



Drone Exploring: Career Spotlights

Exploration — Club

Overview: Drones let scientists and explorers reach places that are too dangerous, too remote, or too small for people to explore directly, from erupting volcanoes and deep caves to the surface of Mars, where NASA's Ingenuity helicopter flew for the first time. In this session, youth explore how drones support scientific exploration in extreme places and design their own concept drone built for a tough environment.

OBJECTIVES

- Introduce youth to the career of using drones for scientific exploration in extreme or remote environments.
- Explain how drones let scientists study places too dangerous or too small for people to explore directly.
- Practice engineering thinking by designing a concept drone for a specific extreme environment.
- Build curiosity about how exploration technology keeps advancing into new frontiers.

SUPPLIES

- Flip chart or whiteboard and markers
- Craft supplies for the drone design activity (paper, cardboard, pipe cleaners, tape, markers)
- Printed or projected images of extreme environments (volcano, cave, polar ice, Mars surface)
- Printed handouts: Drones in Extreme Exploration and Design Your Explorer Drone

ADVISOR NOTES

- Highlight NASA's Ingenuity Mars helicopter as a real example of a drone exploring another planet.
- Encourage creative engineering thinking: There's no single "right" design for the explorer drone activity.
- Discuss how remote or extreme environment exploration often requires teams of engineers, scientists, and pilots working together, not just one person.
- Consider inviting a guest speaker (a research scientist, robotics engineer, or someone who has done fieldwork in extreme environments) to share their experience. See Optional Extensions.
- If no guest speaker is available, Advisors can run the entire session using this outline and the resource links below.

SESSION OUTLINE

- **Welcome and Icebreaker** (10 min)
 - "Extreme Places:" Ask youth to name the most extreme or remote place they can think of (deepest ocean, tallest volcano, coldest pole, another planet).
- **Safety Moment (Why Robots Go Where People Can't)** (10 min)
 - Extreme environments like volcanoes, deep caves, or space are too dangerous or too far for people to explore safely and often.
 - Drones let scientists gather data and images from these places while keeping people safe.
 - Ask: "Why do you think it's important to send a drone first, before sending a person, into a dangerous or unknown place?"
- **Mini-Lesson: Drones in Extreme Exploration** (15 min)
 - Show images or discuss examples: drones monitoring active volcanoes, mapping deep caves, studying polar ice, and NASA's Ingenuity helicopter flying on Mars.
 - Discuss what makes each environment challenging (heat, darkness, cold, thin atmosphere) and what a drone would need to survive it.
- **Activity: Design Your Explorer Drone** (25–30 min)
 - Assign each small group an extreme environment (volcano, cave, polar ice, or Mars).

- Using craft materials and the Design Your Explorer Drone handout, groups design a concept drone with features suited to their environment (heat shielding, lights, extra insulation, etc.).
- **Wrap-Up Share-Out (10 min)**
 - Groups present their explorer drone designs and explain why they chose each feature.

REFLECTION SECTION

Advisor Note: Some sample questions are below. They are designed to help the participants apply what they have learned to their own interests. You are welcome to use these questions or develop your own.

Focusing Questions

- What was the most fun part of designing your explorer drone?
- Which extreme environment would you most want to explore with a drone, and why?

Analysis Questions

- Why did your team choose the features you did for your environment?
- What's one challenge a drone might face in your assigned environment that a person would also face, and one that only affects machines?

Generalization Questions

- Where else in life do people use tools or machines to explore places or situations that are hard or risky to handle directly?
- What's one extreme place you'd like to learn more about?

Challenge: This week, research one real exploration mission (on Earth or in space) that used a drone or robot and share one fact you learn.

OPTIONAL EXTENSIONS

Guest Speaker: Invite a research scientist, robotics engineer, or someone with fieldwork experience in extreme environments to share their story, in person or by video call.

Advisor-Led Option: If a guest speaker isn't available, Advisors can run this session using the outline above and the resource links below. No outside expert is required.

Resource Links: search "NASA Ingenuity Mars helicopter" or "drones exploring volcanoes" on a video platform for kid-friendly explainer videos.

Group Extension: Write a short mission log entry from the point of view of your explorer drone describing what it discovered.

Handout: Drones in Extreme Exploration

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Read through the examples below before starting the Design Your Explorer Drone activity.

Volcanoes

Drones fly close to active volcanoes to measure gases and capture footage without risking a scientist's life.

Caves

Small drones can map deep, dark cave systems that would be difficult or unsafe for people to explore fully.

Polar Regions

Drones survey sea ice and glaciers to study climate change in extremely cold, remote areas.

Mars

NASA's Ingenuity helicopter became the first aircraft to fly on another planet, scouting terrain for the Perseverance rover.

Handout: Design Your Explorer Drone

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For your assigned environment, list at least 3 special features your drone needs and explain why.

Feature

Why It's Needed
