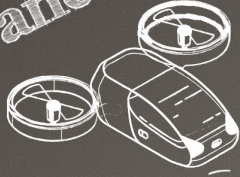




advanced air mobility

drones



urban air mobility

air taxis

STEM LEARNING:
Small Unmanned Aerial
Vehicle Safety Activity Guide

OVERVIEW

This guide presents three different activities designed to help students learn about small Unmanned Aerial Vehicle (UAV) flight safety and etiquette. The activities are designed to be done either individually or together.

Objectives

Students will be able to:

- Research current event issues surrounding small UAVs
- Explain the safety considerations and etiquette involved with operating a small UAV

Standards

Next Generation Science Standards

Science and Engineering Practices

- Obtaining, evaluating, and communicating information

Materials

- Paper—since students will be designing and making posters, large pieces of paper are recommended, but not required
- Markers, colored pencils, or crayons if students are drawing their posters

Preparation

- Gather required materials
- Print out or prepare to electronically show sample posters included in this guide

Student Prerequisite Knowledge

Before beginning this lesson, students should be familiar with:

- Types of small UAVs that are commonly used

Common Core Standards, English Language Arts

Text Types and Purposes:

CCSS.ELA-LITERACY.W.6.2.D

Use precise language and domain-specific vocabulary to inform about or explain the topic.

Research to Build and Present Knowledge:

CCSS.ELA-LITERACY.W.6.7

Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

- Computer with graphics editing software if students are creating their poster using a computer
- Internet connected device for researching small UAV regulations

Teacher Background Information

Drones and small model airplanes make up a group of aircraft called small Unmanned Aerial Vehicles, or small UAVs. Their popularity in the United States continues to grow, meaning that more people use them for commercial and recreational purposes. There are more registered drones in the United States than any other aircraft. Small UAV safety and etiquette practices are crucial skills for any pilot to learn.

The Federal Aviation Administration (FAA) is the government agency charged with overseeing and regulating civil aircraft in the United States. The FAA also controls the national airspace. Because of their responsibilities, the FAA governs the use of small UAVs.

Resources

There are many resources that can be utilized to teach students about this subject. Some well-respected authorities include:

- Find out about small UAV regulations from the FAA's website at <http://www.faa.gov>.
- The FAA joined up with the Academy of Model Aeronautics (AMA) and the Association for Unmanned Vehicle Systems International to create "Know Before You Fly," an educational site that provides guidance and regulations for the use of small UAVs: <http://knowbeforeyoufly.org>.
- An FAA safety app, B4UFly, is also available and will let you know if a small UAV is safe to fly in a specified location.

Steps

ACTIVITY 1 – DESIGN A SAFETY POSTER

For this activity, students will go to the sites listed in the Resources section of this guide, or to other sites the instructor may recommend, and create a safety poster that informs the public about one or more aspects of safe operations for small UAVs. For this activity, the instructor may also want to incorporate the many current events articles and stories about unsafe flights and their effects on society. These stories include small UAVs interfering with wildfire operations and larger aircraft flights, small UAVs colliding with larger aircraft, and small UAVs flying over crowds of people. Posters can be more general in nature or can focus on a specific topic. Some samples of small UAV safety posters created by government agencies are included in appendix 1.

Basic Flight Safety Guidelines:

- Obey all national and local UAV flight rules, including No Fly Zones.
- Check the “Know Before You Fly” website for specifics: <http://knowbeforeyoufly.org> or check with your local model aircraft flying club for more info.
- Always remember that you are responsible for your UAV's flight!
- Make sure you have the property owner's permission before you fly at any location, and check for any flight restrictions.
- Check your UAV for flight readiness each time you fly. Look for any damage that may prevent your UAV from flying properly.
- Fly your aircraft within your line of sight.
- Don't fly your aircraft over anyone's head or in populated areas. This applies only if not required to fly within a netted flight test area.
- Fly in an open area, away from power lines, trees, and other obstacles. This applies only if not required to fly within a netted flight test area.
- If you are losing control of your aircraft, land your craft.
- Before flying your UAV, make sure spectators are aware you will be flying.
- Pay attention to weather conditions; don't fly in high winds, rain, or other questionable weather situations.
- Make sure you avoid all obstacles. It is your responsibility to get your UAV out of the way!
- When in doubt, don't fly.
- Know how to fly and control your UAV.
- Respect personal privacy; don't take photos or invade someone's personal space.

ACTIVITY 2—IS IT SAFE TO FLY?

