

SPOT FIRES

LESSON PLAN | VERSION 2

LESSON OVERVIEW

Prerequisite Knowledge

- Build Essentials
- Fly Essentials
- Proportional relationships

Materials Needed

- Hopper(s)
- safety glasses
- controller(s) or FTW Fly device(s) with Bluetooth capabilities (such as iPads or smart phones)
- FTW Fly device(s) with Wifi capabilities (such as iPads or laptops)
- tape (for the floor)
- measuring tape (up to 20')
- landing pads
- fires (from Challenge Components) or other noticeable objects
- writing utensils
- towers – extension only

Time Allotment

Lesson: 1 hour (or 1 – 2 class periods), Setup: 20 minutes

Documents

- Firefighting Slide Deck I
- Firefighting Student Workbook

Vocabulary

- Remote Pilot in Command (RPIC) – the person flying the drone
- Visual Observer (VO) – the person maintaining visual contact with the drone and in communication with the RPIC
- Navigator – the person responsible for giving the RPIC directions on where to fly
- Spot Fire – a fire that starts outside the main fire
- Control Line – a constructed or natural barrier that contains fires

In this Lesson...

Students learn about and discuss the basics of firefighting. Then, they use their drone flying skills and Hopper's camera to identify spot fires before they can spread.

Learning Objectives

- Participate in a group discussion about firefighting and its current technologies.
- Learn about wildfires and understand how drones are used to identify spot fires.
- Work as a VO, navigator, or RPIC with teammate(s) to navigate Hopper together and practice drone flying skills.

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 | <p>Open the slide deck titled Firefighting Slide Deck I and have the first slide up as the students walk in. Encourage students to think about the bell ringer question:</p> <p>“What are some ways in which fires can be extinguished?”</p> <p>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.</p> <p>The last slide presents the scenario of the Spot Fires activity to the students.</p> | 15 minutes |
| Discussion & Activity | <p>Ensure the activity is set up prior to the beginning of the lesson. Allow for up to 20 minutes to set up.</p> <p>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.</p> <p>Encourage the use of aviation terms such as roll, yaw, pitch, and altitude in the communication between the RPIC, navigator, and VO(s).</p> <p>Implement the extension if time permits. Use the questions provided on page 6 to lead a group discussion with the students. Have them fill out a row in their flight log in their Firefighting Student Workbook.</p> | 45 minutes |

ACTIVITY SCENARIO

You are using Hopper to monitor a wildfire in an area of a 400-acre square. The main fire is within a 100-acre square that is surrounded by roads which are acting as control lines.

You will work with your team to identify any spot fires outside of the control lines of the main fire using Hopper's camera. Then, you will mark the locations of the spot fires on a scaled diagram.

