Unit 5

Jetmen flying over the city of Dubai, United Arab Emirates

TO START

1. We all know that birds fly. What other living things fly? Make a list of as many as you can.
2. Why do you think humans have always wanted to fly?
3. Would you like to be able to fly? Why or why not?

‘From flying dinosaurs to jet packs, the ability to soar among the clouds has always captivated our imagination.’

Ryan Carney

Flying High

1 **Which animal do you think was the first to fly? Why?** Discuss. Then listen and read. 058

350 million years ago

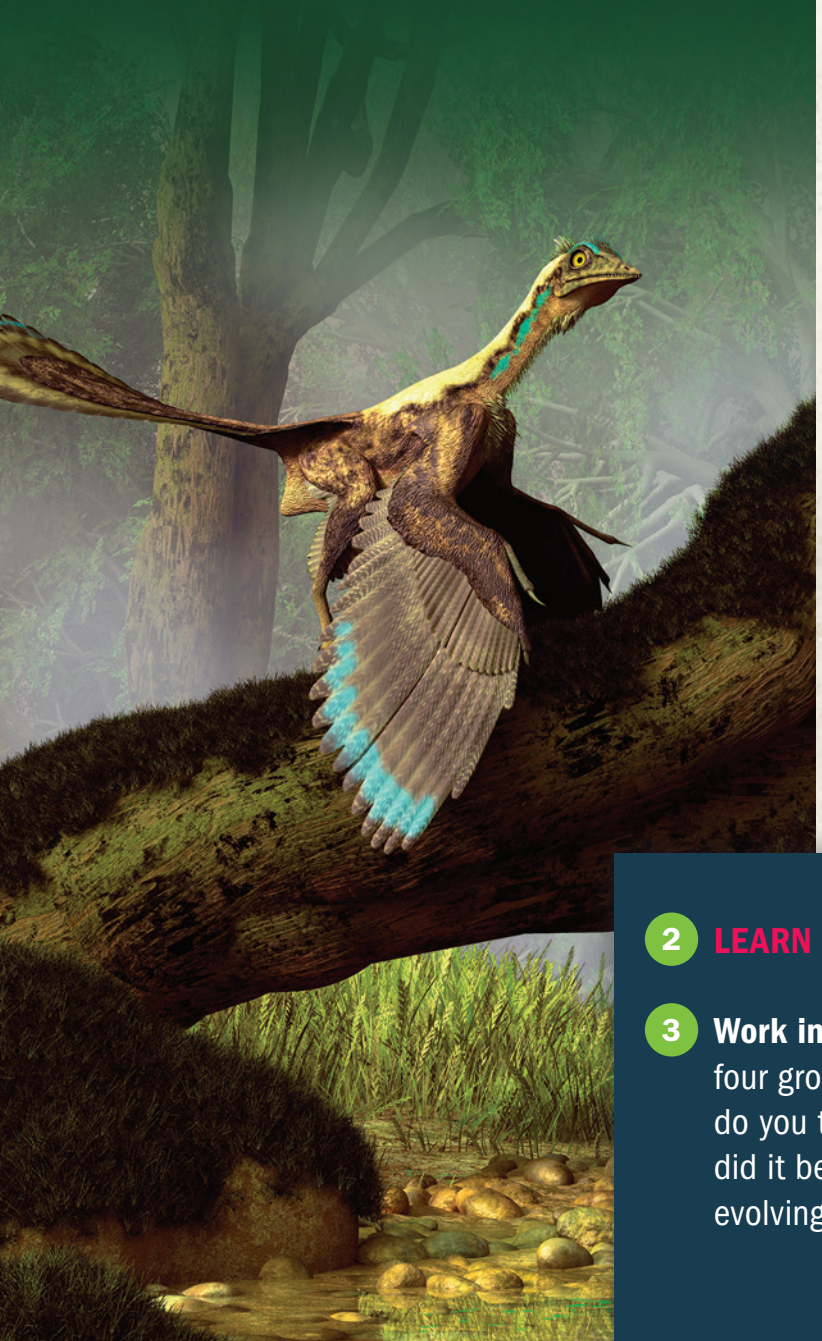
Today it's hard to imagine an empty sky, but many millions of years ago, there was no **flight** of any kind. All life was **limited** to water or land. This included very **early** insects, which were the first animals to develop wings around 350 million years ago. How did wings **evolve**? The most accepted theory is that wings developed from structures that originally supported insects' ancestors as they moved in the water. Over time, these structures became larger and stronger. They turned into wings that first allowed insects to jump and then **glide**. Eventually, insects were able to **flap** their wings and fly.

229 million years ago

By 229 million years ago, flight had also developed in pterosaurs, large flying reptiles. These animals were not dinosaurs, but were closely related to them. They were good fliers because they had strong flight muscles, skin-covered wings and strong but **hollow** bones. They could glide, flap their wings and even **soar**, using the wind to help them stay in the air. The largest flying animal ever was a pterosaur named *Quetzalcoatlus*, which had a head as big as a human and a body as tall as a giraffe. *Quetzalcoatlus* had a **weight** of 200 kg. (440 lb.) and a **wingspan** of 11 m. (36 ft.)!

150 million years ago

Today's birds are actually living dinosaurs! The earliest known dinosaur that is generally considered to be the first bird is *Archaeopteryx*. It had feathered wings like modern birds, but also shared **features** with reptiles, such as teeth, clawed fingers and a bony tail. It could fly, but not very well. Later, birds became more skilled fliers due to better flight **adaptations**.



