



## **The Sky's the Limit Volume IV: Beyond the Earth**

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## Introduction

The Sky's the Limit is a series of books featuring people who have made contributions to the field of aviation. A variety of backgrounds and perspectives are represented as the reader learns about such people as Anne Morrow Lindbergh, an aviation writer and pilot, Angelo De Ponti, an aviation businessman, and Franklin Chang-Diaz, an astronaut and rocket scientist. Each book includes activities related to aviation and the principles of flight. The activities range from making a compass to completing a word-find exercise.

The series begins with the early days of flight in the United States and continues through the space program. The books are not intended to be a complete history of aviation. Rather, they draw from a variety of disciplines to inspire young readers in the areas of math, science, reading, writing, art, and engineering.

## Contents

<b>Mary Ross</b> .....	.3
<i>Teacher &amp; Engineer for Lockheed</i>	
<b>You are the Engineer</b> .....	.5
<i>Construction activity</i>	
<b>Paul Pao</b> .....	.6
<i>Designer of Saturn V rocket</i>	
<b>Watch the Earth Spin</b> .....	.7
<i>Activity demonstrating how the earth spins on its axis</i>	
<b>Franklin Chang-Diaz</b> .....	.8
<i>Scientist and Engineer</i>	
<b>Which is Stronger, You or Air?</b> .....	.9
<i>Activity demonstrating air pressure</i>	

## Mary Ross



Mary Ross was born on August 9, 1908, in Park Hill, Oklahoma. Located near Tahlequah, the capitol of the former Cherokee Indian Nation, Park Hill was a fascinating place to live. Mary liked the customs of this small village, and she liked living near her many relatives and

friends. Mary's great-great-grandfather, a Cherokee Indian chief, had played an important role in the leadership of the former Cherokee Nation, and in the history of our country.

As a child, Mary's favorite activity was reading. Her two sisters were very active in athletics. But Mary, known as the bookworm of the family, was much more interested in books than in sports. She liked reading the popular books of the time such as *Little Women* and other stories about American pioneers.



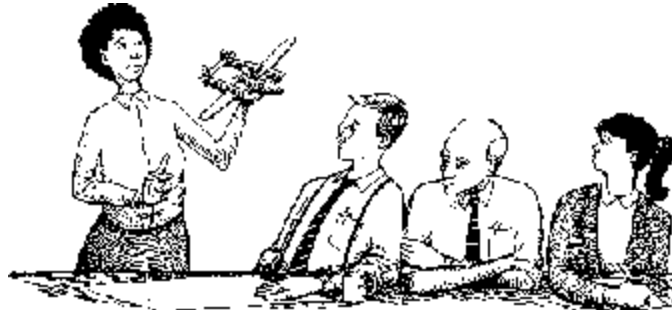
In school, Mary's favorite subjects were math and science. Working through mathematical problems seemed like a fun game to her. In science she liked learning about the universe. It was fascinating to think about our solar system and all of the individual planets. Mary liked school and found her teachers to be inspiring.

Mary always knew that college and education would be in her future because she liked learning so much. What she didn't know was that, someday, she would play an important role in space exploration.

In high school and in college, Mary took all of the math and science classes that were available. After graduating from college, she began her career as a teacher. She taught math and science at a high school.



Then, World War II began. Mary wondered what she could do to help our country. With a background in math and science, she thought she would be useful to a company that was making airplanes. The company was called Lockheed, and it was making a new type of airplane



that would be essential in fighting the war. This new plane, called the P38, was a pursuit plane, the largest and fastest that had ever been built. Working at Lockheed, Mary was part of a team that helped to solve problems that the P38 was having. Like most new designs, the P38 provided many challenges for Mary and the team. The P38 played a very important role in helping our country win the war. Mary and the team at Lockheed felt good because their work had made a huge difference in the outcome of the war.



After the war, Mary continued to work at Lockheed as an engineer. One of her projects was designing guided missiles. Next, she designed satellites for orbiting the earth and moon. After that, she designed satellites for traveling around other planets. The projects that were the most exciting to her were those of designing rockets for getting people and probes into space. It was thrilling to be a part of space exploration!

## You Are the Engineer



Which is stronger, a triangle or a square? Try the following experiment to find out.

**What you will need:**

44 or more toothpicks

38 or more miniature marshmallows (or modeling clay rolled into small balls)

**Structure #1**

Using nine marshmallows (or clay) and 15 toothpicks, build a tall structure.

**Structure #2**

Using 15 marshmallows and nine toothpicks, build another structure.

Which structure is stronger, **#1** or **#2**? What looks different about the two structures?

**Structure #3**

Using 14 marshmallows and 20 toothpicks, build a structure that's strong enough to hold a shoe or a book.

