AERONAUTICS & AEROSPACE
ACTIVITY BUNDLE

For Grades 3-5

Four hands-on STEM activities that introduce grade 3-5 learners to Aeronautics & Aerospace careers through investigation, experimentation, and play.

STEM NEXT
OPPORTUNITY FUND

STEM Next Aeronautics & Aerospace Activity Bundle (Grades 3-5)

Welcome to the STEM Next Aeronautics & Aerospace Activity Bundle! This bundle is one of three bundles now available from the Earth & Space Learning Center of Excellence, powered by the Institute for a STEM Ready America.

Use the four activities below to inspire youth grades 3-5 with hands-on science. Through these activities, youth will develop foundational STEM skills by engaging in hands-on investigations of aeronautics and aerospace concepts while building career awareness by exploring how professionals use science, technology, engineering, and math.

Interested in more resources like this from STEM Next? Check out our Tools in our online Resource Library.

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Lesson 1: Cloud Chasers

In this lesson, youth will be able to:

- Explain how clouds form in the atmosphere.
- Explain how lightning forms in the atmosphere.
- Identify different types of clouds based on a dichotomous key.

Time needed: 60 minutes

Preparation

Materials	• Jar with a lid (1 for demonstration) • Ice • Water • Hairspray (any brand) • Balloon (1 per demonstration, if having groups of youth participate then 1 per group) • Spoon or lightbulb (1 per demonstration, if having groups of youth participate then 1 per group) • Cloud Identification Chart (1 per youth) • Dichotomous Key Handout (1 per youth group)
Setup	• Gather all materials • Copy Cloud Identification Chart • Copy Dichotomous Key Handout
Presentation	Slides

Facilitation

Overview:

In this activity, youth will investigate how clouds and lightning form. Youth will practice making observations and using guiding questions to identify the different types of clouds.

Engage:

1. Ask: *What are clouds made of?* Allow guesses from the group. Explain that today we are going to make a cloud in a jar.

2. *This is best done as a facilitator demonstration.* Fill the jar ½ full of hot water. Swirl it around to warm up the sides of the jar. Turn the lid upside down and place it on the top of the jar. Place several ice cubes onto the lid, and allow it to rest on the top of the jar for about 20 seconds. Remove the lid, quickly spray a bit of hairspray into the jar, and then replace the lid with the ice still on top.

3. Ask the group again what makes up a cloud. Allow new ideas to be shared. Explain (Slide 2): *When you add the warm water to the jar, some of it evaporates and turns to water vapor. The water vapor rises to the top of the jar where it comes into contact with cold air, thanks to the ice cubes on top. Water vapor condenses (turns from a vapor to a liquid) when it cools down. However, a cloud can only form if the water vapor has something to condense onto. In nature, water vapor may condense onto dust particles, air pollution, pollen, volcanic ash, etc. In the case of this activity, the water vapor condensed onto the hairspray.*

4. Ask: *How does lightning form?* Allow several youth to share their ideas.

5. *This demonstration is best done in a very dark room*. You may opt to have 2-3 youth work together to complete this as a hands-on experience rather than a demonstration. Blow up a balloon and tie it off. Ask for a volunteer and rub the balloon in the volunteer's hair for 2-3 minutes. In a darkened room, slowly bring the spoon into contact with the balloon. Pay close attention because the lightning forms quickly. If you are using a light

bulb, follow the same procedure, but touch the end of the light bulb to the charged balloon.

6. Explain (Slide 3): *Lightning is like a giant spark of electricity in the sky. Inside clouds, tiny pieces bump and rub together, creating electrical charges. The top of the cloud gets positive charges, and the bottom gets negative charges. The negative charges in the cloud make positive charges gather on the ground below. These charges collect around tall things like trees, mountains, and people. When the charges from the cloud and the ground connect, a big spark jumps between them. That's lightning!*

Investigate:

1. Ask: *Do all clouds produce rain and lightning?*
2. Explain that today they are going to identify different clouds. Divide youth into groups of 2. Pass out the Cloud Identification Chart. Discuss the different types of clouds.
3. Show pictures of various cloud formations (Slide 4-6) and have youth practice using the Cloud Identification Chart to identify the clouds in the pictures. Ask youth to explain why they identified the cloud the way they did.
4. Distribute one Dichotomous Key Handout to each group. Take the time to mention the meaning and purpose of a dichotomous key and explain that scientists use this type of tool in many different contexts. Field guides are often written in this format.
5. Take the group outdoors to begin cloud observations. Youth should work in their groups to complete the Dichotomous Key Handout.

Wrap-up:

Once everyone has had time to complete the handout, discuss what types of clouds they see. Use this information to have youth predict what the weather will be like in the next few hours

Implementation

Extension:

- Citizen Science: GLOBE Clouds is a citizen science program that allows everyone to observe and record cloud conditions in their area, then submit their data to scientists around the world. By collecting information about

cloud type, cloud cover, and sky conditions, participants help researchers better understand weather patterns, climate, and how clouds affect Earth's atmosphere.