55 million years ago

The fourth and last appearance of flight happened 55 million years ago, when the ancestors of bats developed the **capability** of powered flight. It's likely that these mammals lived in trees and first became gliders. Over time, their bodies formed wings, making bats the only mammals that have evolved to fly.

2 **LEARN NEW WORDS** **Listen and repeat.** 059

3 **Work in pairs.** The capability of flight has evolved in four groups: insects, pterosaurs, birds and bats. Why do you think each of these animals evolved to fly? How did it benefit them? Do you imagine any other animals evolving this way in the future? Explain.

4 **Read and write the words from the list.** Make any necessary changes.

adaptation	**capability**	**evolve**	**flight**
glide	**hollow**	**limited**	**weight**

***Archaeopteryx* feather fossil**

As an evolutionary biologist and palaeontologist, Ryan Carney studies the history of dinosaurs and their modern-day descendants: birds. From a single feather, he was inspired to research the _____ that species made over time in order to fly. He is interested in *Archaeopteryx* because it was the earliest known dinosaur. *Archaeopteryx* was also the earliest species to _____ the _____ of powered flight. Ryan investigates the theory that _____ in birds originated from 'the ground up' (from ancestors that first ran on the ground), and not from 'the trees down' (from ancestors who lived in trees and then learnt to _____, before eventually flying).

Ryan Carney

5 **LEARN NEW WORDS** **Listen to these words and match them to their definitions.** Then listen and repeat. 060 061

allow	**powered**	**skilled**	**support**

_____ 1. to provide the capability to do something

_____ 2. having the capability to do something well

_____ 3. to carry the weight of something

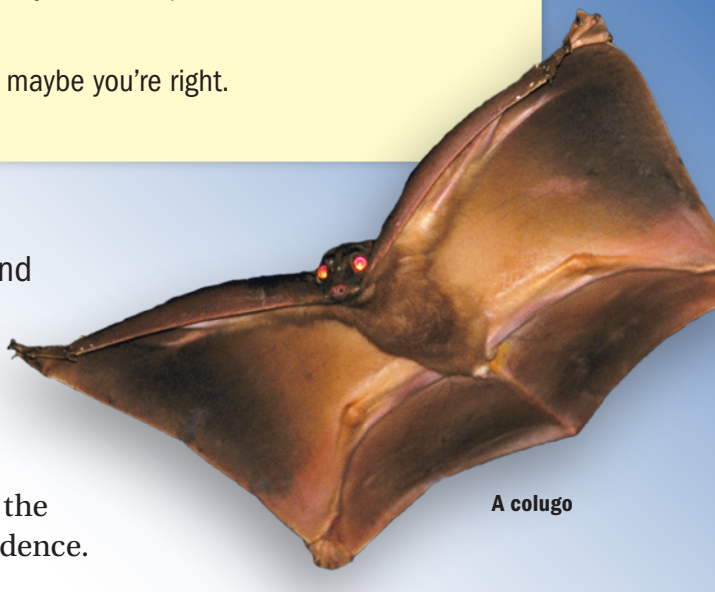
_____ 4. having energy to produce movement

6 **YOU DECIDE** **Choose an activity. Work in pairs.**

1. List three insects that fly and three that don't. Compare the insects on the two lists. What are the advantages of flying for insects?
2. With around 10,000 species in existence, birds have developed a wide variety of adaptations for flight. Compare and contrast two very different-looking birds. How is their flight similar? How is it different?
3. Why do you think bats developed flight to use mainly at night? How are bats' flight adaptations different from those of other fliers?

SPEAKING STRATEGY 062

Arguing	Conceding
I'm sure you agree that _____ .	I guess you have a point.
Well, I think that _____ .	
Most people support _____ .	Well, maybe you're right.
Yes, but what about _____ ?	



A colugo

1 **Listen.** How do the speakers argue their points and concede? Write the phrases you hear. 063

2 **Read and complete the dialogue.**

Ann: You know, we still don't know much about the ancestors of bats. There just isn't much evidence.

Alan: Maybe, but _____ the idea that bats are closely related to a group of mammals that also includes the colugo.

Ann: Yes, _____ the fact that the colugo glides? It doesn't flap its wings and fly.

Alan: Well, I _____ bats and colugos probably had an ancestor in common at some point. Think about it. I'm _____ that they share characteristics. Their wings look very similar. And both species eat insects. So it's logical that their ancestor would be a nocturnal glider who lived in trees.

Ann: I _____ there.

3 **Work in groups.** Cut out the cards. Take turns reading them aloud. Group members argue and concede each point.

Go to page 163.

4 **Work in pairs.** What affects your own life? What do you want to change? Take turns arguing and conceding.

Most students support the idea of less homework. I do, too.

Yes, but what about preparing for tests? Homework can be useful for that.

Well, maybe you're right.

GRAMMAR 064

Past perfect: Talking about the first of two actions in the past

Pterosaurs disappeared.
Modern birds evolved.

Pterosaurs **had** already **disappeared** by the time modern birds evolved.

The capability of flight developed four times in animals.
Humans tried to fly.

By the time humans tried to fly, the capability of flight **had developed** in four groups of animals.

1 **Listen.** Which of the two actions in the past happened first? Tick the box. 065

1. ☐ kite flight ☐ animal flight
2. ☐ running, arm flapping ☐ kite flight
3. ☐ measuring, signalling ☐ human transport
4. ☐ fun and entertainment ☐ military use
5. ☐ kites made of paper ☐ kites made of silk

2 **Read and complete the sentences.** Use past perfect forms of the verbs in the box.

