Smithsonian

Designing a Shuttle

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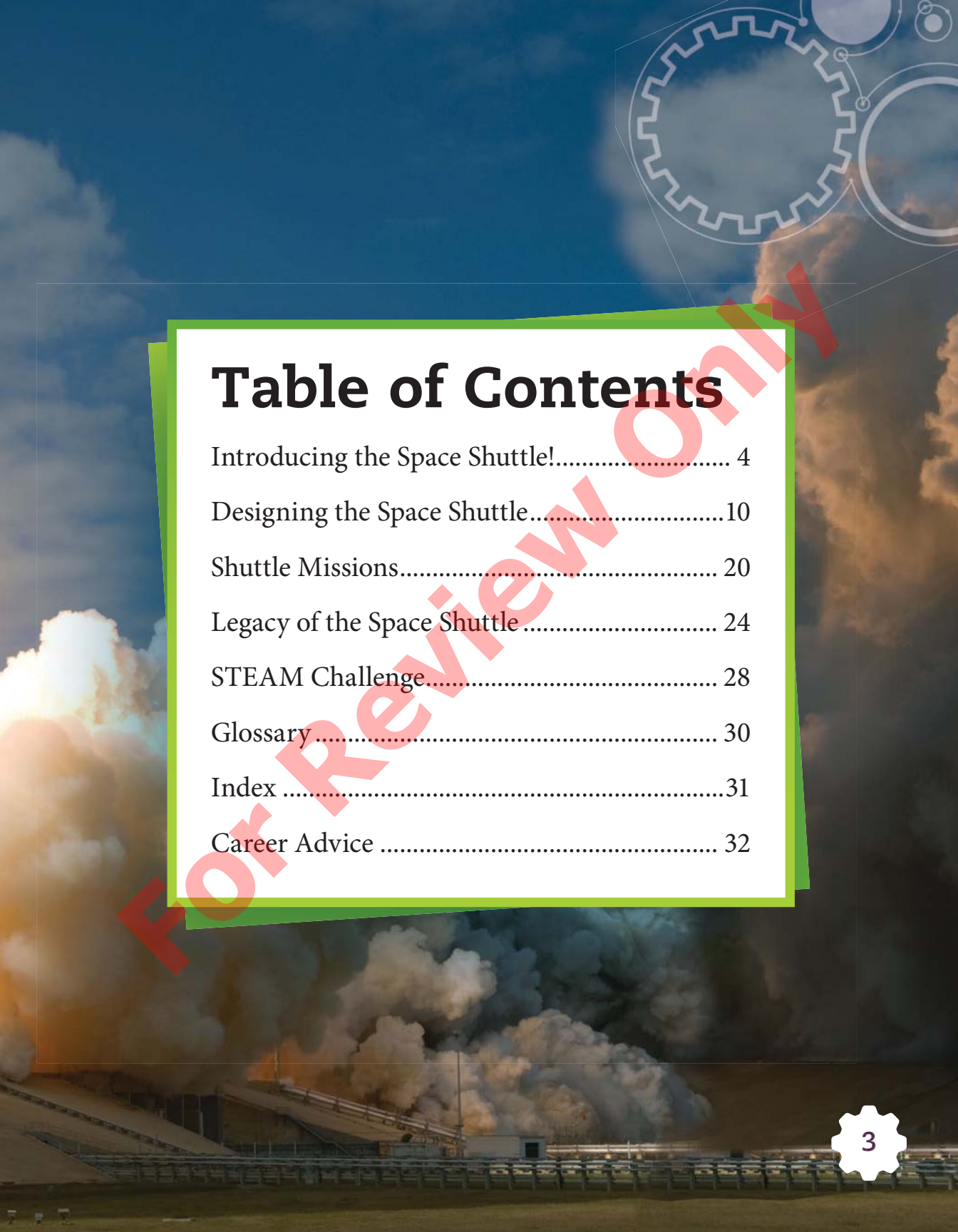

