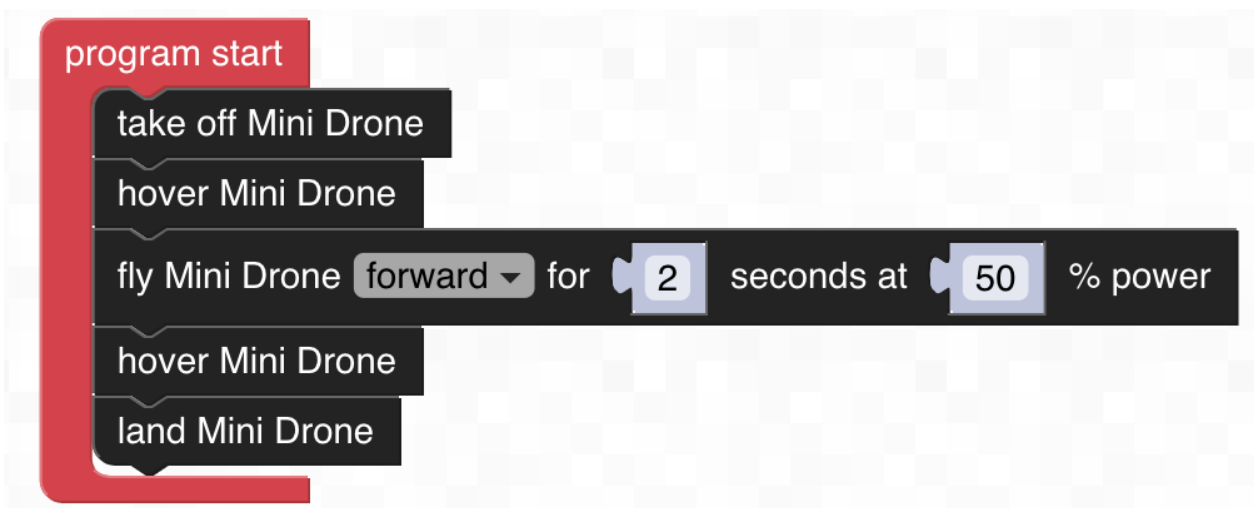


ACTIVITY IMPLEMENTATION

Have each team find Hopper's approximate speed when coded to fly at a certain power percentage and for a certain number of seconds. It is recommended to stay at 50% power or below.

A team's power percentage should stay *roughly* the same throughout this activity.

To stabilize Hopper after takeoff and before landing, it is recommended to command Hopper to hover. An example of a code students could write is shown below.



The takeoff and landing spots of Hopper should be measured.

Then, have each team use the formula rate = $\frac{\text{distance}}{\text{time}}$ to find the rate (speed) in feet per second of Hopper at the power percentage they chose.

Review with students that the formula for finding the rate is derived from the well-known formula:

$$\text{distance} = \text{rate} \times \text{time}$$

ACTIVITY IMPLEMENTATION

Activity Facilitation

Go through the following steps with the students to facilitate the activity.

1. Place Hopper on Hopper's starting landing pad. Each team can decide the direction that Hopper's eyes face depending on how they write their code.

2. Have each team code Hopper to fly along the coastline following the landing pads that indicate where Hopper should change directions. They should use these landing pads and the taped 5' × 5' grid as guides when writing and testing their code.

   Encourage students to draw and label where they want Hopper to go, and to write down what they want Hopper to do in words before coding as needed. They can keep the answers to any calculations they do in exact form for coding. They can use the operation command in the Math tab for improper fractions, or they can convert to decimals.

   Depending on the ages and abilities of the students, they can use basic trigonometry to calculate angle measurements and distances. Otherwise, students should use approximations and educated guesses when writing their codes.

   Encourage the use of the Angles Reference page in the Shark Week 2025 Student Pages document. Remind them to think about the direction Hopper is facing before rotating at each landing pad as needed.

3. If a team was not successful in the accuracy of coding Hopper, have them adjust their code and try again. If Hopper ever flies too far outside of the 20' × 20' square, the student should click on the red Emergency Land button.

ACTIVITY IMPLEMENTATION

Extension

If time permits, challenge the students to simulate finding sharks along the coastline using their code and Hopper's camera.

Place one or more objects along the representative coastline while the team has their back turned to the setup. Then, have them identify the location of the object(s) representing the shark(s) while viewing Hopper's camera feed while they run their code.

Additionally, challenge the students to rewrite their code so that Hopper flies along the coastline in th ***opposite*** direction while starting at Hopper's other landing pad.

Post-Activity Discussion Questions

Use the following questions to lead a group discussion after implementing the activity.

1. Was your initial calculation of Hopper's speed accurate? Or did you have to adjust it while coding the scenario?
2. Did you calculate any other values to help with coding Hopper? If so, what did you calculate? Did you use any formulas?
3. Did you write down or draw your code before creating it in FTW CODE? If so, what did you create and how was it helpful?
4. Compare the code from your group to the codes that other groups wrote. Are they different? If so, how?
5. After comparing codes, would you make any changes to yours? If so, how would you make improvements to your code to make it more efficient?

CODING EXAMPLE

```
program start
  take off Mini Drone
  rotate Mini Drone 26.6 degrees counterclockwise
  fly Mini Drone forward for 2.4 seconds at 25 % power
  hover Mini Drone
  rotate Mini Drone 45 degrees counterclockwise
  fly Mini Drone forward for 3.4 seconds at 25 % power
  hover Mini Drone
  rotate Mini Drone 71.6 degrees clockwise
  fly Mini Drone forward for 2.2 seconds at 25 % power
  hover Mini Drone
  rotate Mini Drone 45 degrees counterclockwise
  fly Mini Drone forward for 1.2 seconds at 25 % power
  hover Mini Drone
  rotate Mini Drone 11.3 degrees counterclockwise
  fly Mini Drone forward for 3.85 seconds at 25 % power
  hover Mini Drone
  land Mini Drone
```