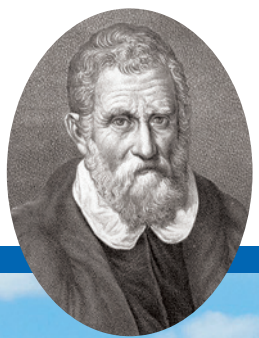
design	draw	forget	jump	run	try

Jumping from towers, walls and cliffs was among many ways humans tried to fly. Many men _____ to fly like the birds before success was achieved in 875 CE. In that year, a man named Abdul Qasim Abbas Ibn Firnas jumped from a high wall built over a valley in Cordoba, Spain. Before his experiment, he _____ wings covered in feathers. He planned to wear them on his arms and legs. Also, he _____ on paper a series of wing movements to use in flight. According to the people who saw his experiment, he began to fall after he _____. Afterwards, he climbed even higher than his starting point. He glided for several hundred feet, turned and came back to the wall. He hurt his back in the experiment, possibly because he _____ to include a tail in his design.

1000 BCE
The Chinese invent kites.

875 CE
Abbas Ibn Firnas wants to **prove** that man can fly. He tries flying by jumping with feathered wings.

1295
Marco Polo describes man-carrying kites.



3 **LEARN NEW WORDS** **Listen.** Learn about Leonardo da Vinci and the history of human flight. Then listen and repeat. 066 067

4 **Read the sentences.** Tick T for *true* or F for *false*.

1. Gravity is one of the forces that acts on flying and falling objects. (T) (F)
2. Leonardo da Vinci designed his parachute in 1595. (T) (F)
3. A stable flying object does not move from side to side. (T) (F)
4. Da Vinci created a helicopter that ascended into the sky at an angle. (T) (F)
5. A parachute can be used to help people descend safely from the sky. (T) (F)
6. Experts proved that da Vinci's glider was almost the same as Cayley's. (T) (F)

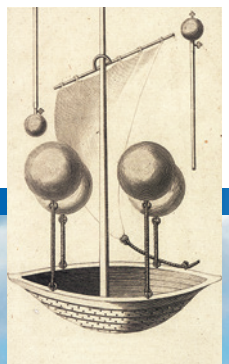
5 **Work in groups.** Use the timeline and new words to make four true sentences about flight. Use the past perfect.

1. _____
2. _____
3. _____
4. _____

1485
Leonardo da Vinci studies **forces** that affect objects in the air in order to design flying machines.

1595
Fausto Veranzio designs a **parachute**.

1670
Francesco Lana de Terzi designs an airship.



1783
The Montgolfier brothers launch hot-air balloons. These balloons **ascend** when the air inside is hot and **descend** when it cools.

1800
George Cayley designs the first **stable** glider to carry a human.

1 **BEFORE YOU READ Discuss in pairs.** What do you know about the Wright brothers and flight? Make a list. What are three facts you expect to find in the reading?

2 **LEARN NEW WORDS Find the words in the reading.** What do you think they mean? Then find the words *land*, *fuel* and *pilot* in a dictionary. Look at the different ways these words can be used. Then listen and repeat all of the new words. 068

engine **fuel** **to land** **pilot** **to take off**

3 **WHILE YOU READ Notice the order in which events happened.** 069

Reaching FOR THE Sky

The Dream of Human Flight

One day while travelling, Milton Wright saw a small toy helicopter that was powered by rubber bands. He bought this toy for his two young sons, Orville and Wilbur. Mr Wright surely had no idea this simple act would lead to the creation of the world's first powered aeroplane. The toy gave the brothers a strong interest in flight. They soon began trying to build similar models themselves.

When they were older, the Wright brothers decided they wanted to make a 'small contribution' to the field of flight. At that time, most attention on flight focused on hot-air balloons and gliders. However, the brothers were more interested in a heavier flying machine, powered by an engine and controlled by a pilot. They first read all the books they could on the early mechanics of flight. Then they used kites to better understand the forces that controlled objects in the air.

Over the next three years, the Wright brothers worked on designs and shapes for different types of gliders. During this time, they worked with engineers Otto Lilienthal and Octave Chanute, both authors of books on flight. These men were important influences on the brothers' work.

In December 1903, Orville Wright takes off with his brother Wilbur running beside him.

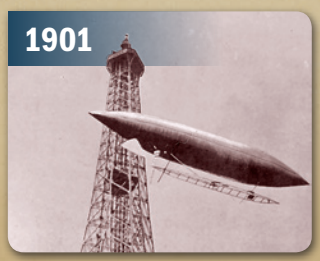
The brothers had built a wind tunnel to test different shapes of wings and tails for their gliders. Then they began to think about how to get a flying machine weighing 272 kg. (600 lb.) into the air and keep it there. They designed a 12-horsepower engine that generated enough force to allow the Flyer to take off from the ground in December 1903. It ascended about 3 m. (10 ft.) into the air and continued to fly 36 m. (120 ft.) in about 12 seconds. The first heavier-than-air flight became a reality!

The second, third and fourth flights followed on the same day. But the Wright brothers observed that the Flyer was not stable enough and was hard to control. They spent two more years perfecting their aeroplane. Finally, on the 5th of October 1905, Flyer III flew about 39 km. (24 mi.) in 39 minutes. The plane landed only because it ran out of fuel. The dream of human flight had finally come true.

Otto Lilienthal builds a glider.

Octave Chanute's book on flying machines is published.

Samuel Langley creates his aerodrome model.



