Presidential Series
Field Trip Enhancement Program

Cold War Kids: Space Race

Presented by the
Eisenhower Foundation

IKE Education

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Cold War Kids: Space Race

INTRODUCTION

The Cold War was a competition between the Soviet Union and the United States in every area, even space. This competition was started when the Soviet Union launched a satellite, Sputnik I, into space. The rocket power that launched Sputnik into space scared Americans who worried that the Soviets had gained the technologies to launch ballistic missiles with nuclear weapons to the United States.

The United States was quick to respond. Under President Eisenhower, NASA was established, fueling a "space race' in which the Soviet Union and the United States pushed each other to new feats of rocketry and eventually sending a man to the moon.

OBJECTIVES

- Students will gain knowledge of the characteristics and value of primary sources.
- Students will create a timeline of key events during the space race.
- Students will create a rocket to investigate motion and stability as they systematically test solutions to a problem.

TARGET AUDIENCE Grades 6-8

TIME REQUIREMENT 1 Hour

ACKNOWLEDGEMENTS

This unit was produced in July 2017 by the Eisenhower Foundation.

Shannon Heintz, writer

Mitzi Bankes Gose and Ben Ines, editors

Thanks to the Eisenhower Presidential Library, Museum and Boyhood Home for support.

CONTENTS

NATIONAL CURRICULUM STANDARDS

Next Generation Science Standards, Middle School
MS-PS2-2 Motion and Stability: Forces and Interactions
MS-ETS1-2 Engineering Design Evaluate Design Solutions
MS-ETS1-3 Engineering Design: Anaylze data

Common Core State Standards for Literacy in History/ Social Studies, Science, and Technical Subjects:
RST.6-8.1 Support Analysis
RST.6-8.9 Compare & Contrast Information
WHST.6-8.7 Research to Answer Question
WHST.6-8.9 Evidence and Reflection

Lesson Plan

1. Preparation for this lesson

A. Pre-print the following pages:

- Pages 4-5: one double-sided copy per group of 2-3 students
- Page 6: one set of these pre-cut pieces per group
- Pages 8-19: print and post around the classroom
- Pages 22-23: one double-sided copy per group

B. A smart phone or tablet and internet accessibility is needed for each group.

C. Gather materials for the straw rocket activity (see pages 20-21).

2. Read through **Introduction** (page 4) with students. Check their understanding by asking them WHEN primary sources are created. The key is that primary sources were created during the time period being studied. In this lesson, it will be the Space Race years 1957-1975. Show some of the primary sources collected for this topic. 5 minutes

3. Show students this Ted Ed **video** about the Space Race: www.youtube.com/watch?v=FxpC-8f--xo. Or show this Simply History video: https://www.youtube.com/watch?v=xvaEvCNZymo 5 minutes

4. Break students into groups of two or three students and give each group one copy of the **Space Race Timeline** (page 5) and one set of the **Timeline Event Cards** (page 6; pages 8-17 provide larger, more complete images if desired).

5. The **primary source/QR code posters** should be placed around the room. Instruct students that they will travel around the room with their group and their iPads to scan the QR codes* on the primary source/QR code posters (pages 8-19). As they read about that primary source, they are looking for a specific date for each event.

6. Each group should work together to place the appropriate timeline event cards in the correct box (thus chronological order), of the Space Race Timeline page. 15 minutes

7. When all groups have finished their Space Race Timeline, review the events as a class. Students should correct their timeline if needed as it is reviewed. The **teacher's key** is found on page 7. 5 minutes

8. Direct students through the **Straw Rocket Activity** (See pages 20-21). 30 minutes

* If QR codes are not working, the web addresses can be found on the resource list pages 25-26. The teacher may want to have these internet pages printed out as a backup.

Introduction

INTRODUCTION

The Cold War was a competition between the Soviet Union and the United States in every area, even space. This competition was started when the Soviet Union launched a satellite, Sputnik I, into space. The rocket power that launched Sputnik into space scared Americans who worried that the Soviets had gained the technologies to launch ballistic missiles with nuclear weapons to the United States.

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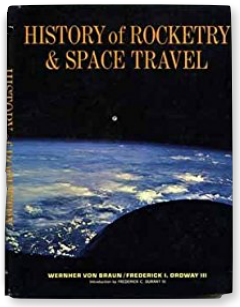
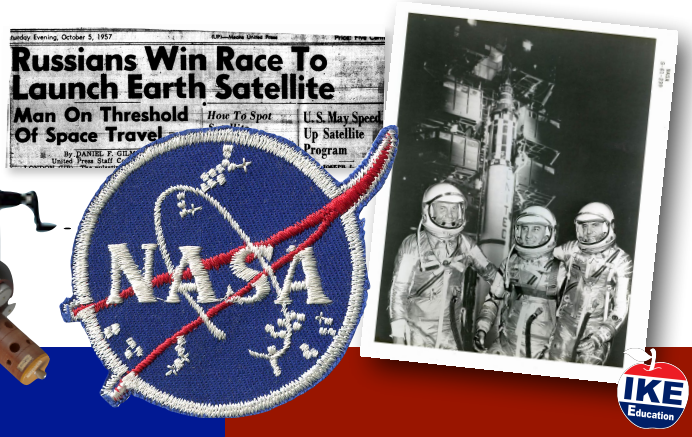
PRIMARY SOURCES
provide a window into the past.

What is a **primary source**? It is any direct evidence produced during a specific period under study. They vary widely and include objects like artifacts, documents, photographs, diaries, maps, movies, songs, and eyewitness accounts. The key is that they were created during the time period being studied. The Eisenhower Presidential Campus is full of primary sources! It is their mission to preserve and protect these amazing items so we can continue learning from them far into the future.

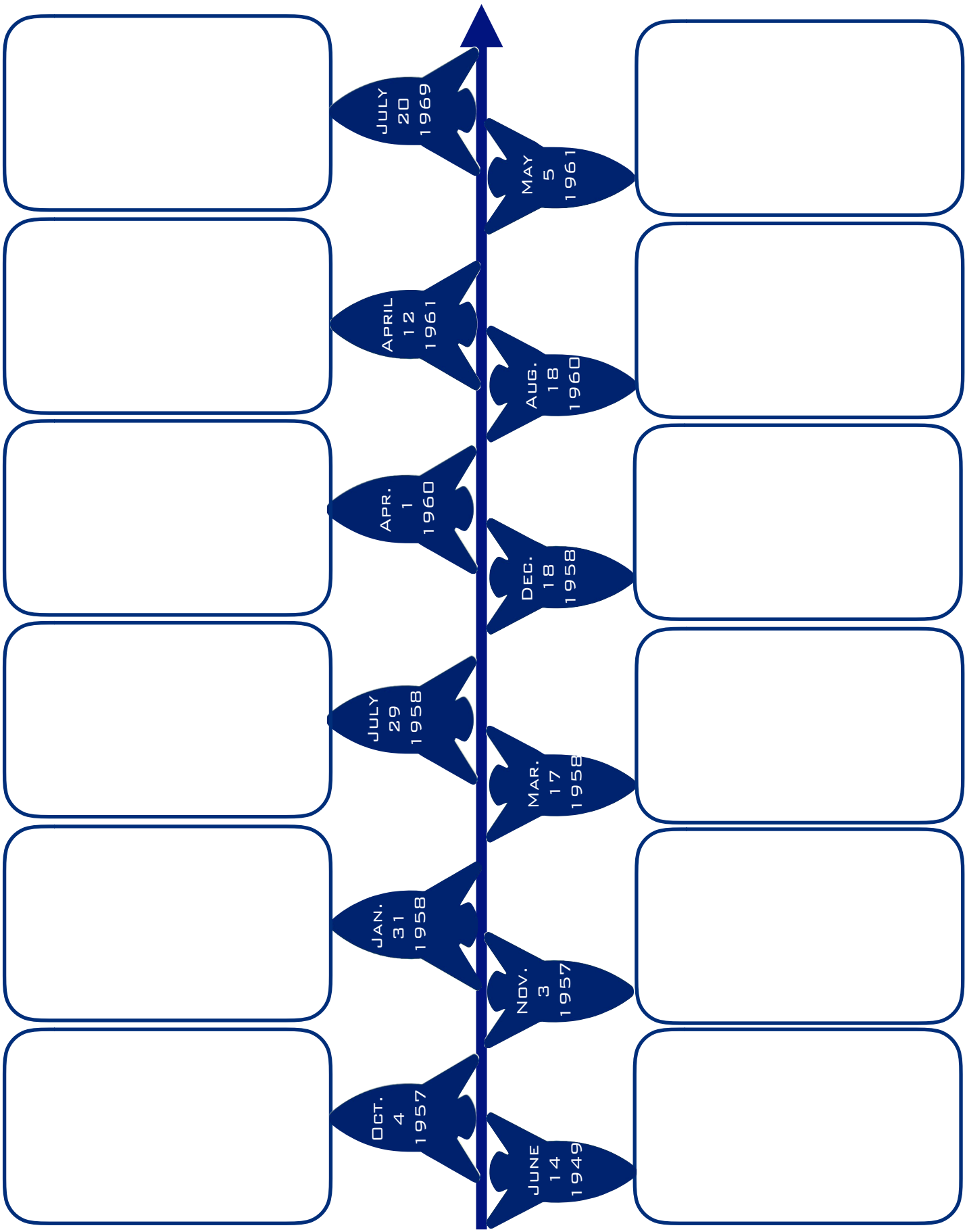
Primary sources differ from a **secondary source**, which is an interpretation of the past. History text books are typically secondary sources because the authors were not present at the time in history they are writing about, but are interpreting what they have learned about the event.