Career Connection:

- Meteorologist
    - Share the Career Profile
    - Look at local weather maps: Youth love to interact and explore the weather maps at the National Weather Service. Have the group look up the temperature in your location or any location in the US, Find the location in the US that is the windiest, or just let youth ask and answer their own weather questions.

Lesson 2: Rocket Racers Challenge

In this lesson, youth will be able to:

- Use the engineering design process to solve a problem.
- Explain how rocket design features, such as fins and size, influence flight performance.
- Collect observations from tests and use evidence to make design improvements that increase rocket stability and distance.

Time needed: 60 minutes

Preparation

Materials	• Plastic straws • Tape, scotch and painters • Various types of paper (tissue, copy, construction, card stock) • Scissors
Setup	• Cut paper the length of the straw. • Tape off a designated landing zone to use during the final test.
Presentation	Slides

Facilitation

Overview:

In this activity, youth explore the science of rocket flight by creating and testing their own straw rockets. Youth will use the engineering design process to build, test, and improve rocket prototypes, investigating how design features such as fins, size, and materials affect stability and distance.

Engage:

Show the video (Slide 2), Artemis II Launches Astronauts to the Moon. Discuss students' reactions to the video and to space travel in general. Explain that today they will make their own straw rockets to model how engineers designed the rockets for Artremis.

Investigate:

1. Demonstrate how to make a straw rocket and launch it.
    - Roll a piece of paper around a pencil to create a tube.
    - Apply a small piece of tape to hold the tube together.
    - Close the top of the rocket with scotch tape.
    - Insert a plastic straw and blow to launch the rocket.

2. Ask the group: *What is my rocket missing that many rockets have? What is the advantage of having fins on the rocket? Do you think I could make my rocket travel further? How?*
3. Explain the challenge to the group (Slide 3): Design a straw rocket that will travel furthest in a straight path. Share the constraints and criteria.
    - Criteria
        - Your rocket must be launched from a straw.
        - It must land in the landing zone.
    - Constraints
        - You may only use the materials that your group is provided.

4. Divide students into small teams. Distribute the materials. Allow 15-20 minutes to build a prototype. During this time encourage youth to build, test and redesign as needed. As youth work, you should circulate and assist by asking groups some guiding questions such as: *Have you tried different kinds of paper? Did the size of the fins affect the distance? Did the size of the rocket affect the distance?*

Wrap-up:

Bring the group back together for the blast off. Have all groups launch their rockets at the same time to determine who met the challenge. After the launch examine the rocket that went the furthest and discuss how that design was different or the same as the rest. Ask what important characteristics were needed for a successful rocket. Ask each group how they think they could make their rocket even better.

Implementation

Extension

Have each group measure the distance that their rocket traveled. Compile the total distance that all the rockets in the group traveled. Calculate the average distance that the rockets in the group traveled.

Career Connection:

- Aerospace Engineer
    - Share Career Profile
- Satellite Technologist
    - Share Career Profile

Lesson 3: Rescue Mission

In this lesson, youth will be able to:

- Explain how drones are used to solve real-world problems.
- Use grid coordinates and systematic search patterns to plan and navigate an efficient search route.
- Collaborate effectively by communicating clear directions, adapting to changing conditions, and revising plans.

Time needed: 60 minutes

Preparation

Materials	• Printed satellite maps of a local park or forest, if you do not have a map of local space available you may choose to use the attached map of a national forest. • Map grid • Clear plastic sheet protectors (1 per youth group) • Dry-erase marker (1 per youth group) • Coin or game piece to act as the "drone."
Setup	• Gather all materials • Copy satellite map and grid
Presentation	Slides

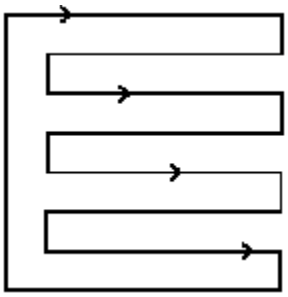
Facilitation

Overview:

In this challenge, youth explore how drones are used in real-world search and rescue missions by planning and carrying out systematic grid searches. Working in pairs, participants use maps, coordinates, and communication skills to navigate a drone through a search area while overcoming obstacles and conserving battery life.

Engage:

1. Ask youth: *What is a drone? How does a drone work? Do any of you have a drone?* (Slide 2) Allow youth to share their experiences. Explain: D*rones have many possibilities. Drone pilots are often called to find lost hikers or animals because drones can see things from high above. The thing is, drones cannot just fly around randomly. They will run out of battery. They must follow a strict, efficient grid pattern.*
2. Group youth into pairs. Hand out the satellite map and clear sheet protector to each group. Have youth place the map into the protector. Show youth how the grid works using letters (A, B, C) on the side and numbers (1, 2, 3) across the top. Practice finding a coordinate together (e.g., "Put your finger on grid square B-4").
3. Assign a role to each youth in the group. One is the Mission Planner and the other is the Drone Pilot.
4. Using the dry-erase marker, have them practice drawing a "Lawnmower Pattern" (parallel lines back and forth across the map squares) to ensure 100% coverage of the area without wasting battery by overlapping rows (Slide 3).



