EDUCATOR'S GUIDE

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VIRGINIA PENINSULA COMMUNITY COLLEGE
Glossary

- Drones: A vehicle that flies with no human on board
- Airspace: The legally available area in which aircraft can be flown
- PTS: Post-traumatic stress can occur after a person experiences a shocking, terrifying or dangerous event. It may cause nightmares or flashbacks and interfere with daily life.
- Aerial: Operating or existing in the air
- Ethics: Moral principles that influence how a person behaves
- Surveillance: Close watch over an area in order to collect information

Additional Resources

Web
Center for the Study of the Drone at Bard College: dronecenter.bard.edu/

Books
Drones in Education: Let Your Students' Imaginations Soar by Kimberly Crowley and Laura B. Zieger

Introduction

Over the last 75 years, drones have evolved from remote-controlled planes used for target practice into versatile and highly specialized aircraft. Drones—sometimes called remotely piloted vehicles, unmanned aerial systems or unpiloted aerial vehicles—fly with no human on board. This capability, along with a combination of onboard and remote control technologies, gives drones significant advantages over piloted aircraft. Equipped with various degrees of autonomy, or self-control, drones perform long-duration, high-altitude surveillance. Others, armed with missiles, fly over and strike targets with a high degree of accuracy, without endangering the lives of pilots. Soldiers in the field carry suitcase-sized drones used to observe enemy positions. Drone helicopters deliver supplies to dangerous or hard-to-reach locations. Loaded with cameras and remote sensing equipment, some drones perform aerial surveys to analyze crop production and monitor the effects of climate change. Recreational drones have spawned the new sport of drone racing and given photographers and artists dynamic new ways of showing us the world. As these aircraft fill the skies, they raise concerns about airspace, privacy and ethics in modern warfare. But these concerns are eclipsed by excitement for their potential: someday drones will explore Mars, serve as pilotless flying taxis, and deliver packages and groceries to our front doors.
Essential Questions

Use the Essential Questions below to connect the themes of the exhibition to your educational curriculum. To explore these questions, please visit the sections listed in green in this exhibition guide and within the exhibition itself.

How have drones changed over time?
- History of the Drone
- Military Drones
- Drones, Drones, Everywhere!

How is drone technology a positive advancement or a negative advancement?
- Controversies
- Drones, Drones, Everywhere! Is the Sky the Limit?

Student Extension Activities

- Have students write down observations and questions as they walk through the exhibition. Have students then use their notes during a discussion of the question “Does drone technology have a positive or negative impact on society?”

- Have students identify different jobs in their community and record their answers. Group students in pairs and have them design a drone that would assist each job listed.

- Ask students to compare drones to piloted aircraft and debate the benefits of using piloted aircraft or unmanned aircraft to achieve a task.
Teaching in the Exhibition

Main Introduction

Exhibition Introduction (text panel)
Drones—sometimes called remotely piloted vehicles, unmanned aerial systems or unpiloted aerial vehicles—fly with no human on board. This capability, along with a combination of onboard and remote control technologies, gives drones significant advantages over piloted aircraft. Students can discuss what comes to mind when they hear the word “drone” and how they think drones are typically used.

History of the Drone

History of the Drone (text panel)
Unmanned kites and balloons predate human flight by hundreds of years. The invention of gas-filled balloons in the 18th century made human flight feasible. The first practical winged aircraft was developed in the early 20th century. Daring aviators flew higher and farther, and flying machines soon revolutionized warfare. Have students discuss the limitations of early drones.

Images of Early Drones
Early inventors lacked flight experience but constructed pilotless aerial vehicles that observed battlefields and even carried weapons. The earliest vehicles were in the form of balloons and kites. In December of 1903, the Wright brothers designed the first winged aircraft capable of carrying people. Soon after, this breakthrough was adapted for pilotless applications in warfare. Students can discuss what they notice about these early drones and what scientific advances were necessary to bring drone technology to the next level.