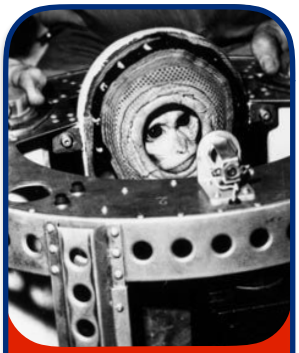
This is what makes learning with primary sources so engaging -- you get to hold a real piece of history in your hands and come up with your own conclusions of its significance. The answers are not always provided by the primary sources, so you are encouraged to seek the answers through inquiry and research.



Space Race Timeline



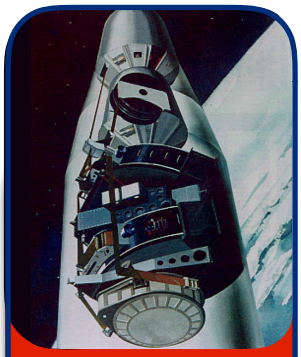
Timeline Event Cards



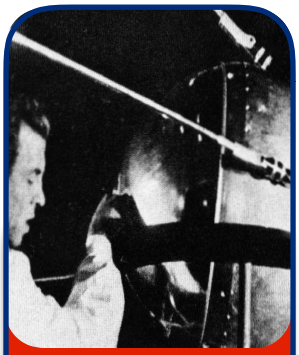
Albert II — U.S.A.
1st primate in space

Laika—U.S.S.R.
1st Dog to orbit Earth

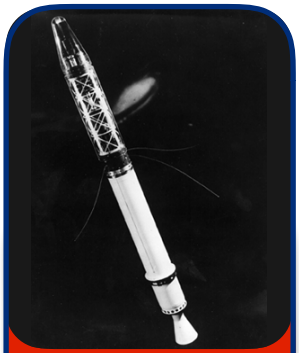
Vanguard I- U.S.A.
1st Satellite to run on solar power



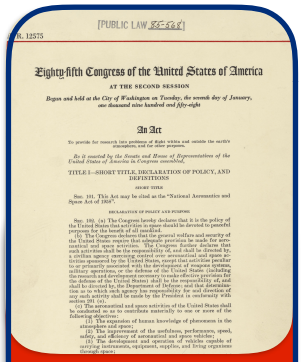
Corona - U.S.A.
1st satellite surveillance



Sputnik I - U.S.S.R.
1st satellite to orbit earth



Explorer I - U.S.A.
1st Satellite with scientific instruments


[PUBLIC LAW 85-568]

Eighty-fifth Congress of the United States of America

AT THE SECOND SESSION

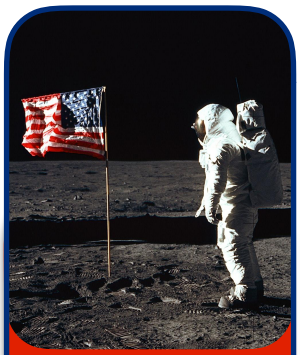
An Act

President Eisenhower establishes N.A.S.A.

Project SCORE - U.S.A. 1st Communication satellite

Yuri Gagarin - U.S.S.R.
1st human in space

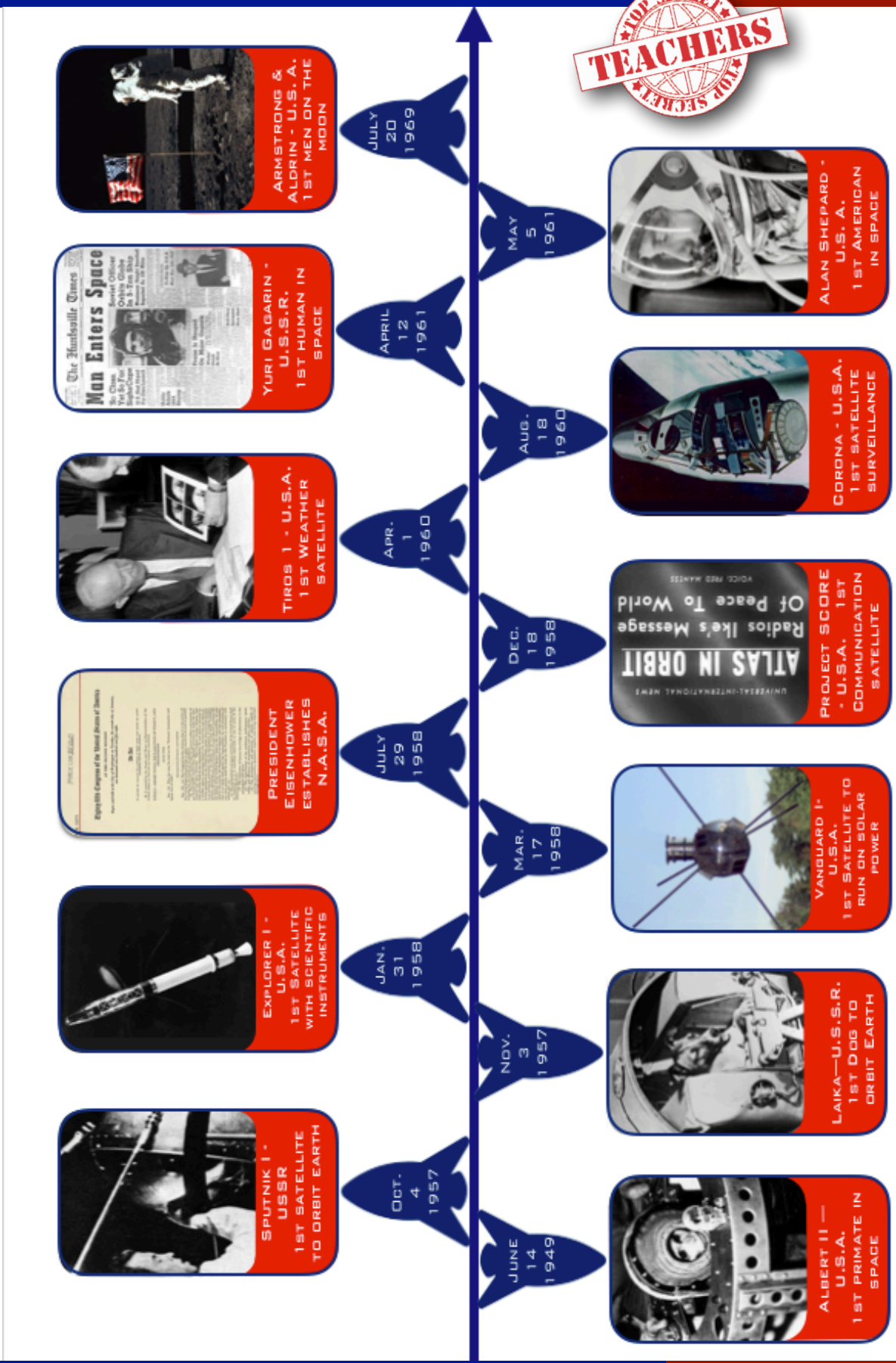
Alan Shepard - U.S.A.
1st American in space