Investigate:

1. Tell youth the challenge: *We just received an emergency alert. A group of hikers went exploring in the woods, and they haven't returned. The forest is too thick and too large for park rangers to search on foot before the sun goes down. We need eyes in the sky. Today, you are Drone Search and Rescue Teams* (Slide 4).
2. Tell youth: *You will work in pairs. One of you will be the Mission Planner on the ground. You know where the hiker is, but you cannot fly the drone. The other person is the Drone Pilot. Pilots, you will close your eyes while the Planner hides the hiker on the map. When you open your eyes, you have to move your drone piece square-by-square based only on the directions*

your Planner gives you. Remember that you have limited battery time and need to use a specific grid search.

3. How to play:
    - Have the "Pilots" close their eyes, the "Mission Planners" choose the location of the lost hiker by writing down one secret grid square on the map to represent the lost hiker. The Mission Planners can choose any square but should not tell the Pilot the location.
    - The Pilot "launches" their drone (a coin or game piece) at square A-1.
    - The Mission Planner gives verbal coordinate commands (e.g., "Fly east to B-1, fly east to C-1, fly south to C-2"). The Pilot draws the flight line with the dry erase marker as they move their piece. Remind youth that the drone can move up and down, but not diagonally. The Pilot must systematically search the grid until they land on the hidden hiker.
    - As youth work, introduce "Wind" or "No-Fly Zones." Walk from group to group and draw a red circle on three random grid squares. The drone cannot cross these squares and must program a route around them.
    - Have the group swap roles so both youth get a turn to plan and pilot.

Wrap-up:

Ask: *What were the challenges? What happened to your battery line if you didn't plan your path first? How did the No-Fly zones change your strategy? What skills would a drone pilot need to be successful?*

Implementation

Career Connection:

- Drone Pilot
    - Share Career Profile
- Helicopter Pilot
    - The Helicopter Pilot: I Can be a What?: Helicopter pilot Shelley talks about her job flying an emergency medical helicopter. (Play 0:17–1:44; total length 8:30)

Lesson 4: Ready for Takeoff! Aviation Career Game

In this lesson, youth will be able to:

- Identify a variety of aviation careers and describe how they contribute to the design, operation, maintenance, and support of aircraft.
- Compare careers based on required skills, education, training, and working conditions.

Time needed: 20 minutes

Preparation

Materials	• Set of Aviation Career Cards (1 set per youth group)
Setup	• Copy and cut apart career cards. ○ It is suggested to print career cards on heavy cardstock to make the game easier to play.

Facilitation

Overview:

In this review activity, youth discover the wide variety of careers that support the aviation industry through brainstorming and a collaborative matching card game. As they play, participants identify the skills, education, and working conditions associated with different aviation careers while expanding their understanding of the many ways people contribute to air travel and aerospace.

Engage:

1. Have the group brainstorm all the reasons people use aircraft. Write these ideas on a whiteboard or piece of chart paper. Prompt students with some suggestions if they are having difficulty. Responses can include:
    - Moving people
    - Moving things

- Helping people (e.g., search and rescue)
- Fighting fires
- Getting people to the hospital

2. Have the group brainstorm careers/jobs of people that work with and on aircraft. Write these ideas on a whiteboard or piece of chart paper. If students find this task challenging, you could provide some category prompts such as people who:
    - Design aircraft
    - Build aircraft
    - Fly aircraft
    - Fix aircraft
    - Help passengers on aircraft
    - Help direct aircraft to their destinations

Investigate

1. Divide the group into teams of 3. Give each team a deck of Aviation Career Cards.
2. Explain that they will play a card game similar to Old Maid. The goal is to create as many pairs as possible and be the first one with no cards left.
    - Choose one dealer. Have the dealer shuffle the cards. The dealer will distribute all the cards face down to all the players.
    - Players will look at their cards. The player to the left of the dealer will start. They will try to make a pair from the cards in their hand. Players make sets by matching the words in the Skills, Working Conditions, or Education and Training sections of the cards.
    - If the player does not have a pair in their hand, they ask any player for a specific type of card (e.g., “Do you have a person who works outside? Do you have a person who needs on-the-job training?”). If that specific player has a card matching the description, they must give the card to the player who asked. If the asked player does not have the card, they simply say no.
    - Play then continues moving to the left. Players will continue to take turns until one player has gone out or there are no more pairs to be made.

- Have youth play several rounds.

Wrap-up:

After the group has played several rounds, bring all back together. Ask: *What new careers can we add to the list we started earlier?* Add any additions to the list on the chart paper or whiteboard. Ask: *Which career sounded the most interesting? Do you think you would like any of these careers? Why?*

Implementation

Alternative Facilitation

Career Guess Who: Give each pair of students a set of Aviation Career Cards. Lie all cards face up on the table. One student chooses a career card without revealing it to their partner. With all the cards still lying face up on the table, the other asks yes/no questions (e.g., "Do they work outdoors?" "Do they need a university degree?") until they guess the career. Switch roles. *To keep the game moving, it is recommended to limit the number of questions asked before the career is revealed. For example, limit it to 10 or 20 questions.*