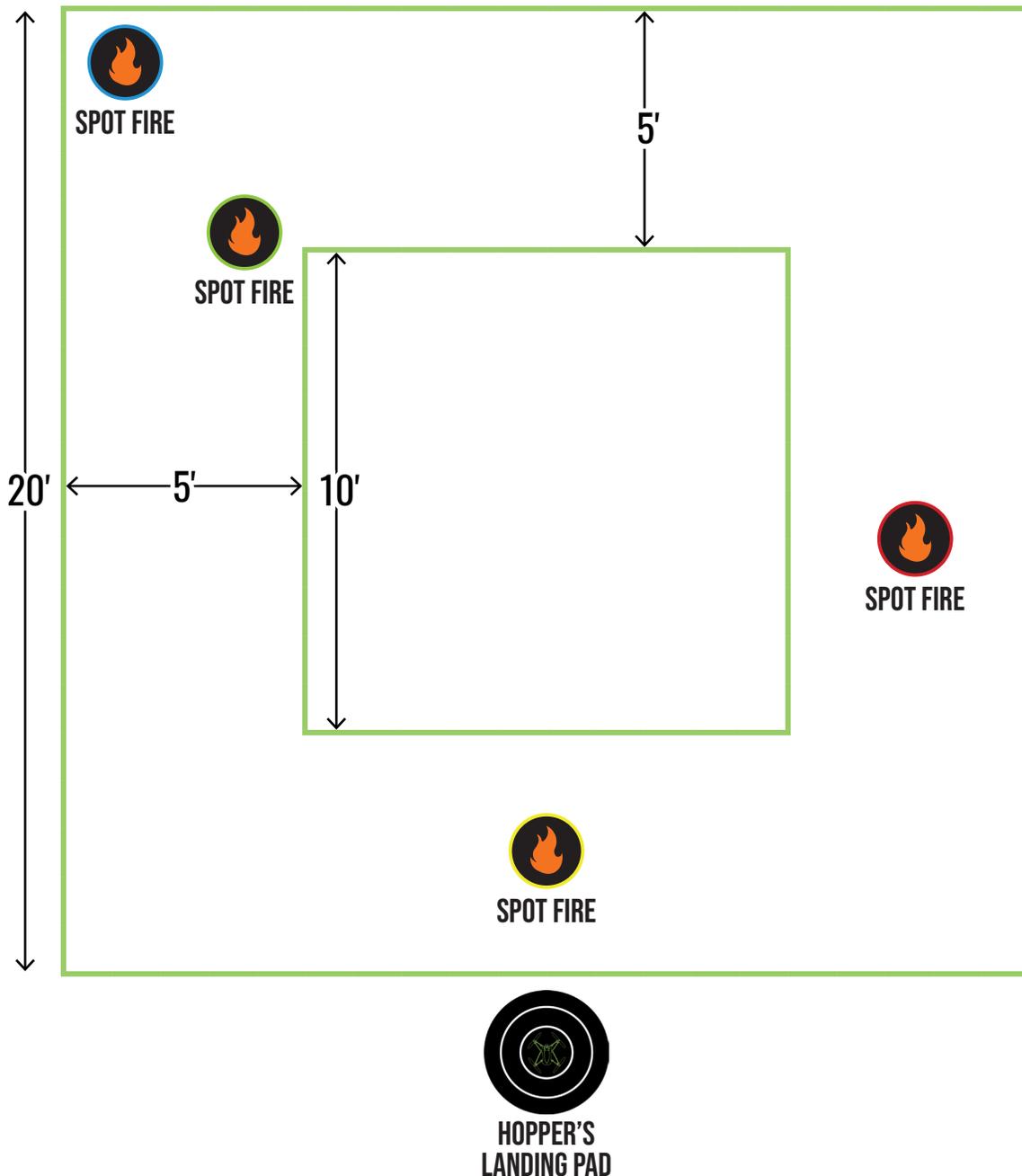
400 ACRES



ACTIVITY SETUP

Tape a 20' × 20' square on the ground which represents the fire zone. Then, tape a 10' × 10' square in the center of the bigger square (5 feet from each side) which represents concrete roadways as control lines. Place printed fires from the Challenge Components (or other noticeable objects such as landing pads or cones) inside the bigger square but outside the smaller square. These objects represent spot fires. Place a landing pad for Hopper outside of the bigger square.

An example of the setup is shown below.



ACTIVITY IMPLEMENTATION

Activity Facilitation

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

1. Assign one team member to be the RPIC (remote pilot in command) and another to be the navigator. The remaining team member(s) are the VOs (visual observers). These roles will rotate.
2. Have the RPIC and navigator place Hopper on the landing pad and have them both turn away from the flying zone. Then, have them connect their controller or FTW Fly device to Hopper through Bluetooth and Wifi in the FTW Fly App. The RPIC will focus on flying Hopper while the navigator will focus on observing the camera feed and communicating with the RPIC.

The VO(s) will retrieve and replace their team's Hopper as needed throughout the activity.

3. Have the VO(s) stand outside the flying zone where they can maintain visual contact with Hopper. They will ensure that Hopper does not go outside of the fly zone for safety. If Hopper goes outside of the fly zone and the RPIC is not able to quickly navigate Hopper back inside the fly zone, have the RPIC land Hopper immediately. A VO can then pick up and place Hopper back into the fly zone before the RPIC takes off again.

If a team crashes, a VO from that team must get a facilitator's permission to enter the fly zone and reset Hopper.

4. As the RPIC flies Hopper, either the navigator or a VO is going to mark on a scaled diagram of the fly zone (located in the Firefighting Student Workbook) where they have identified spot fires outside of the smaller square where the main fire is.

The objective of this activity is to mark the locations of the spot fires as accurately as possible. The RPIC, navigator, and VO(s) need to communicate effectively to complete each setup.

5. Change the setup for each RPIC of the same team. Consider having a setup where there are no spot fires.

Ideally, only one team would go at a time. However, up to two teams can fly in the fly zone at a time if needed.

ACTIVITY IMPLEMENTATION

Extension

If time permits, challenge the students by adding towers as obstacles to the setup so that the RPIC must also avoid them while the navigator is trying to identify the spot fires.

Post-Activity Discussion Questions

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

1. Was flying Hopper while viewing the camera stream easier or harder than flying Hopper while maintaining visual contact?
2. How did the RPIC and navigator approximate where they identified spot fires on the scaled map? How accurate did they think their markings were?
3. How did the navigator communicate with the RPIC? What kind of direction did they provide? Did the RPIC communicate back to them?
4. How was safety ensured? If Hopper flew out of the fly zone, how did the RPIC respond?

Flight Log

Have students fill out a row in their flight log in their Firefighting Student Workbook. An example of what it could look like is shown below.

| Date | Drone Model | Location | Flight Time | Notes |
|------------|-------------|----------------------------------|-------------|--|
| 04/01/2025 | Hopper | Carnegie Middle School Gymnasium | 25 minutes | My partner Dan and I flew Hopper over a wildfire to identify spot fires outside of the control lines of the main fire. Then, we marked their locations on a diagram. |