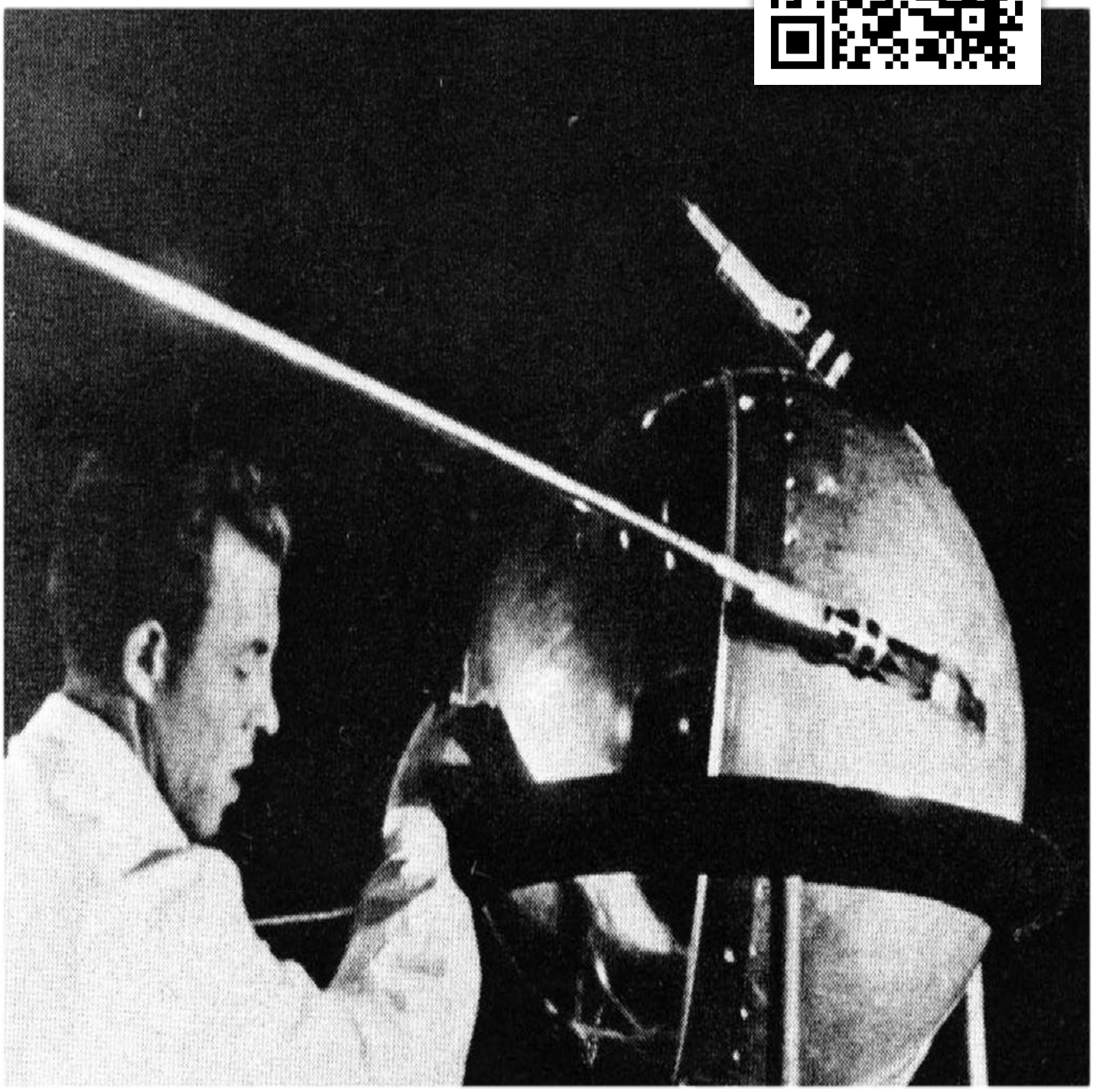
Armstrong & Aldrin - U.S.A.
1st men on the moon