Alberto Santos-Dumont circles the Eiffel Tower.

The Wright brothers fly for 39 minutes in Flyer III.

4 AFTER YOU READ Work in pairs to answer the questions.

1. What is the main idea of the reading?
2. How did the Wright brothers prepare for their project?
3. Whose ideas on flight influenced the Wright brothers?
4. The Wright brothers worked on their flight project for years. What personality characteristics do you think they had that helped them reach their goals?

5 Put the events in order.

_____ The Wright brothers built a wind tunnel to test the wings and tails of their gliders.

_____ They read everything they could about flight.

_____ They flew Flyer III about 39 km. (24 mi.) before it ran out of fuel.

_____ They designed a 12-horsepower engine to power the Flyer.

1 They used kites to learn more about how things fly.

_____ They worked for two years to make the Flyer more stable.

6 Discuss in groups.

1. How do you think the Wright brothers' work helped shape the 20th century? What aspects of life changed?
2. Is just one person ever truly responsible for a great idea or invention? Do all ideas and inventions build on the work of previous generations? What do you think? Why?

VIDEO

1 **BEFORE YOU WATCH** **Discuss in pairs.** What makes bees different from other insects? Why are bees important?

2 **Work in pairs.** You're going to watch a video called *Flight of the RoboBee*. Based on the title and the photo, predict what the video is about.

3 **WHILE YOU WATCH** **List three benefits that robotic bees will have.** **Watch scene 5.1.**

1. _____
2. _____
3. _____

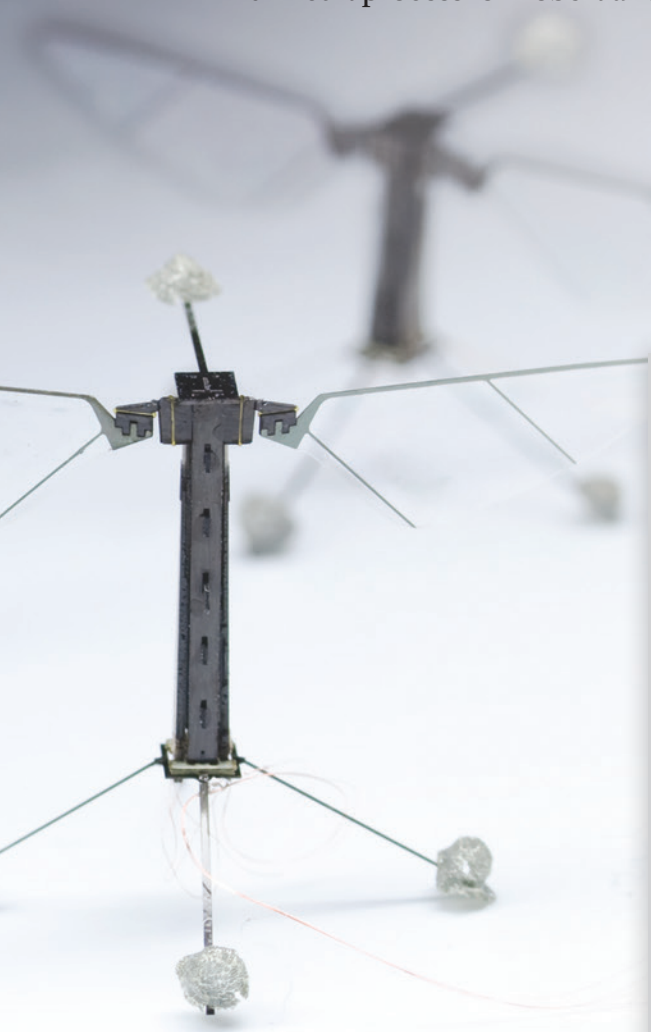
Robotic bees developed by Robert Wood, Electrical Engineer/National Geographic Explorer

4 **AFTER YOU WATCH** **Work in pairs to decide if each sentence is *true* or *false*.** Tick the correct answer.

1. Robert Wood says that most new robots are large, powerful and dangerous. (T) (F)
2. Robert's robots are inspired by nature. (T) (F)
3. Robert looks at real insects to work out how to construct his robotic bees. (T) (F)
4. Robotic bees haven't got the supports necessary to fly independently. (T) (F)
5. Robert doesn't plan to send robotic bees into dangerous areas because they could break. (T) (F)
6. Getting the robots to fly was a long, difficult process for Robert and his team. (T) (F)

5 **Discuss in groups.** In the video, Robert says, 'If you don't fail, you don't learn enough.' Explain what you think he means by this.

6 **Work in groups.** You learnt about man's early attempts at flying. Compare and contrast the process of getting the robotic bee to fly with the processes of the flight pioneers you learnt about.



7 **YOU DECIDE** **Choose an activity.**

1. **Work independently.** Research other robotic insects that are being developed. Choose one and create a short presentation on it. Explain what it's used for. Compare it with the robotic bee.
2. **Work in pairs.** Robert says that robotics is 'the next big thing to impact our lives'. Find an example of a robot that is making an impact on people's lives. Write an article about this robot and the impact it's having.
3. **Work in groups.** Create a poster to advertise robotic bees. Use illustrations and text to describe them, and explain why they are useful.

