Smithsonian

The Evolution of Space Suits

Danica Kassebaum

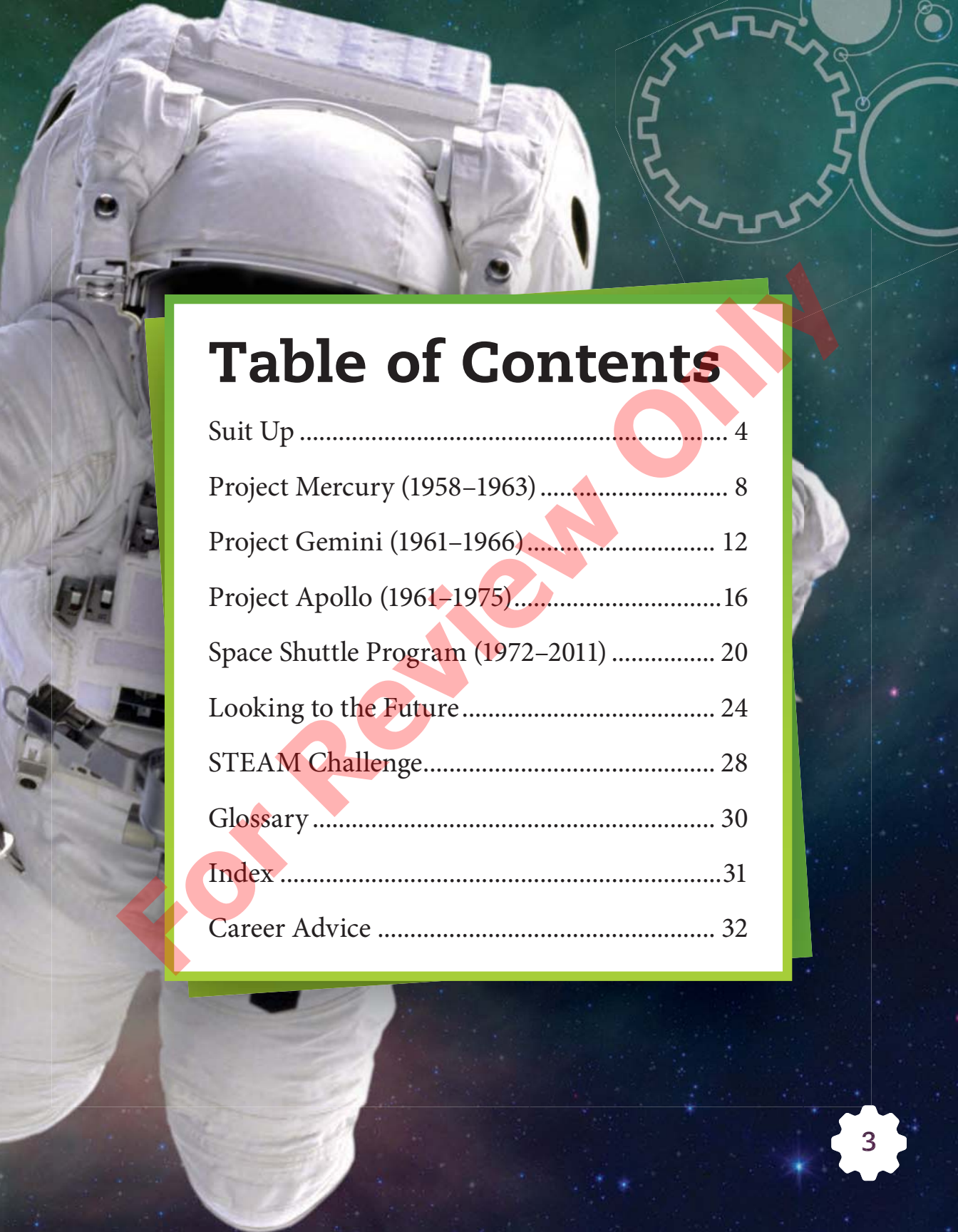
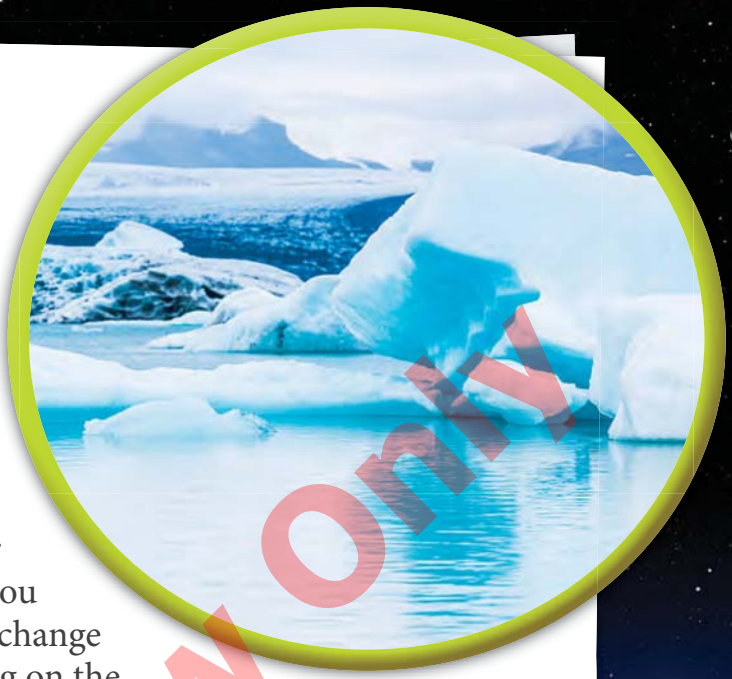