Tiros 1 - U.S.A.
1st Weather satellite

KEY: Space Race Timeline



Sputnik I – U.S.S.R.
1st satellite to orbit Earth
Primary Source 12.3



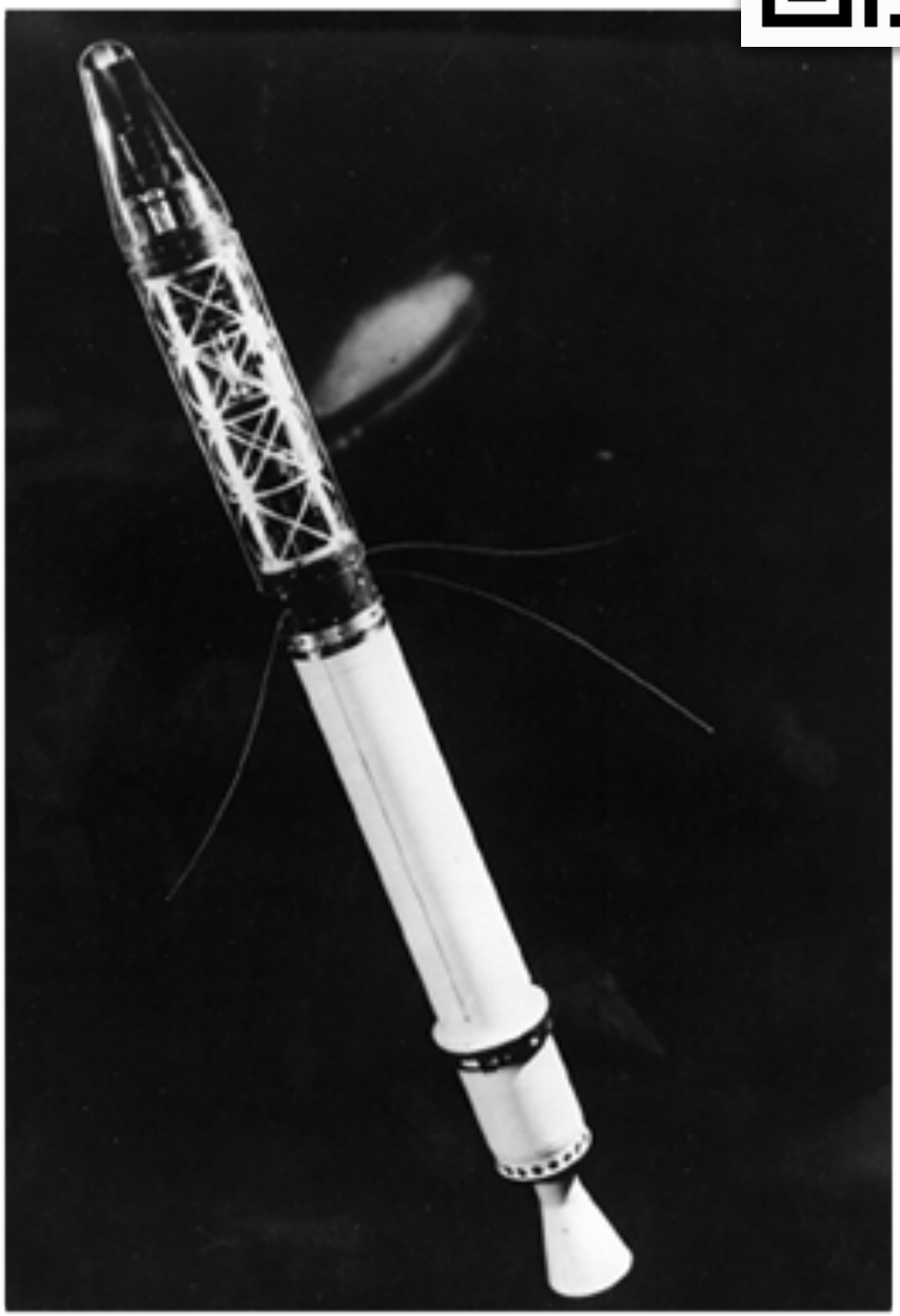
Primary Source

Neil Armstrong and Buzz Aldrin – U.S. A.
1st man walks on the moon
as part of Apollo 11 mission
Primary Source 12.4

Explorer 1 – U.S.A.

1st satellite to orbit Earth and carry science instruments

Primary Source 12.5



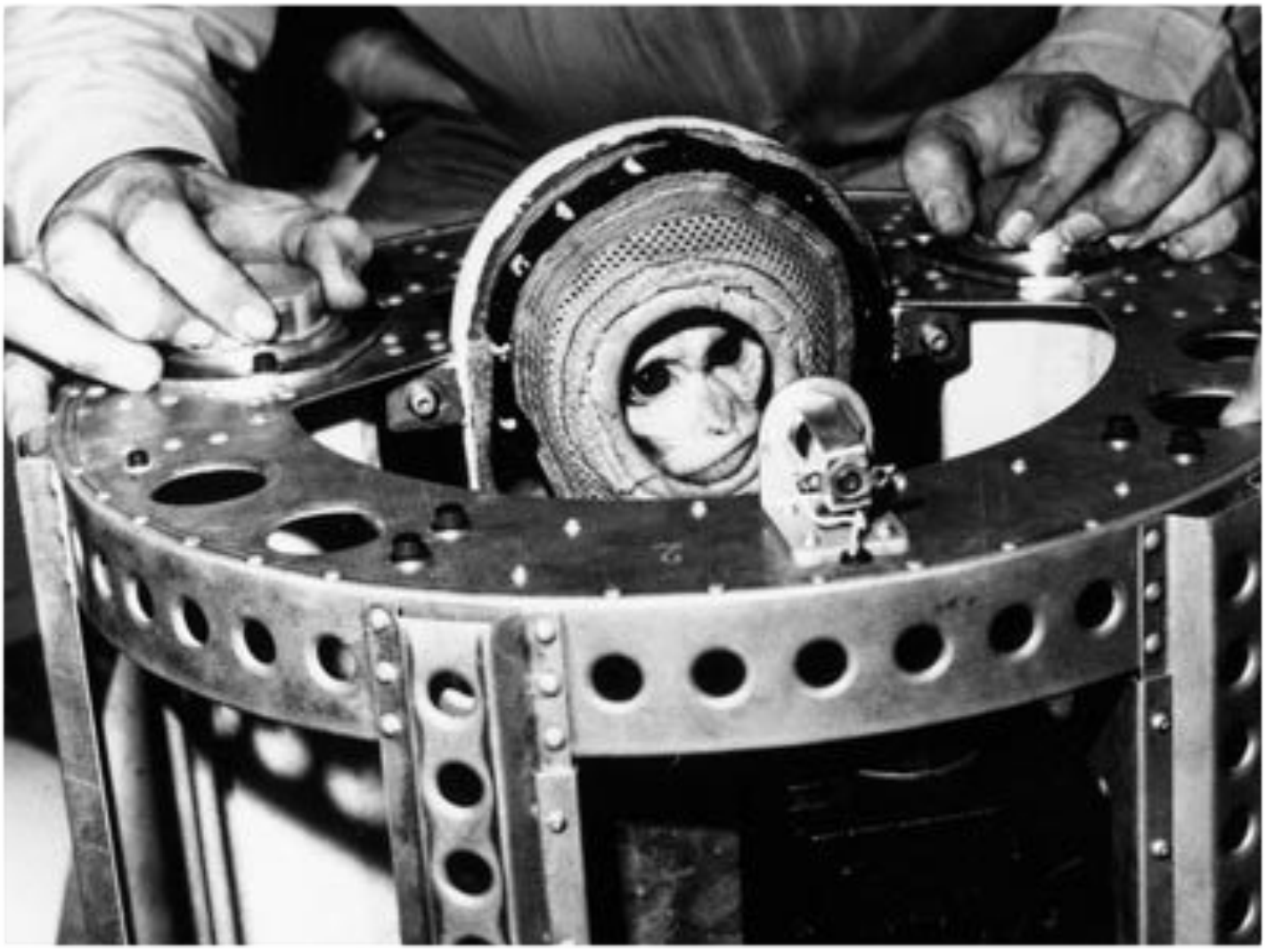
80" long
6.25" wide
30.66 lbs

Primary Source

Albert II— U.S.A.

1st primate/monkey to cross into space

Primary Source 12.6



National Aeronautics and Space Act

Primary Source 12.8

[PUBLIC LAW 85-568]

H. R. 12575

Eighty-fifth Congress of the United States of America

AT THE SECOND SESSION

Begun and held at the City of Washington on Tuesday, the seventh day of January, one thousand nine hundred and fifty-eight

THE WHITE HOUSE JUL 18 1958 RECEIVED

GENERAL SERVICES ADMINISTRATION RECEIVED JUL 29 1958 NARS FEDERAL REGISTER DIVISION

An Act

To provide for research into problems of flight within and outside the earth's atmosphere, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—SHORT TITLE, DECLARATION OF POLICY, AND DEFINITIONS

SHORT TITLE

SEC. 101. This Act may be cited as the "National Aeronautics and Space Act of 1958".

DECLARATION OF POLICY AND PURPOSE

SEC. 102. (a) The Congress hereby declares that it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind.

(b) The Congress declares that the general welfare and security of the United States require that adequate provision be made for aeronautical and space activities. The Congress further declares that such activities shall be the responsibility of, and shall be directed by, a civilian agency exercising control over aeronautical and space activities sponsored by the United States, except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including the research and development necessary to make effective provision for the defense of the United States) shall be the responsibility of, and shall be directed by, the Department of Defense; and that determination as to which such agency has responsibility for and direction of any such activity shall be made by the President in conformity with section 201 (e).