GRAMMAR 070

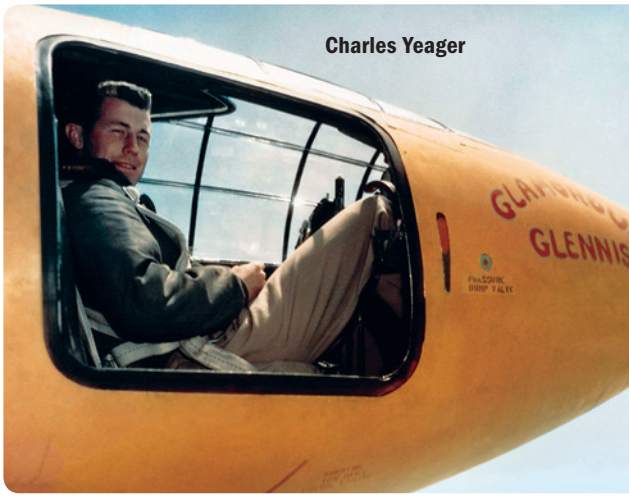
Past perfect continous: Talking about the first of two actions in the past

The Wright brothers **had been working** on powered flight for several years before Wilbur Wright flew for 2 hours and 19 minutes in 1908.

Before Louis Bleriot first crossed the English Channel in an aeroplane in 1909, pilots **had been using** hot-air balloons.

1 **Read.** Complete the sentences with past perfect continuous forms of the verbs in brackets.

1. Otto Lilienthal _____ (use) gliders for around five years before he crashed in one in 1896.
2. Before Samuel Langley's large Aerodrome A crashed while taking off, he _____ (build) smaller machines that flew successfully.
3. Before Alberto Santos-Dumont made the first successful powered flight in Europe, he _____ (win) awards for his flights in balloons.
4. Engineer Frank Whittle _____ (work) on his theories for nine years before he tested his first jet engine in 1937.
5. Before Charles Yeager became the first pilot to travel faster than the speed of sound in 1947, he _____ (fly) for about five years.


Charles Yeager

2 **Work in pairs.** Take turns throwing the cube. Ask and answer questions. Use the past perfect continuous.

Before you became part of the team, how long had you been playing basketball?

I had been playing basketball for six years.

Go to page 165.

WRITING

When we classify, we organise our ideas into categories. First, we introduce the topic. Then we divide it into categories. Each category gets its own paragraph in the essay. In each paragraph, we describe shared characteristics that make up that category. A classification essay ends with a conclusion. In the conclusion, we bring the categories back together to talk about the main topic.

1 **Read the model.** Work in pairs to identify the categories and details.

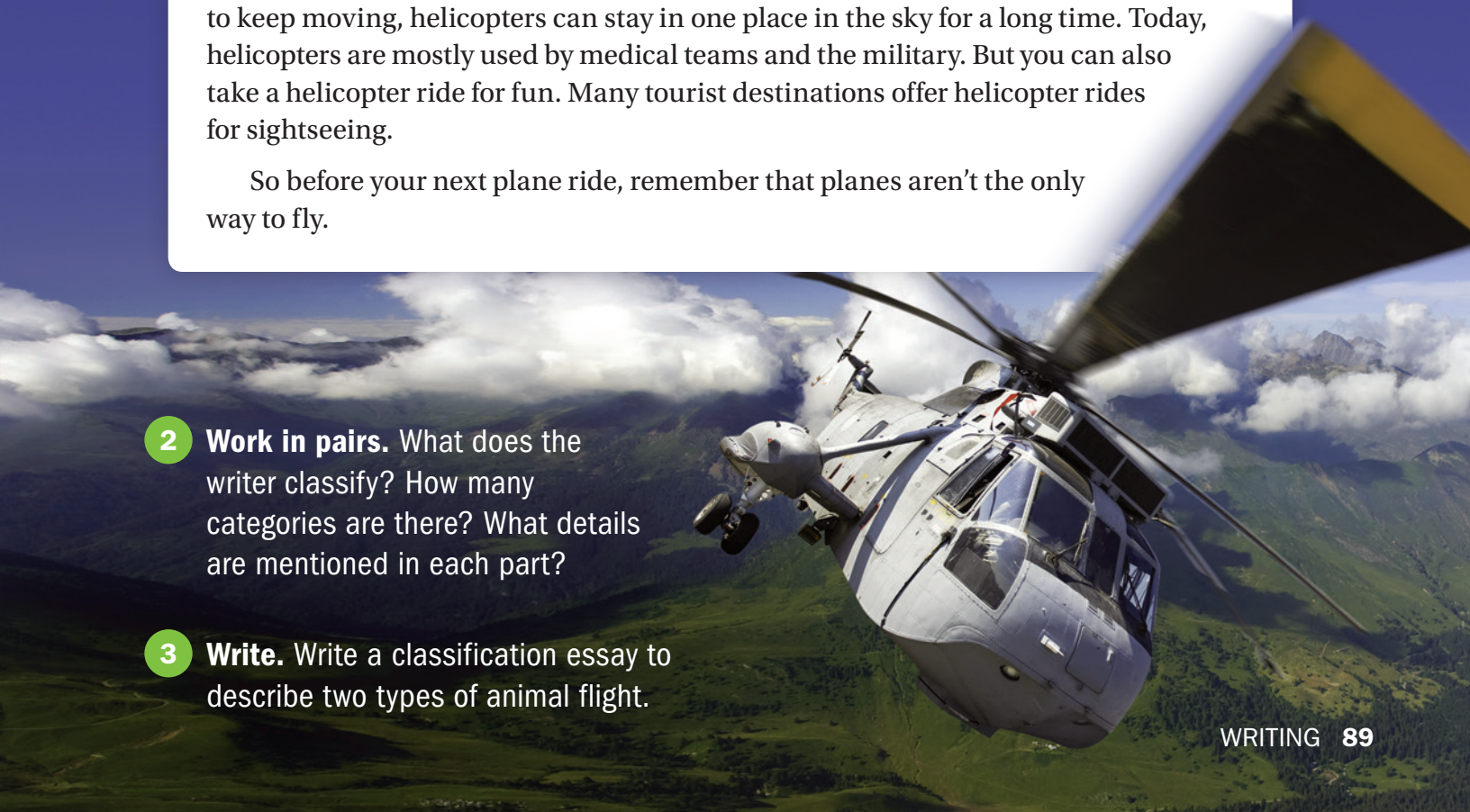
Long before we had aeroplanes, people had been experimenting with different flying machines. We still use some of those flying machines today. Some depend on air for movement, while others use engines.