**Structure #4**

Build a bridge that can span about 1 foot (30 cm) between two objects

## Paul Pao



Paul Pao was born in Canton, China, in 1940. As a child, Paul's favorite activities were reading and traveling with his family. He liked learning new information, whether it was from going someplace new, or from reading a book. There was no television in those days, but there were plenty of good adventure stories to be discovered at the library. Paul's favorite books were Tarzan, Sherlock Holmes, The Last of the Mohicans, and a Chinese classic called The Monkey King. Paul also liked reading about astronomy. He was amazed when he read about the distance between the stars and the earth, and the size of our universe.

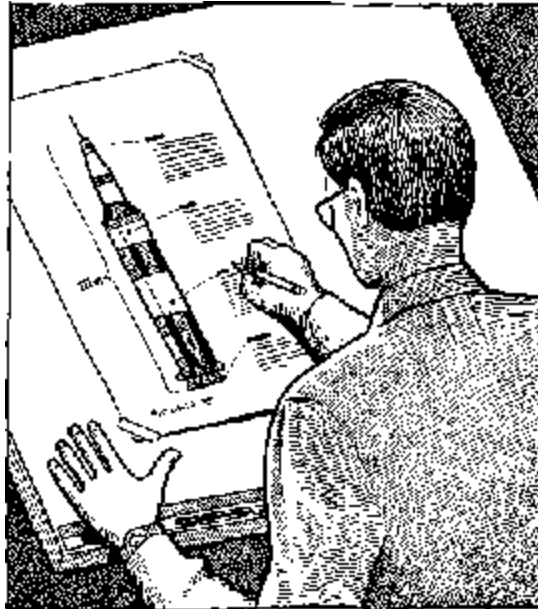


In school, Paul had fun and worked hard, especially at math. His school had some very difficult math classes, which turned out to be a big help to him later when he went to college.

When Paul was 16 years old, he went to college and studied engineering. College required a lot of discipline, but Paul didn't forget to have fun too. When he wasn't studying, Paul could be found bicycling or going to movies. After earning a degree in engineering, Paul moved to the United States to work and to study aeronautical engineering at the University of Florida.

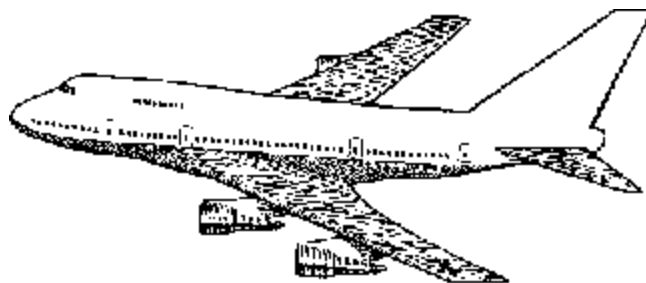
After graduating from the University of Florida, Paul was honored and thrilled at being asked to work on the design and testing of the Saturn V rocket. This was the rocket that launched the Apollo spacecraft, and carried the first astronauts into lunar orbit and to the first lunar landing.

When the design of the Saturn V rocket was completed, Paul was asked to work on another very important project. This new project was going to help our environment. Paul was to design a quieter jet-powered airplane engine. There are several areas to look at to reduce the noise of a jet engine: noise from combustion, the turbulent air in the powerful jet plume, and the design and shape of the engine.



Through research and experimentation, Paul was successful at designing a quieter jet engine. The next time you are at an airport, watch the jets take off from inside the terminal and notice that you don't hear any noise from the jet engines.

Working on Saturn V and reducing jet engine noise were two very exciting projects to Paul. It is a good feeling to him to know he has helped to get the first astronauts to the moon, and that he has helped our environment by designing a quieter jet engine.



During Paul's career as an engineer, he has worked on many different projects. One thing he has noticed in his life, and that today's kids might want to know, is that you must be prepared to learn new ways of doing things every 5 to 10 years, and be humble and curious. Paul feels very fortunate to have had the opportunity to learn so many new and interesting things.

## Watch the Earth Spin

Planet Earth is moving all the time. Here is an activity that allows you to see Earth making it's daily rotation.