(c) The aeronautical and space activities of the United States shall be conducted so as to contribute materially to one or more of the following objectives:

(1) The expansion of human knowledge of phenomena in the atmosphere and space;

(2) The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles;

(3) The development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space;

(4) The establishment of long-range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes;

(5) The preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere;

(6) The making available to agencies directly concerned with national defense of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control nonmilitary aeronautical and space activities, of information as to discoveries which have value or significance to that agency;

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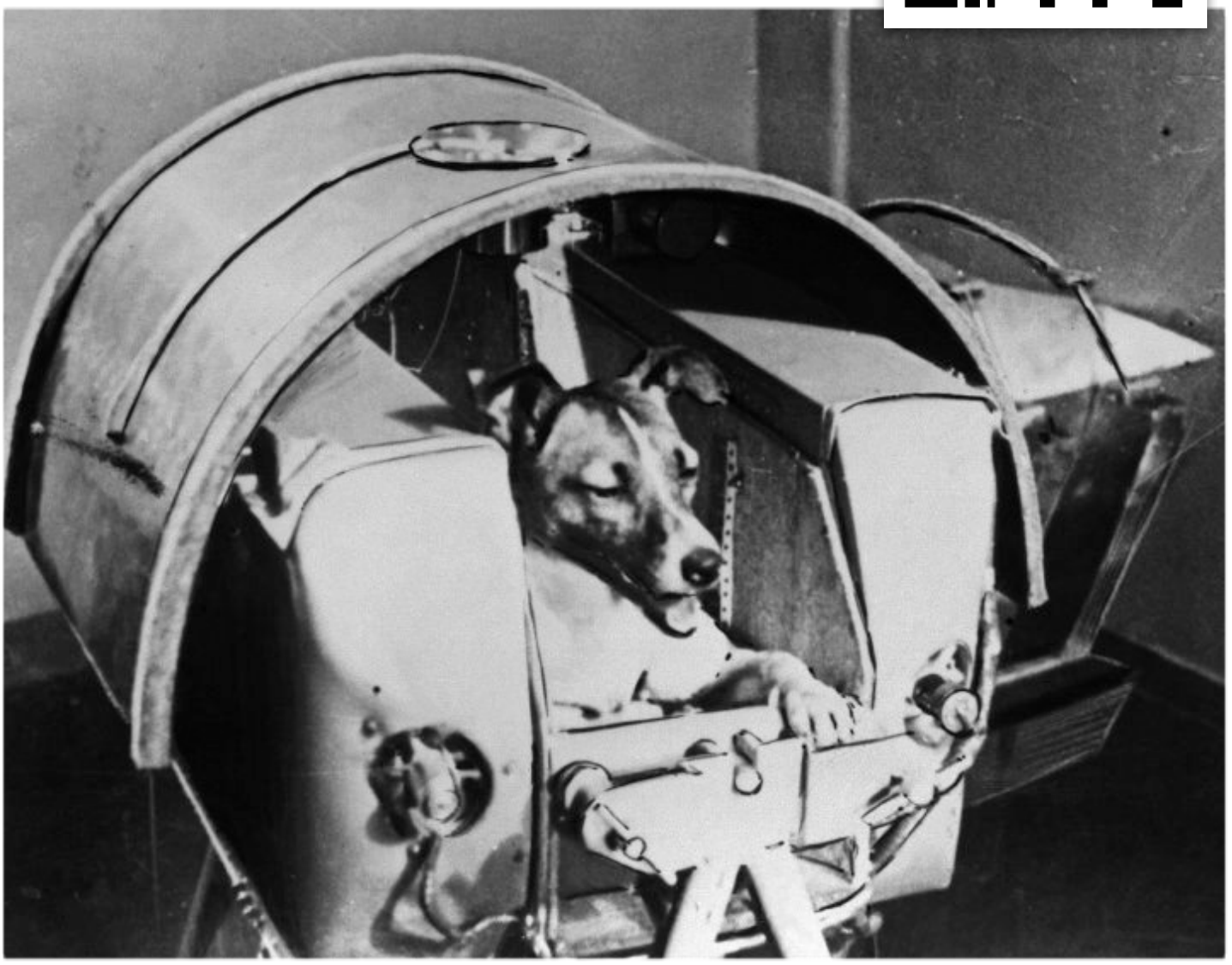
IKE Education

Primary Source

Laika — U.S.S.R.

1st living being/dog to orbit Earth

Primary Source 12.10



Primary Source

Vanguard I– U.S.A.

1st Satellite to run on solar power

Primary Source 12.11

Primary Source

Yuri Gagarin – U.S.S.R.
1st human in space
Primary Source 12.12

The Huntsville Times

Man Enters Space

'So Close, Yet So Far,' Sighs Cape

U.S. Had Hoped For Own Launch

Soviet Officer Orbits Globe In 5-Ton Ship

Maximum Height Reached Reported As 188 Miles

Hobbs Admits 1944 Slaying

To Keep Up, U. S. A. Must Run Like Hell'

Praise Is Heaped On Major Gagarin

'Worker' Stands By Story

Reds Deny Spacemen Have Died

Reds Win Running Lead In Race To Control Space

Primary Source

Alan Shepard – U.S.A.

1st American in space

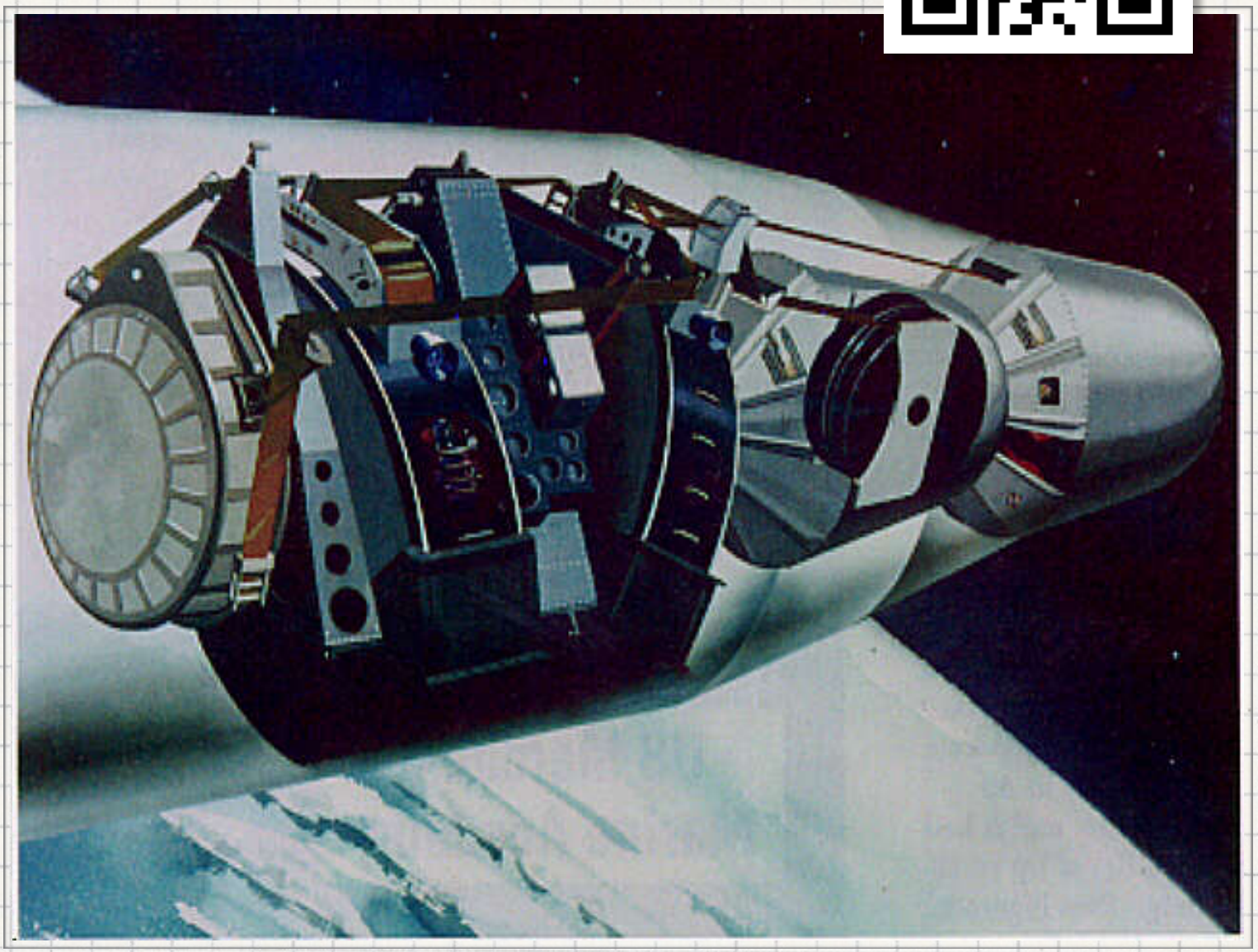
Primary Source 12.13

Primary Source

Corona – U.S.A.