For this activity, students will select a location (such as school or home) and use the B4UFly app, the “Know Before You Fly” AMA Flying Sites Map available at <http://knowbeforeyoufly.org/for-recreational-users/>, or another site of the teacher’s choosing in order to find out if there are any flight restrictions in that area. If so, they should research what those restrictions are. They should then write a 1–2 paragraph explanation or make a presentation to the class about what restrictions apply to that area. The paragraph(s) and/or presentation should be explanatory and should be written for a small UAV pilot that is planning on flying in that location.

ACTIVITY 3—WHAT SHOULD YOU DO?

This activity asks students to consider at least one of the following scenarios and decide what they would do in each case. This can be a written assignment or can be done as a group discussion. These scenarios relate to safety, etiquette, or both. Students should refer to the rules they’ve researched in activity 1 in order to discuss these scenarios. If activity 1 was not completed, students can use the same resources listed in order to complete activity 3.

- **Scenario A:** At a family picnic, your uncle knows you can fly drones and asks you to fly one around the picnic and record a video of the occasion that is being held in the neighborhood park. It is a busy Saturday afternoon. The family is eating and socializing in a reserved picnic area. Then, the family decides to go to the softball field across the street. Finally, the evening concludes with roasting marshmallows in a fire pit.
 - Should you fly your drone at this event? If so, what—if any—rules should you make sure to follow?
- **Scenario B:** You always hear a strange noise coming from your neighbor’s yard at sunset. You want to see what the noise is, just on the other side of the privacy fence, but you don’t know your neighbor that well and don’t feel comfortable asking them about the noise.
 - Should you fly your drone to try to figure out what the noise is? What are the legal versus ethical parts of this question?
- **Scenario C:** Your parents own a real estate company and want to hire you to take photos of houses they are trying to sell.
 - Are you allowed to do this? If so, what are the requirements?