Hot-air balloons and gliders use air currents for movement. Hot-air balloon pilots steer their aircraft by ascending or descending into air currents that move the balloon. The pilot controls the balloon's movement by heating the air inside the balloon, or by allowing it to cool naturally.

A glider also uses air currents to soar and glide. Small planes pull gliders along a runway to help them take off. But once in the air, gliders use the currents, not an engine, to move. Their long wingspan and strong body give riders a safe, smooth flight. Hot-air balloons and gliders are most often used for fun and adventure.

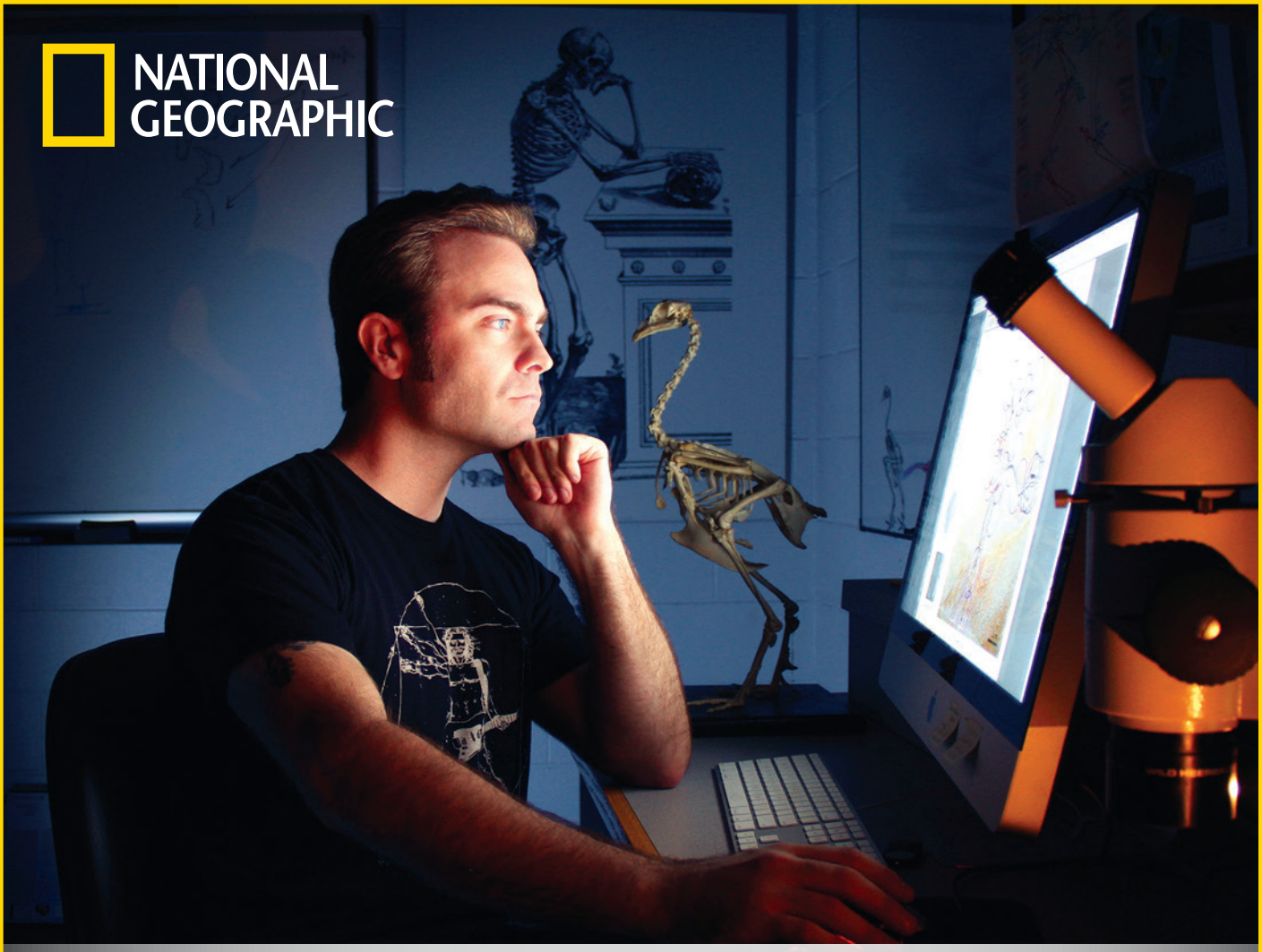
Helicopters first appeared during World War II. A helicopter hasn't got wings, but, like an aeroplane, it's got an engine that makes its blades spin at high speeds. This allows the helicopter to ascend into the sky. Unlike an aeroplane, which has to keep moving, helicopters can stay in one place in the sky for a long time. Today, helicopters are mostly used by medical teams and the military. But you can also take a helicopter ride for fun. Many tourist destinations offer helicopter rides for sightseeing.