1st satellite surveillance

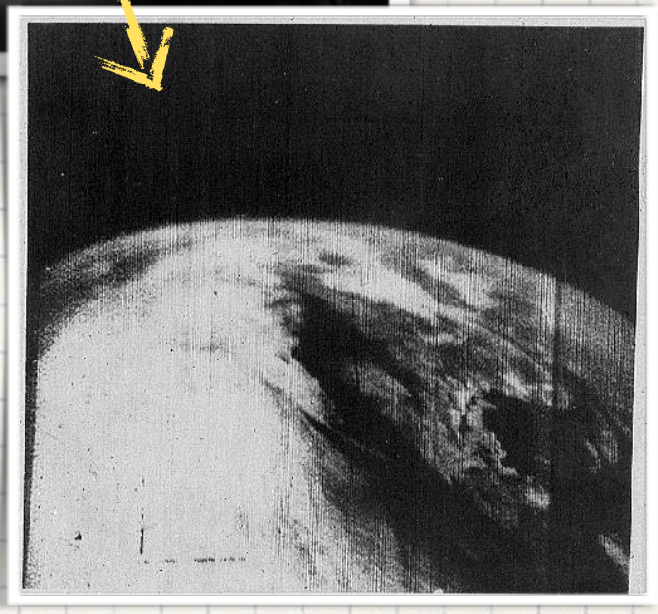
Primary Source 12.14



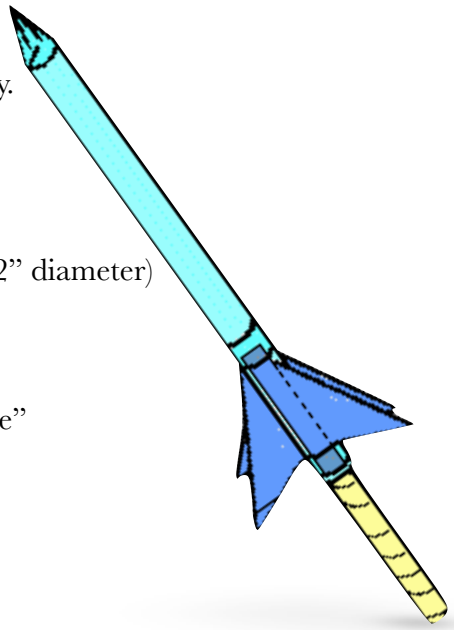
Primary Source

Project SCORE – U.S.A.
1st Communications satellite into orbit,
1st Voice transmitted from space:
President Dwight D. Eisenhower
Primary Source 12.15

Tiros 1 – U.S.A.
1st Weather satellite
Primary Sources 12.16, 12.17



Straw Rocket Activity



1: Prepare ahead of time

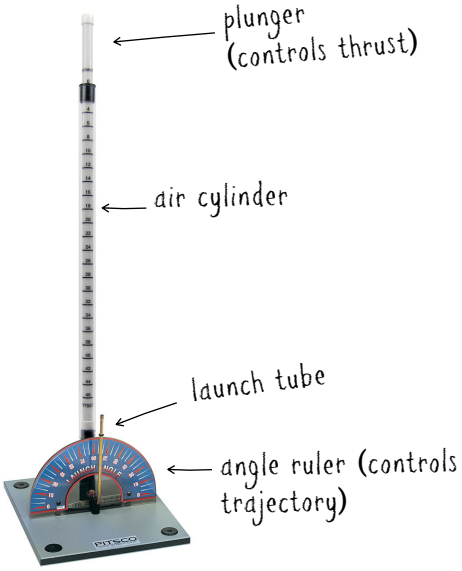
A. Read the lesson and teacher notes to become familiar with the activity.
B. Gather the following materials:
   - small amount of modeling clay
   - cardstock or blank index cards
   - scissors
   - Pitsco Education Precision Straws, or drinking straws (at least 7/32" diameter)
   - scotch tape and/or construction tape
   - marker
   - measuring tape
   - two-sided copies of pages 30-31, "Rockets" and "Design Challenge"
C. Build an example rocket.
D. Set up the target, launching point, and mark distance.*
E. Set up and test the rocket launcher.**

2: Introduce the activity 10 minutes

A. Distribute a Rockets/Design Challenge sheet to each group.
   i. Using the "Rockets" side, instruct students about the the forces on a rocket, the basic parts of a rocket, and a few rocket facts. Teachers may want to spend much more time going into these terms and laws depending on their classroom objectives. www.NASA.gov is an excellent source.
   ii. Using the "Design Challenge" side, inform students that they are being challenged to make a rocket out of straw that uses air power to try to hit a target. Improving a design based on testing is called the **engineering design process**. They will apply this by testing their rockets, and finding ways to make it work better.
B. Show kids your example rocket. See if they can name the main parts and introduce them to new vocabulary. Teachers may want to post these new words and/or show a visual.
C. Demonstrate how to construct the straw rocket and how to record the variables on the Design Challenge sheet.
   i. Start with a straw. Cut out fins from cardstock and secure to straw (with tape). The shape and number of the fins is up to each group, but they need to record it on the challenge sheet.
   ii. Add some modeling clay for a nosecone at the end of the straw. Amount (weight) and shape is up to each group, but they need to record it on the challenge sheet.

** Set up a target (a bullseye is provided on page 32) and a launching point (a piece of tape on the floor works to ensure the launcher stays in the same place. Use a measuring tape and construction tape to mark distance from launcher to target so students can measure how far their rocket flew.*

*** We have chosen to use a Pitsco Education straw rocket launcher. www.pitsco.com/Straw-Rocket-Launcher*



D. Show students how the rocket launcher works.

i. The Straw Rocket Launcher features an adjustable launch tube and plunger. These features allow students to change the launch trajectory and thrust.

ii. Adjust the angle of trajectory by moving the launch tube. Record the angle indicated on the ruler behind the launch tube.

iii. Adjust the thrust by raising the plunger to different heights. This will vary the volume of air that is compressed when one lets go of the plunger. Record the centimeters indicated on the air cylinder.

iv. Launch the example rocket. Record its distance.

E. Brainstorm ways that students can change the design of the rocket to change the outcome.

i. What are some ways you can change a rocket? *(the length of the straw; the straw's weight; the weight and shape of the nosecone; the number and position of fins)*

ii. How will adding weight to the straw's nose or having fins affect how it flies? *(Adding weight to the straw's nose or placing fins near the back can help it fly straighter.)*

iii. When you launch your straw rocket, how does the launch angle affect where it lands? *(Launching a rocket straight up sends it high but not far; straight out makes it fall quickly to the floor. This could be a great opportunity to explore angles with kids.)*

iv. Note to students that it is scientifically best to change only one component at a time in order to know exactly which change had what effect. Because of time constraints today, each group will probably only get three launch attempts, so watch others' rocket launches to learn how changes affect their rockets.

3: Build, test, evaluate, and redesign 15 minutes

A. Distribute the materials needed per rocket (one rocket per group).

B. Students now build their rocket, being careful to record its information.

C. Students can change their rocket design after their initial attempt and launch it again. Their goal is to design a rocket to fly the closest to the target.

4: Discuss what happened 5 minutes

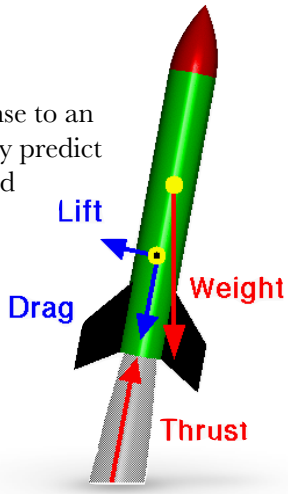
A. Have the students reflect by answering the Final Questions at the bottom of the Design Challenge sheet.