APPENDIX 1—SAMPLE POSTERS

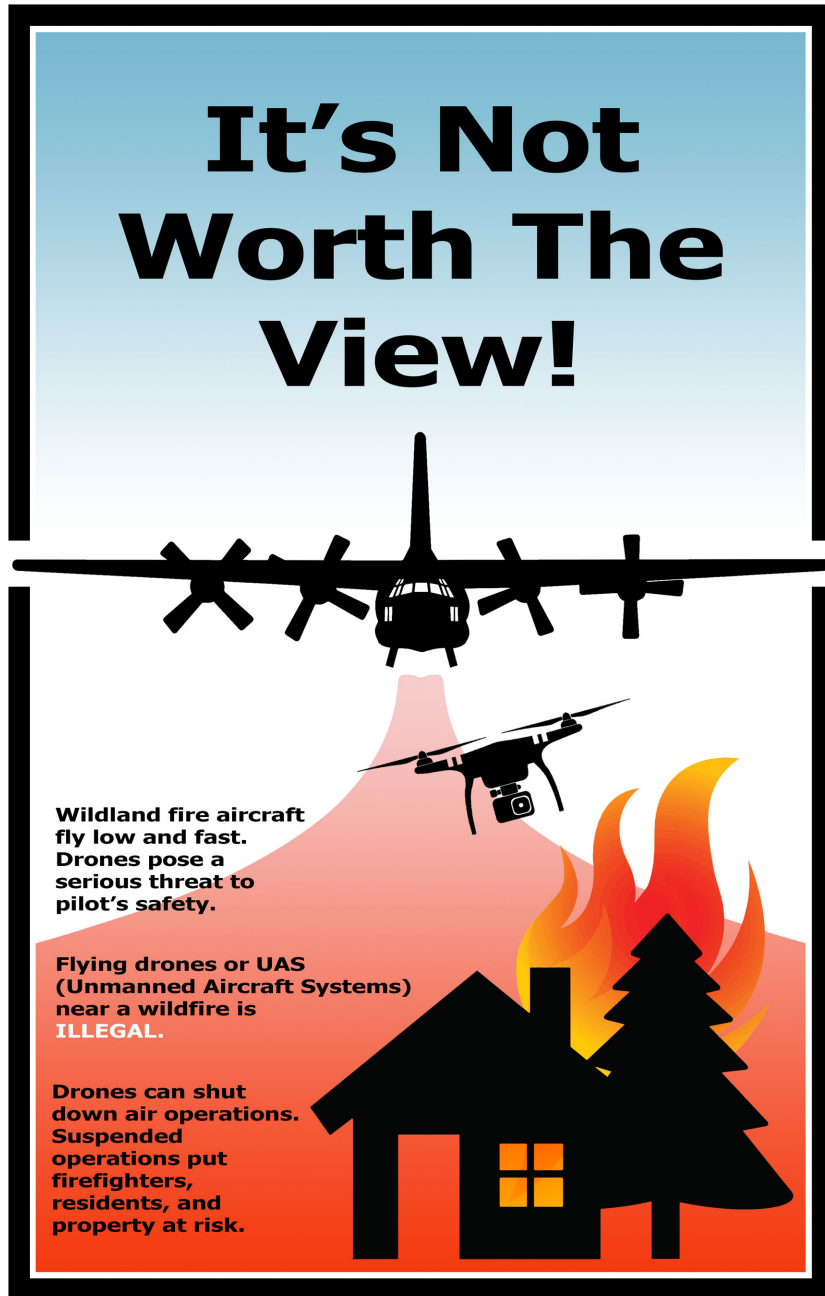


Figure 1. https://www.fs.usda.gov/Internet/FSE_MEDIA/fseprd507872.jpg

**IF YOU FLY,
WE CAN'T**

**RECREATIONAL DRONES
NEAR WILDFIRES ARE NOT SAFE**

Flying recreational drones over or near wildfires could cause injury or death to firefighters and hamper the effectiveness of wildfire suppression operations.

If recreational drones are detected over or near a wildfire, aerial firefighting aircraft may be grounded, causing wildfires to grow larger and unduly threaten lives, property, and natural and cultural resources. Individuals who interfere with wildfire suppression efforts may be subject to civil penalties and criminal prosecution.

**CONTACT YOUR NEAREST
LAND MANAGEMENT AGENCY
OFFICE TO LEARN MORE ABOUT
FLYING DRONES ON PUBLIC LANDS.**

USDA is an equal opportunity provider, employer, and lender. Revised January 2018 FS-1057a

USDA United States Department of Agriculture United States Department of the Interior

#IFYOUFLYWECANT #NODRONESINFIREZONES

Figure 2. <https://www.nifc.gov/drones/outreach.html>


Hobby / Recreational Flying

What Can I Do With My Model Aircraft?

Having fun means flying safely! Hobby or recreational flying doesn't require FAA approval but you must follow safety guidelines. Any other use requires FAA authorization.


AVOID DOING ANYTHING HAZARDOUS TO OTHER AIRPLANES OR PEOPLE AND PROPERTY ON THE GROUND

- ✔ **DO** fly a model aircraft/UAS at the local model aircraft club
- ✔ **DO** take lessons and learn to fly safely
- ✔ **DO** contact the airport or control tower when flying within 5 miles of the airport
- ✔ **DO** fly a model aircraft for personal enjoyment
- ❌ **DON'T** fly near manned aircraft
- ❌ **DON'T** fly beyond line of sight of the operator
- ❌ **DON'T** fly an aircraft weighing more than 55 lbs unless it's certified by an aeromodelling community-based organization
- ❌ **DON'T** fly contrary to your aeromodelling community-based safety guidelines
- ❌ **DON'T** fly model aircraft for payment or commercial purposes



For more information about safety training and guidelines, visit www.knowbeforeyoufly.org

For more information, visit www.faa.gov/uas



Federal Aviation Administration

Figure 3. <https://www.af.mil/Portals/1/images/151123-F-XXXXX-900.jpg?timestamp=1448298206231>

APPENDIX 2—ACTIVITY 3 ANSWER KEY

Scenario A: At a family picnic, your uncle knows you can fly drones and asks you to fly around the picnic and record a video of the occasion that is being held in the neighborhood park. It is a busy Saturday afternoon. The family is eating and socializing in a reserved picnic area. Then, the family decides to go to the softball field across the street. Finally, the evening concludes with roasting marshmallows in a fire pit.

- Should you fly your drone at this event? If so, what—if any—rules should you make sure to follow?
 - It is okay to fly your drone at this event as long as others at the event are aware that you are doing so. Do not fly over people's heads, keep the drone in your line of sight, and do not fly 30 minutes after sunset. If flying the drone at the softball field, consideration should be made not to disturb others at the park and be careful not to fly over others' heads.

Scenario B: You always hear a strange noise coming from your neighbor's yard, just at sunset. You want to see what the noise is, just on the other side of the privacy fence, but you don't know your neighbor that well and don't feel comfortable asking them about the noise.

- Should you fly your drone to try to figure out what the noise is? What are the legal versus ethical parts of this question?
 - Privacy concerns are a huge topic with small UAVs. It is not legal or ethical to fly a drone in order to infringe on another's right to privacy.

Scenario C: Your parents own a real estate company and want to hire you to take photos of houses they are trying to sell.

- Are you allowed to do this? If so, what are the requirements?
 - If flying a drone commercially, a drone pilot's license or "remote pilot certificate with a small UAS [unmanned aircraft system] rating" is required. You need to be at least 16 years old to earn this certificate, which falls under FAA regulation Part 107.

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