So before your next plane ride, remember that planes aren't the only way to fly.



2 **Work in pairs.** What does the writer classify? How many categories are there? What details are mentioned in each part?

3 **Write.** Write a classification essay to describe two types of animal flight.



Explore Your Interests

'As an evolutionary biologist, I get to combine both childhood interests into my research: dinosaurs and animation!'

Ryan Carney

National Geographic Explorer, Palaeontologist/Evolutionary Biologist

1. **Watch scene 5.2.**
2. What are your interests? How have they changed over the years? Is there anything that you were interested in as a child that you are still learning about? What is it?
3. The people you read about in this unit, from Leonardo da Vinci to Ryan Carney, made their interests their life's work. How could you turn your own interests into a career? What would you need to do?

Make an Impact

YOU DECIDE **Choose a project.**

1 Design a flying machine.

- Plan and design a flying machine.
- Use your plans to create a model of the machine.
- Present your machine to the class. Explain how it works.

2 Make an evolution poster.

- Choose an animal that has evolved the capability of flight.
- Research how this animal has evolved over time. Draw and label at least four steps in its evolution.
- Arrange your drawings in order on a poster. Display the poster in class.

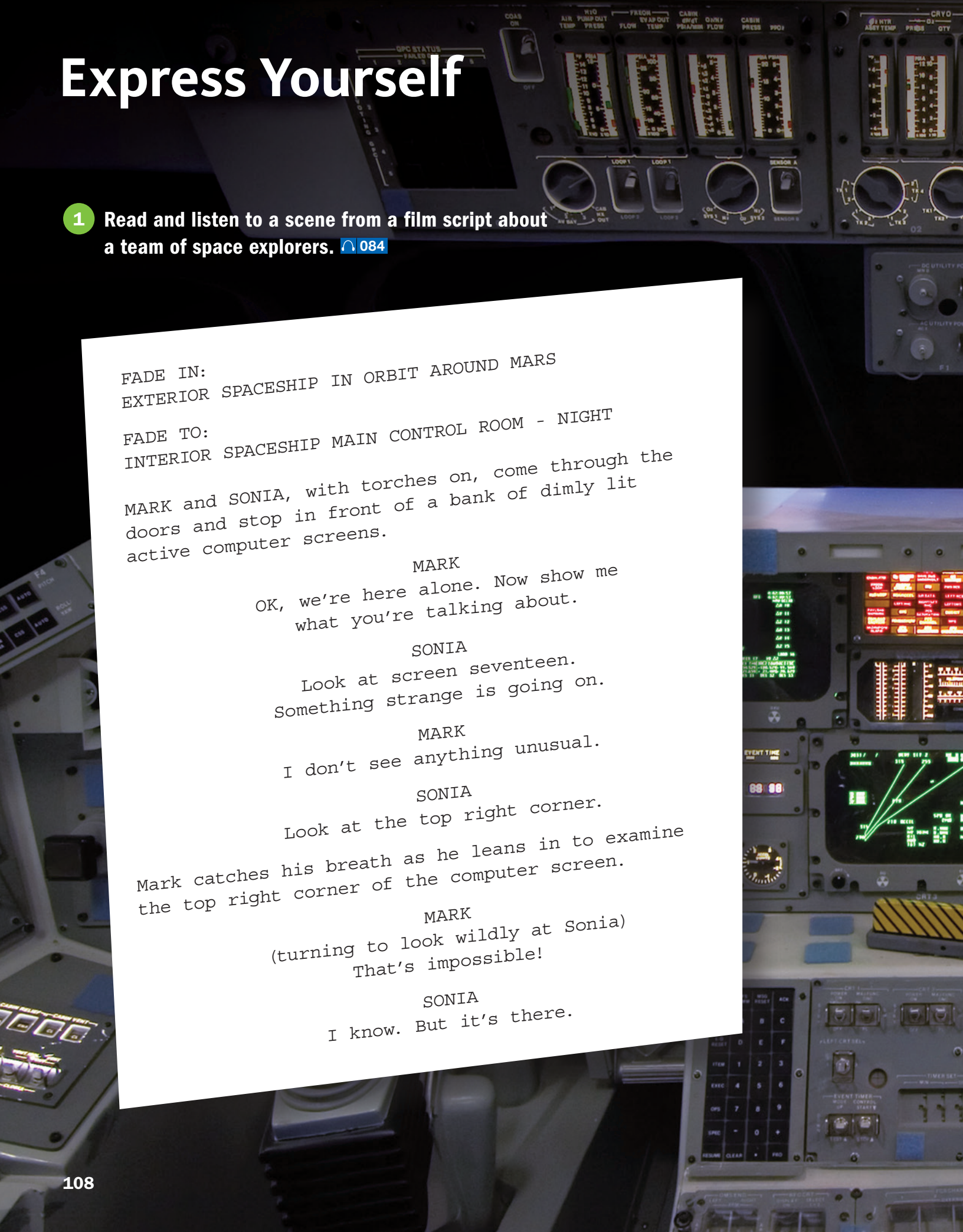
3 Advertise a flying machine.

- Choose a flying machine that you learnt about.
- Think about the benefits and risks of using that machine.
- Make an advertisement for the machine. Try to persuade your audience to fly in it.