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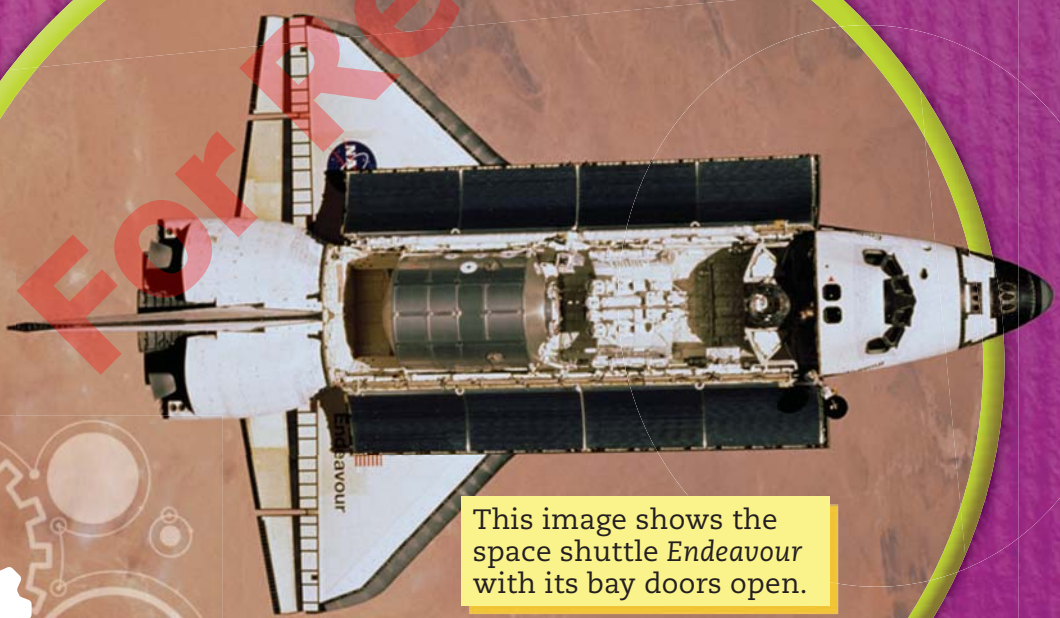
Introducing the Space Shuttle!

In the early 1970s, the United States was the world leader in space travel. Americans landed men on the moon six times. The National Aeronautics and Space Administration (NASA) wanted to make more trips into space. But flying to space was expensive. Each trip used a new spacecraft. When a ship came back to Earth, it crashed into the ocean. It could not be used again.

NASA wanted to build a new kind of spacecraft. Its goal was to design a craft that could be used over and over again. This would save money and make it easier to bring people and equipment to and from space. This goal turned into NASA's space shuttle program.

The space shuttle program came out of years of research. It took a long time for people and rockets to start launching people into space. Scientists and engineers had to figure things out one step at a time. Luckily, they had a long history to build on.



This image shows the space shuttle *Endeavour* with its bay doors open.

Apollo 16 launches in 1972.

Mercury's *Friendship 7* launches in 1962.

A single rocket launch in the 1960s cost NASA up to $375 million.

Long Ago

No one knows when the Chinese discovered the recipe for **gunpowder**. Around the year 900, they learned that if they made a small change to the recipe, gunpowder would burn instead of explode. This mixture was first put in bags tied to arrows. The arrows burned whatever they hit.

After a while, the bags were replaced with tubes. This changed everything. When the gunpowder burned, it pushed the arrow forward. The arrow flew farther. They didn't know it then, but these were the first rockets.

This print shows Chinese soldiers with flaming arrows.

gunpowder

Four hundred years later, Galileo Galilei (ga-lih-LEY-oh ga-lih-LEY) used a telescope to look into the night sky. This allowed him to see distant stars and planets more clearly. People used telescopes to learn more about the **solar system** and Earth's place in it. The dream to fly to these places was not long off.

1891 woodcut of Galileo

SCIENCE

Rocket Science

Rockets create **thrust** by burning fuel in a mostly sealed container. When fuel is burned, it turns into a gas and expands. Because it is in a sealed container, it can only escape from one place. Gas passes through a nozzle that helps control the rocket's direction. As gas escapes in that direction, the rocket moves in the opposite direction.