### What you will need:

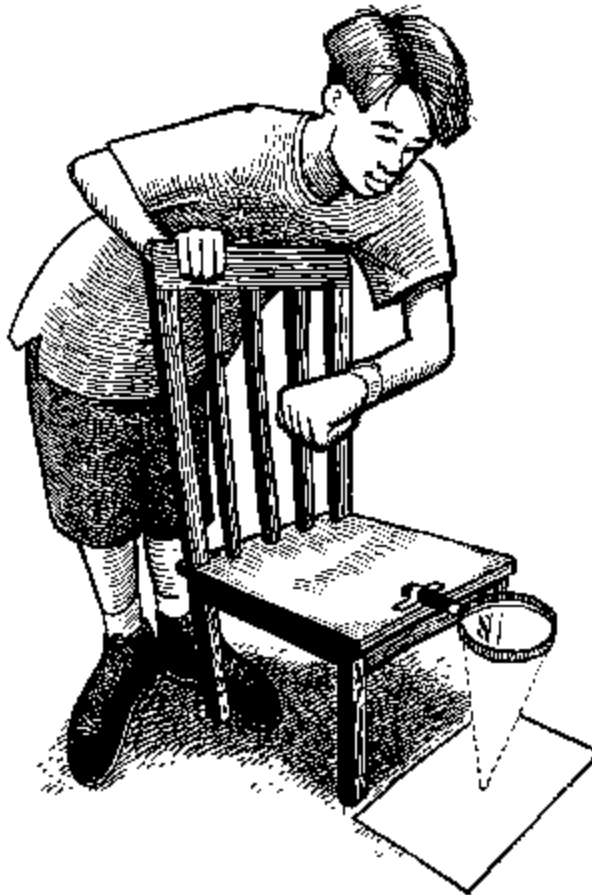
- a magnifying glass
- strong tape
- a chair or stool
- a piece of white paper
- a watch or a clock that has a second hand
- a stack of books

1. Place the chair outside in a sunny spot. Tape the magnifying glass to the chair as shown in the picture.

2. Place the sheet of paper on the ground underneath the magnifying glass so that the sunlight coming through the glass shines on the paper. You need the light shining on the paper to form a sharply focused circle. To get the sharp focus, you may need to raise the paper higher than the ground (you can set it on a stack of books), or you may need to raise the magnifying glass higher (set it on a stack of books on top of the chair, taping the magnifying glass to the top book instead of the chair).

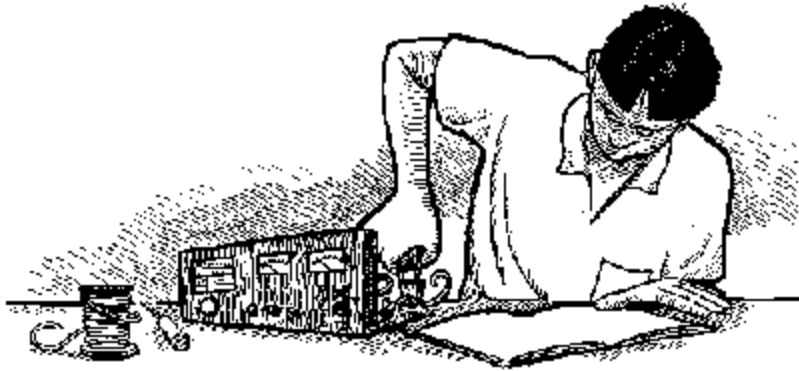
3. Trace the spot of light that shines on the paper. Now wait and watch your clock and the spot of light. The light in the circle you have just traced is going to move out of the circle. Use the watch or clock to see how long it takes for the light to get completely out of the circle. The circle of light shining through the magnifying glass onto the paper is a reflection of the sun. The light moving across the paper is caused by Earth moving away from the sun.

From this activity, you can calculate how long the day is. Take the number of seconds it took for the light on your paper to move out of the circle you traced, and multiply that number by 720. Now, convert that number to hours by dividing by 3600. Your answer is the length of a day.





## Franklin Chang-Diaz



Franklin Chang-Diaz was born on April 5, 1950, in San Jose, Costa Rica. As a boy growing up in Costa Rica, Franklin enjoyed the activities of most boys of his neighborhood: climbing trees, playing outside, and chasing iguanas, squirrels, and other creatures in the yard.

Franklin was always a very inquisitive child. He especially liked constructing things. On his birthdays, he often received gifts that allowed him to make something such as a radio kit, or a construction set. One such birthday gift was a laboratory set. Franklin was allowed to turn the back porch into his laboratory. In his lab, he built small rockets, which he launched with gun powder that he had made from a recipe he had read about.