A pilot guiding a home-made machine during a flying competition in Moscow, Russia

Express Yourself

1 **Read and listen to a scene from a film script about a team of space explorers.** 084



FADE IN:
EXTERIOR SPACESHIP IN ORBIT AROUND MARS

FADE TO:
INTERIOR SPACESHIP MAIN CONTROL ROOM - NIGHT

MARK and SONIA, with torches on, come through the doors and stop in front of a bank of dimly lit active computer screens.

MARK
OK, we're here alone. Now show me what you're talking about.

SONIA
Look at screen seventeen. Something strange is going on.

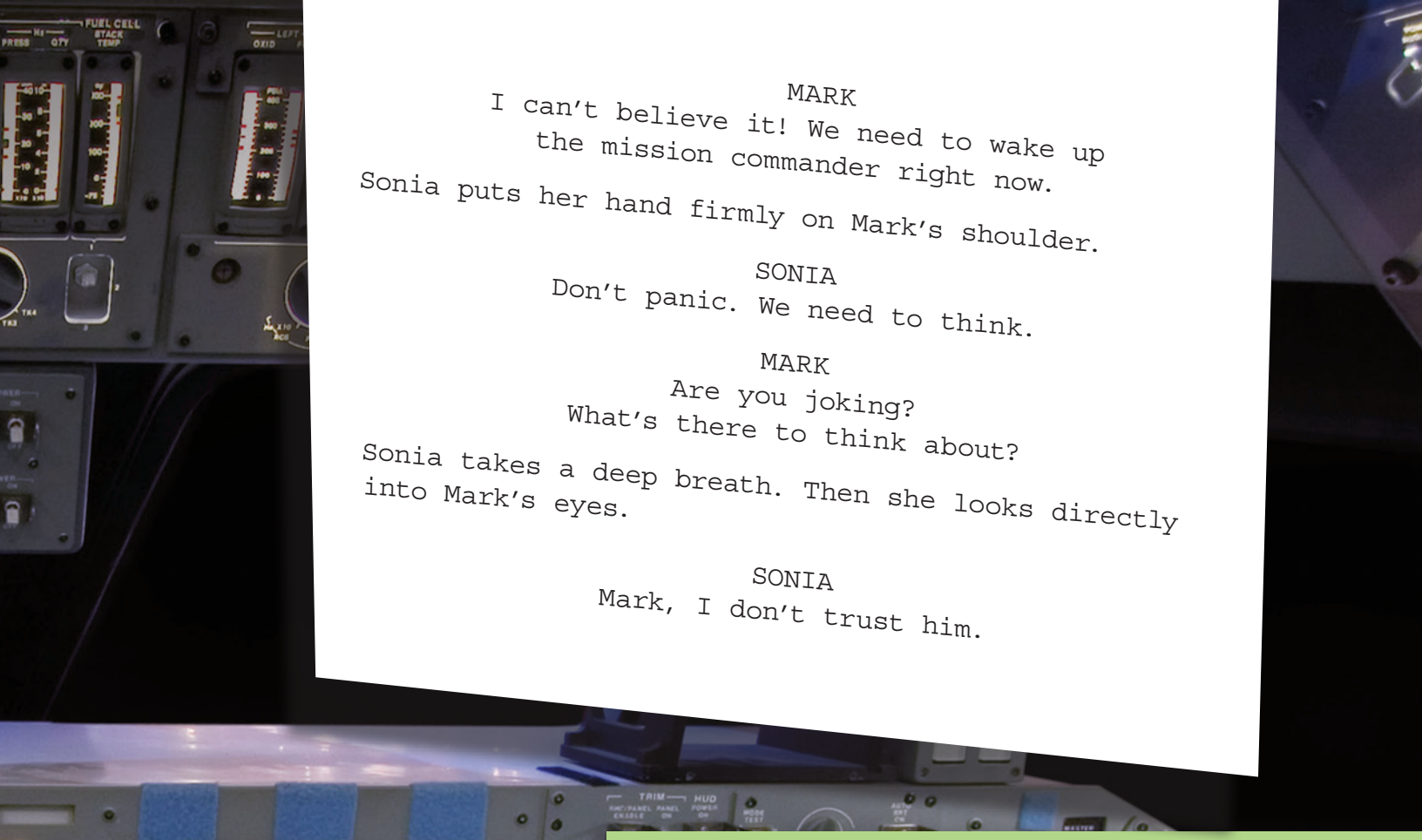
MARK
I don't see anything unusual.

SONIA
Look at the top right corner.

Mark catches his breath as he leans in to examine the top right corner of the computer screen.

MARK
(turning to look wildly at Sonia)
That's impossible!

SONIA
I know. But it's there.



MARK
I can't believe it! We need to wake up the mission commander right now.

Sonia puts her hand firmly on Mark's shoulder.

SONIA
Don't panic. We need to think.

MARK
Are you joking? What's there to think about?

Sonia takes a deep breath. Then she looks directly into Mark's eyes.

SONIA
Mark, I don't trust him.

2 **Work in groups.** In this scene, two astronauts see something very unusual on their screen. What do you think they see? List three possibilities. Then compare your ideas with those of another group. Are your ideas similar? Which idea is the most surprising?

3 **Connect ideas.** In Unit 5, you learnt about the history of flight. In Unit 6, you learnt about space exploration. How did the early pioneers of flight set the stage for space exploration? Discuss the evolution of flight that led to spacecraft.

4 **YOU DECIDE Choose an activity.**

1. Choose a topic:
   - flight
   - space exploration
2. Choose a way to express yourself:
   - the next scene of the film script
   - a presentation on flight (including spacecraft)
   - an original film or play
3. Present your work.