Radioplane OQ-2/TDD Target Drone (scale model)
After World War I (1914–1918), aviation technology boomed. The technology inspired a new hobby and created an upsurge in model airplane enthusiasts, including Reginald Denny, a famous silent film actor of the 1920s. In 1940, Denny founded the Radioplane Company, which designed and manufactured some of the first radio control equipment for model aircraft. At the outbreak of World War II, Denny adapted his technology for the war effort. The result was the OQ-2/TDD aerial target drone. Ask students: What did target drone technology make possible?

Japanese Balloon Bombs (video and images of guided bombs and weapons)
With advancements in guidance and control systems, drones became a true weapon during World War II. Unpiloted aircraft successfully carried weapons or served as the weapon itself. Have students read the labels for objects on this wall and watch the video about Japanese balloon bombs. Ask students: What were these drones capable of doing? What were the limitations of this drone technology?

Gyrodyne QH-50 Drone Anti-Submarine Helicopter (DASH) and AAI Corporation RQ-2 Pioneer (scale models)
During the Cold War era (1947–1991), drones supported intelligence operations. Jet engine technology was applied to drones for increased speed and altitude. More advanced computers improved preprogrammed flight paths, and more sophisticated cameras captured high-resolution images. Space-based satellites, also used to capture imagery, slowed the adoption of drones, but ultimately drones provided more precision. By the 1990s, drone systems rose to prominence in part because of their video capabilities, used in counterterrorism and counterinsurgency operations as an alternative to manned aircraft. Have students discuss why drone technology might be preferred for surveillance missions over satellites and manned aircraft.
Teaching in the Exhibition

Military Drones

Military Drones (text panel)
Drones are cheaper than piloted aircraft and keep soldiers out of the line of fire. With these benefits, they will be adapted for even more tasks in the future. Drones will transport ammunition and fuel to dangerous terrain on a routine basis, evacuate casualties and act as communication relays. Ask students: How do you think the military's use of drones will expand in the next decade?

Military Operations Today (text panel)
The U.S. military classifies drones into five groups according to weight, operating altitude and airspeed. Most military drone operations today focus on gathering information or deploying weapons. These vehicles will soon have additional capabilities, such as supply transport, medical evacuation or communication relay between units. Drones are also a force multiplier—another tool in the arsenal for commanders. Have students read the text panel and identify how the groups of drones differ.

Logistics (Cormorant 18” scale model)
Extended military campaigns require significant resources to keep forces prepared professionally, physically and psychologically. Typically, getting supplies to the front lines requires a complex logistical chain from the home base to international outposts. Transporting food, ammunition and fuel through contested or enemy territory is often a risky endeavor. Have students look at the scale model of the Cormorant and watch the video of it in action. Ask students: How might these types of drones benefit military operations?

Drones in Everyday Life

Drones, Drones, Everywhere! (text panel)
Military advances paved the way for a new generation of inexpensive and sophisticated unmanned aerial systems. Lightweight, portable and easy to operate, drones of the 21st century have been adapted for civilian, scientific and commercial use. Have students explore this section of the exhibition to identify four potentially positive effects of civilian drone use and four potentially negative effects.

Fireman’s Helper (text panel with video)
An aerial perspective is an asset to security and public safety. In the United States, border protection, municipal police and fire departments, and other agencies use un piloted vehicles as their eyes in the sky. Students should identify how aerial drone surveillance can be helpful to various municipal agencies.

DJI Phantom Pro 4 and Citadelle (video)
Photographers and filmmakers use drones to shift visual perspectives and evoke a unique sense of space and landscape. Recreational imaging has raised privacy concerns, and the use of drones for these purposes has been limited by law. Many countries are struggling to define regulations and rules. Ask students: What regulations regarding privacy do you feel are necessary in our society?
Teaching in the Exhibition

Is the Sky the Limit?

In The News (interactive station)

Much like GPS and the Internet, drones may become as critical to civilian life as they are to the military. As drones become more widely available, the applications of this technology are limited only by the imagination. For now, concerns about civilian drone use center on privacy issues, airspace and data hacking, but the future holds more questions. As militaries around the world adopt these increasingly capable and agile aircraft, weaponized drones will challenge the rules of warfare, especially on future urban battlefields. Have students explore this section of the exhibition and identify what drone usage might look like in the future. Ask students: How should drones be regulated? Have students explain their answers with examples from the exhibition.