B. If time allows, student groups should show each other their rockets and talk about their design decisions.

Rockets

Forces on a Rocket

Over 300 years ago, **Sir Isaac Newton** first accurately described the motion of an object in response to an external force **using his three laws of motion**. Engineers still use Newton's laws to design as they predict and test the flight of full scale rockets. In flight, a rocket is subjected to four forces; weight, thrust, and the aerodynamic forces, lift and drag.



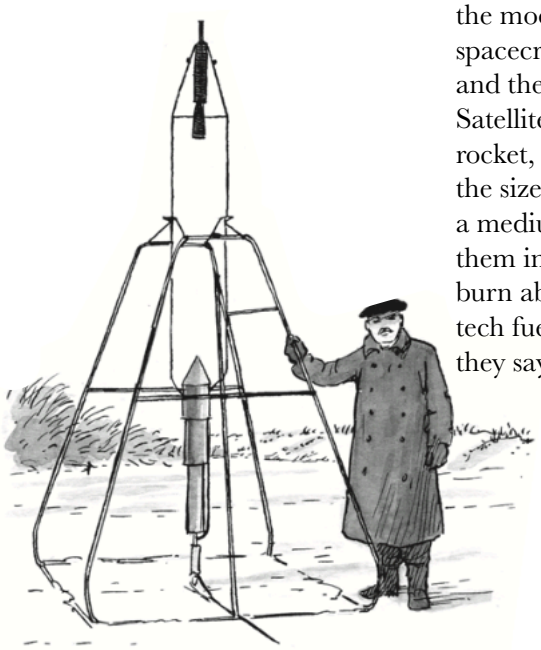
- **aerodynamic** = how air flows over the rocket
- **drag** = the aerodynamic force that opposes an aircraft's motion through the air
- **engineering design process** = improving a design based on testing
- **lift** = the aerodynamic force perpendicular to the flight direction
- **stability** = lack of wobbling during flight; staying vertical along its flight path
- **thrust** = the force which moves an aircraft through the air. Thrust is used to overcome the drag of an airplane, and to overcome the weight of a rocket. Thrust is generated by some kind of propulsion system
- **trajectory** = the path followed by a moving object
- **weight** = the mass of all the parts of the rocket. The weight is always directed towards the center of earth and acts through the center of gravity.

My, How Things Have Changed

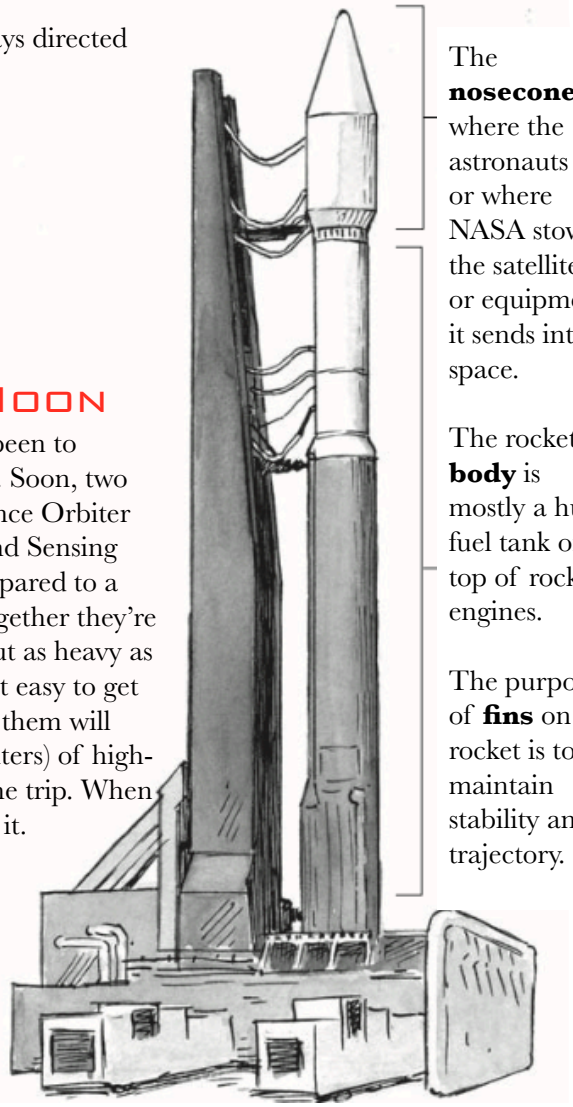
In 1926, Robert Goddard designed and built the first liquid-fuel rocket. It flew for only 21/2 seconds and went just 41 feet. Today's rockets travel fast, far, and for a long time. One rocket, called Voyager 1, has been traveling for more than 30 years and is now about 10 billion miles from Earth! Talk about improving a design!

Take Me to The Moon

It's been over 25 years since NASA's been to the moon. But that's about to change. Soon, two spacecraft — the Lunar Reconnaissance Orbiter and the Lunar Crater Observation and Sensing Satellite — will be on their way. Compared to a rocket, these spacecraft are tiny — together they're the size of a school bus and only about as heavy as a medium-sized elephant. Still, it's not easy to get them into space. The rocket carrying them will burn about 90,000 gallons (341,000 liters) of high-tech fuel in the first few seconds of the trip. When they say, "Blast off," they really mean it.



Robert Goddard and the first liquid-fuel rocket



The **nosecone** is where the astronauts sit or where NASA stows the satellites or equipment it sends into space.

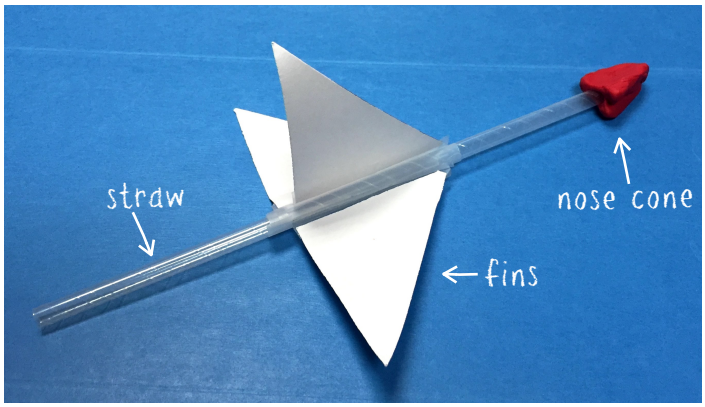
The rocket **body** is mostly a huge fuel tank on top of rocket engines.

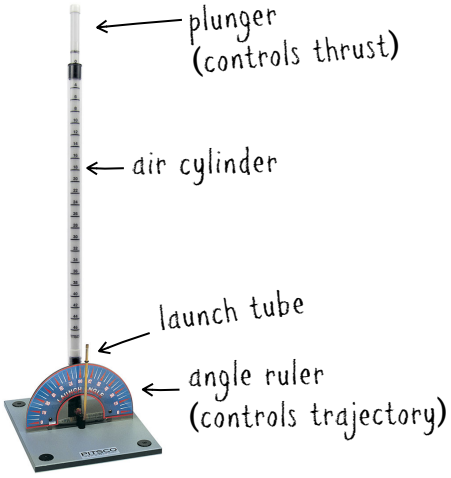
The purpose of **fins** on a rocket is to maintain stability and trajectory.

This page of information is adapted from "Launch It" at www.nasa.gov

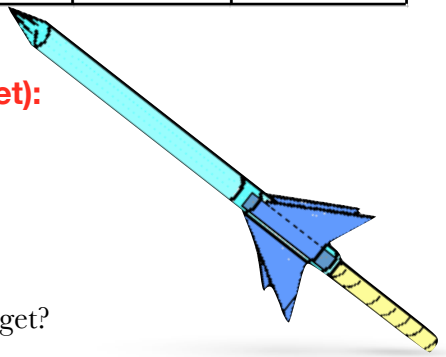
Straw Rocket Design Challenge Sheet

Challenge: Use the engineering design process to build and test an air-powered rocket that can hit a distant target.