Space Race

By the 1950s, scientists and engineers in the Soviet Union and the United States learned a lot about rockets. The two countries were rivals. They did not share data. People in each country wanted to prove their technical abilities.

In 1957, the team from the Soviet Union surprised the world when it put a **satellite** into orbit. The team from the United States worked hard to catch up. They wanted to be the world leader in space. Four years later, the Soviets struck first again when they sent a man into space. President John F. Kennedy challenged NASA to have an American walk on the moon before 1970. In July 1969, they did. The Soviets could not keep up. This was the end of the space race.

The space race taught scientists a lot. They knew astronauts could spend time in space safely. Research in space was now possible. The space shuttle program was started so NASA could send people into space more often. Rockets were expensive and could only be used one time. A new spacecraft that could be used over and over again would let NASA fly into space more often.

Over five hundred people have been to space. Of them, 355 rode on a space shuttle at least once.

Yuri Gagarin was the first man in space.

This illustration shows *Vostok 1*, the craft that carried Gagarin.

This is a replica of *Sputnik 1*, the first satellite in orbit.

Vostok 1 after it landed on Earth

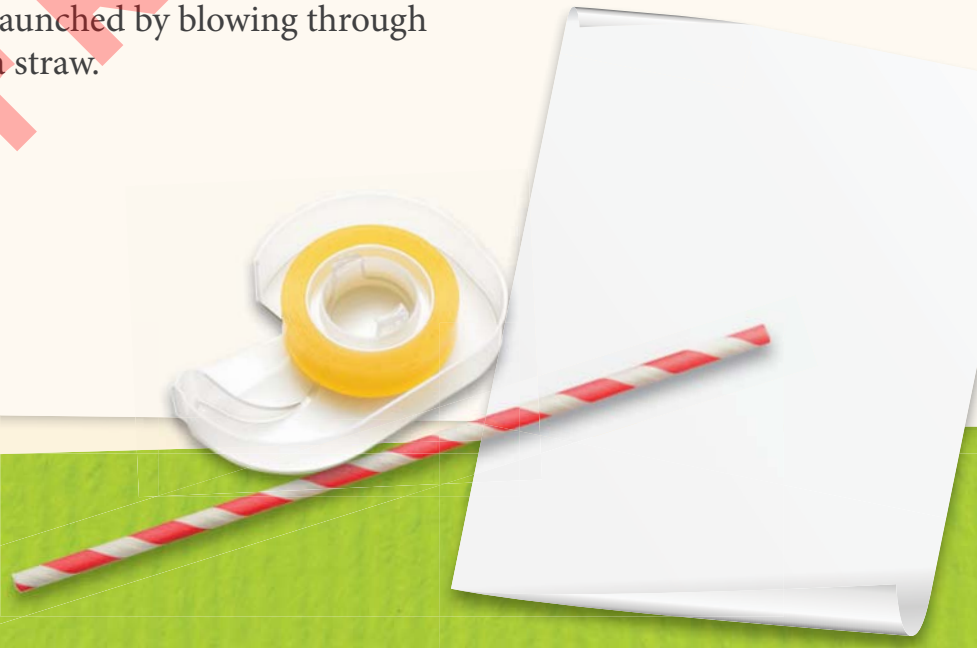
STEAM CHALLENGE

Define the Problem

An engineer's first design is rarely the best solution to a problem. When designing something as large as a space shuttle, engineers often make small models to test their designs. Your task is to build a model shuttle that can be successfully launched with a straw.

Constraints: Your model may only use one sheet of paper and tape.

Criteria: The paper shuttle must go at least 1 meter (1 yard) when launched by blowing through a straw.



Research and Brainstorm

What wing shape will work best? How many wings will work best? Where should the wings be placed? What forces are acting on your shuttle?

Design and Build

Sketch your design including measurements for each part of your model shuttle. Build the model.

Test and Improve

Launch your paper shuttle from your straw three times. Did your shuttle go 1 m (1 yd.) or more? Did your shuttle design provide consistent results? Get feedback. Modify your design and try again.

Reflect and Share

What factors affected your shuttle's flight pattern? How can you minimize the effects of these factors? Will other types of materials improve the results?