Table of Contents

Suit Up



Imagine stepping outside on the coldest day of the year. What would you wear? Most likely, you would wear something to protect yourself from the freezing wind and cold. Now, imagine stepping outside on the hottest day of the year. Would you wear the same thing? Of course you wouldn't. On Earth, people change the way they dress depending on the weather.

Now, what if you were in space? The conditions in space are much more extreme than they are on Earth. Humans would not last long in space without special clothes. So, engineers developed suits just for astronauts.

Many different space suits have been made over the years. They were designed to help astronauts do their jobs in space. These suits have different features that help astronauts do different things. But the main job of every space suit is the same—keep the person inside safe.

The coldest temperature ever recorded on Earth was –89 degrees Celsius (–128 degrees Fahrenheit). The temperature in deep space is –271°C (–455°F).

This suit was worn by the first human in space.

Building a Suit

In the early days of space research, people knew very little about what it was like among the stars. Most of what they learned, they learned from experience. Early pilots knew that air became colder as they flew higher. Flight suits were made to keep pilots warm. At first, they just wore heavy jackets. As airplanes flew higher, pilots found it harder to breathe. This is because the air is thinner at higher **altitudes**. There is less oxygen to breathe.

Later, flight suits became special full-body suits with masks. The masks gave pilots oxygen to breathe, while the suits put pressure on their bodies similar to the pressure felt on the ground. The first space suits were modeled after these pressure suits.

Today's space suits are the result of years of research. But they were not always this advanced. It took a lot of hard work by scientists and engineers to create the space suits used today.

Pilot Amelia Earhart wears a flight suit.

Earhart wears a heavy jacket and head gear.

an early pressure suit used in an airplane

Early pilots used to fly hot-air balloons to run experiments at high altitudes. At the time, balloons could fly much higher than airplanes could.

Project Mercury (1958–1963)

The first U.S. space program was called Project Mercury. Its goal was to send a person into space, orbit Earth, and return home safely. At the time, scientists in the Soviet Union had their own plans to send a man into space. Each country wanted to succeed before the other did. This competition was known as the Space Race.

Project Mercury began in the U.S. Air Force. But it was soon moved to the National Aeronautics and Space Administration (NASA). The focus of the program was to study space and compete with the Soviet Union. The Soviets had already sent a satellite into space. NASA needed to work quickly to keep up.

Scientists at NASA knew they needed to build a suit that would keep a person safe in space. They did not know for sure what a space suit would need. No one had ever been so far away from Earth. Scientists knew that a space suit would need to work like a pressure suit. But they would need to make some changes.

The Space Race began in 1958 when the Soviets launched their first satellite—*Sputnik 1*.

Project Mercury astronauts in 1959

NASA Langley Research Center in Virginia (above) was the main site of Project Mercury before operations moved to Texas.

STEAM CHALLENGE

Define the Problem

NASA is continually upgrading space suits to make astronauts safe from space dust and debris. Your task is to design a protective layer for a space suit. The layer should protect an "astronaut" (represented by an object such as a marshmallow, inflated balloon, potato, or something similar) from "space dust and debris" (represented by rocks, gravel, nails, or similar items).

Constraints: Your protective layer must be made of five materials or less.

Criteria: Your protective layer should not break when $\frac{1}{2}$ liter (about 2 cups) of debris is dropped on it. Your layer can be punctured, as long as the astronaut stays unharmed.

Research and Brainstorm

How have space suits changed over time to keep astronauts safe? What materials have the best chance of keeping your astronaut safe from debris? What other factors should be considered while designing the protective layer?

Design and Build

Sketch your design, including measurements for each part of your protective layer. Build the model.

Test and Improve

Place your protective layer around your astronaut. Drop different types of space dust and debris onto your protective layer. How did your layer hold up? Did any debris get to your astronaut? Modify your design and try again.

Reflect and Share

Remember, space dust and debris travel at great speeds. Knowing that, how might you make your test more realistic? Would other types of materials provide different results? Explain what types of materials might make your protective layer better.