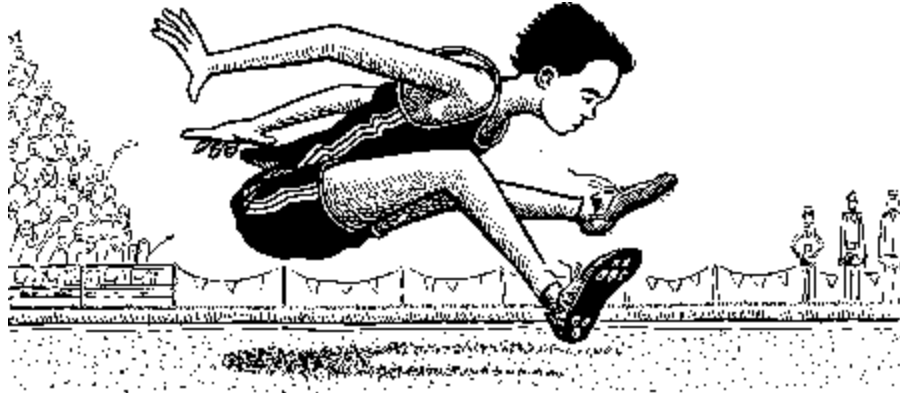


His lab also served as an animal hospital when his cat needed surgery. With the help of his older cousin, nine-year-old Franklin removed a tumor from the outside of his cat's belly. To put the cat to sleep for the surgery, ether from their local drugstore was purchased. The surgery was a success, and the cat lived happily ever after.

But when you're experimenting, not everything turns out like you think it will. Franklin did have some unexpected explosions in his laboratory. He once accidentally blew up a rain gutter on his house, which he was using to launch one of his rockets. For that, he was reprimanded of course. But then the gutter was rebuilt, and Franklin was back in business.

As a child, Franklin thought a lot about outer space, and traveling to other planets. Franklin and several friends made spaceships out of cardboard boxes and had imaginary travels to faraway planets in the universe.

In school, Franklin was not a model student. He found it difficult to sit still and listen to facts. He preferred to learn by doing. His favorite subject was science where he could learn by experimenting.



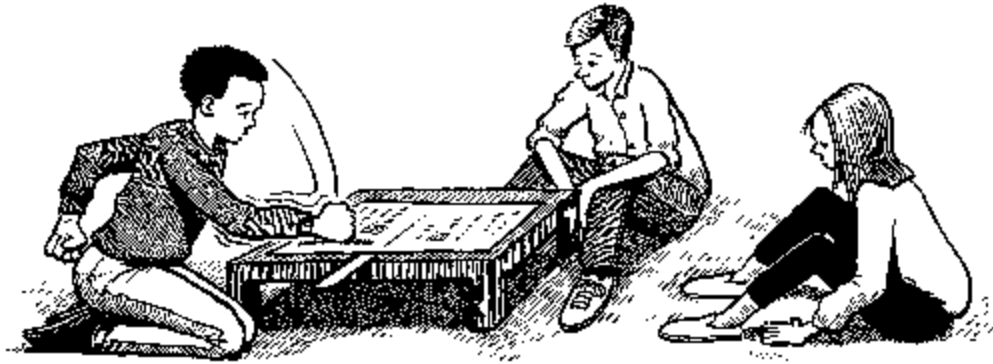
In high school, Franklin had fun participating in track and field sports. One year he won the national championship in the pole vault, and long jump!

All during his childhood, Franklin was encouraged by his parents and teachers. His grandfather often told him, "Franklin, someday you are going to be a scientist". His grandfather was right. Franklin went on to college and studied engineering and science. After college, he became a scientist and was later selected to be an astronaut. As an astronaut with NASA, Franklin said, "When I'm up orbiting Earth, I feel like there is nowhere else I'd rather be."

Back on the ground again, Franklin is working on a very exciting project. He is designing a rocket to get people to Mars. Franklin's dream is to travel to other planets in the hope of finding signs of other life. "If there are living creatures out there, let's find them and learn from them."



### Which is stronger, you or air?



Here's a great trick to show your friends.

**What you will need:**

- one ruler
- one page of a newspaper

1. Place the ruler on a table so that part of it extends past the edge of the table. Put the newspaper page on top of the part of the ruler that is on the table.
2. Ask your friends what they think will happen to the newspaper if you hit the extended end of the ruler.
3. Make a fist and hit the end of the ruler. Did the paper lift? Have your friends try it.

Why won't the paper lift up when you hit the ruler? Air actually has weight or pressure, 15 pounds per square inch. Air pressing down on the newspaper resists being lifted up quickly.

**FIND AND CIRCLE THE WORDS LISTED**

E N V I R O M N T D I A S  
 N A B S A T E L L I T E A  
 V I E N G I N E E R A N T  
 R O N S A F E L L I T Y T  
 A S T C S C R E N T I I E  
 N C I I T A O T U R M R L  
 M A R E R S S S R N A O I  
 I E O N O R S A T U R N T  
 N I N T N A S T R O S M E  
 E S D I A Z I P A G I E S  
 E T E S U I R A N M A N T  
 R I N T T P R O C K E T S  
 S A T E L L I E N T I S T

- ROSS
- SATELLITE
- ENGINEER
- PAO
- SATURN
- ENVIRONMENT
- DIAZ
- ASTRONAUT
- SCIENTIST
- ROCKET
- MARS