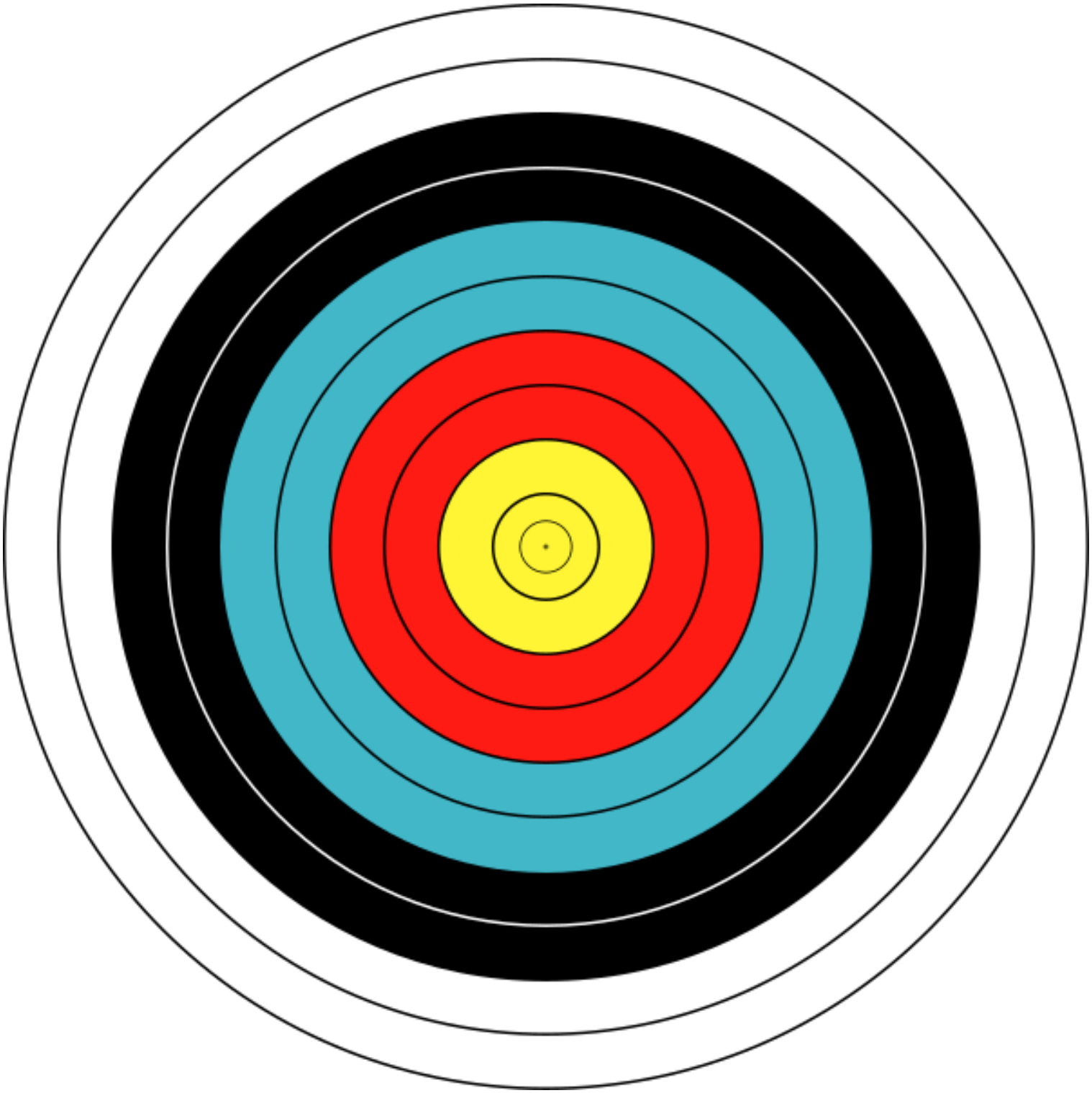
launch #	shape of fins	# of fins	shape of nosecone	rocket's weight	launch angle (trajectory)	height of plunger (thrust)	distance traveled
1							
2							
3							
4							



Final Questions (answer after flying and redesigning your rocket):

1). After each launch, why did you make the changes you did?

2). What features of your design helped your rocket come closest to the target?



Sources

Benson, Tom. "Welcome to the Beginner's Guide to Rockets." *NASA*. June 12, 2014. Nov. 8, 2017. https://www.grc.nasa.gov/.

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12.13 photo	Alan Shepard Image Credit: NASA https://www.nasa.gov/multimedia/imagegallery/image_feature_171.html https://www.nasa.gov/multimedia/imagegallery/image_feature_1076.html
12.14 image	Corona satellite Image Credit unknown http://www.geog.ucsb.edu/~kclarke/Corona/story2.htm
12.15 video	Universal-International Newsreel, "Atlas in Orbit: Radios Ike's Message of Peace to World" December 22, 1958 https://www.youtube.com/watch?v=KTOpjhL1430
12.16 photo	April 1, 1960 - Eisenhower and Dr. T. Keith Glennan review photographs transmitted from Satellite Tiros I. The satellite was designed under NASA's national program in space exploration to aid in meteorological research. Eisenhower Presidential Library, Abilene, KS Photo Collection: 72-3381-1 (NPS) http://www.dwightdeisenhower.com/gallery.aspx?PID=295
12.17 photo	The first photo of Earth from a weather satellite, taken by the TIROS-1 satellite on April 1, 1960. https://www.nasa.gov/topics/earth/earthday/gall_tiros.html

Sources Continued

Number/Type	Description
12.1 magazine*	*TIME* Magazine, December 6. 1968, Race for the Moon
12.2 magazine*	*LIFE* Magazine, June 15th, 1959, Traveling space monkeys, Able and Baker
12.3 photo	Sputnik 1 satellite Image credit: NASA/Asif A. Siddiqi https://www.nasa.gov/multimedia/imagegallery/image_feature_924.html
12.4 photo	Neil Armstrong takes photo as Buzz Aldrin walks on the moon Photo credit: NASA, GPN-2001-000012 https://www.nasa.gov/mission_pages/apollo/apollo11.html
12.5 photo	Explorer I satellite Photo credit: NASA https://www.nasa.gov/mission_pages/explorer/explorer-overview.html
12.6 photo	Albert II, the monkey Photo Credit: NASA https://www.universetoday.com/38704/first-monkey-in-space/
12.7 document*	Statement by the President regarding H.R. 12575, the *National Aeronautics and Space Act of 1958*, July 29, 1958 Eisenhower Presidential Library: Kevin McCann Collection of Press Releases, Box21, July 1958; NAID #12060469. https://www.eisenhower.archives.gov/research/online_documents/nasa/Binder17.pdf
12.8 document	Act of July 29, 1958 (*National Aeronautics and Space Act of 1958*), Public Law 85-568, 72 STAT 426 https://catalog.archives.gov/id/299868
12.9 photo*	President Eisenhower presenting NASA commissions, July 29, 1958 Image credit: NASA https://www.nasa.gov/multimedia/imagegallery/image_feature_1139.html
12.10 photo	Laika the dog Photo credit: unknown source http://news.bbc.co.uk/onthisday/hi/dates/stories/november/3/newsid_3191000/3191083.stm
12.11 photo	Vanguard 1 satellite Photo credit: NASA image: https://nssdc.gsfc.nasa.gov/image/spacecraft/vanguard1.jpg content: https://www.nasa.gov/content/vanguard-satellite-1958
12.12 newspaper	"Man Enters Space." *The Huntsville Times."* April 12, 1961 Image credit: NASA https://www.nasa.gov/mission_pages/shuttle/sts1/gagarin_anniversary.html

*This primary source is on display for students to see, but is not used as part of the QR code timeline activity.