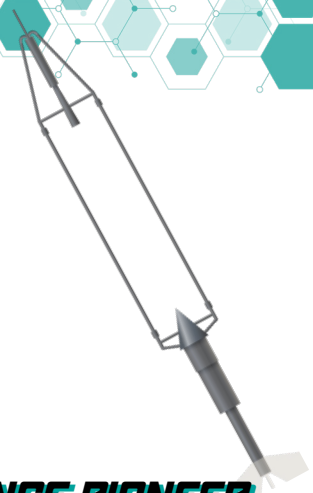
ROBERT GODDARD STEM TOOLKIT

TEAM TASKS



Explore the origins of modern rocketry by learning about **Robert Goddard**, the first person to successfully launch a **liquid-fueled rocket**. Through engineering challenges and scientific thinking, experience what it was like to be at the very beginning of space exploration.

Watch the historical documentary **Robert Goddard: Mr. Rocket Science** on YouTube to get some background knowledge about Goddard's life and achievements. Then, complete the quiz to see what you discovered about the American engineer, physicist, and inventor who is widely recognized as the father of modern rocketry.

ROBERT GODDARD: ROCKET SCIENCE PIONEER

1. What is Robert Goddard most famous for inventing?
   - A. The first airplane
   - B. The first liquid-fueled rocket
   - C. The first telescope
   - D. The first satellite

2. As a young person, what inspired Goddard's interest in space travel?
   - A. Meeting astronauts
   - B. Watching airplanes fly
   - C. Reading science fiction books
   - D. Studying at Princeton University

3. What important day did Goddard celebrate every year of his life?
   - A. The day he launched his first rocket
   - B. The day he received funding from the Smithsonian
   - C. October 19th, which he called "Anniversary Day"
   - D. The day he moved to Roswell, New Mexico

4. Why did Goddard choose to use liquid fuel instead of solid fuel for his rockets?
   - A. Liquid fuel was cheaper
   - B. Liquid fuel was easier to find
   - C. Solid fuel created too much smoke
   - D. Solid fuel didn't provide enough thrust to escape Earth's gravity

5. What health problem did Goddard overcome in 1913?
   - A. Tuberculosis
   - B. A broken leg
   - C. Heart disease
   - D. Pneumonia

6. What did Goddard prove about rockets that many people didn't believe?
   - A. That rockets could be painted different colors
   - B. That rockets could work in a vacuum (space)
   - C. That rockets could carry people
   - D. That rockets could be controlled remotely

7. Who helped provide Goddard with funding and a better place to launch his rockets?
   A. The U.S. government and NASA
   B. Charles Lindbergh and Harry Guggenheim
   C. Jules Verne and H.G. Wells
   D. The New York Times and Mary Pickford

8. What important rocket component did Goddard invent that is still used today?
   A. The parachute
   B. The fuel tank
   C. The nozzle
   D. The control panel

9. Why did Goddard move to Roswell, New Mexico?
   A. To be closer to his family
   B. To work with other scientists
   C. For better weather conditions for launching rockets
   D. To keep his work secret from the government

10. What happened after Goddard's death that finally recognized his contributions?
    A. A museum was built in his hometown
    B. NASA paid his widow for his patents
    C. A crater on the Moon was named after him
    D. German scientists admitted copying his work

GODDARD'S ROCKET LOG

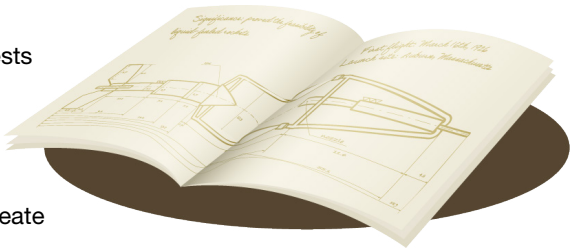
Objective: Use historical imagination and science writing skills to reflect on early rocketry.

Your Task: Write a journal entry as Robert Goddard on the night before his first successful rocket launch in 1926. Prompts may include:

- What challenges did you face today?
- What are your hopes or fears about tomorrow's launch?
- What do you think the future of space travel might look like?

Make sure to include:

- Descriptions of materials and tests
- Scientific reasoning
- Emotional reflection



Share your entry with your team or create a "Rocket Log Wall" display.

ROCKET CHAIN REACTION CHALLENGE

Objective: Learn about engineering sequences and cause-and-effect in launching rockets. First, watch **Rockets 101 | National Geographic** to learn about how rockets work and what happens during a launch.

Materials:

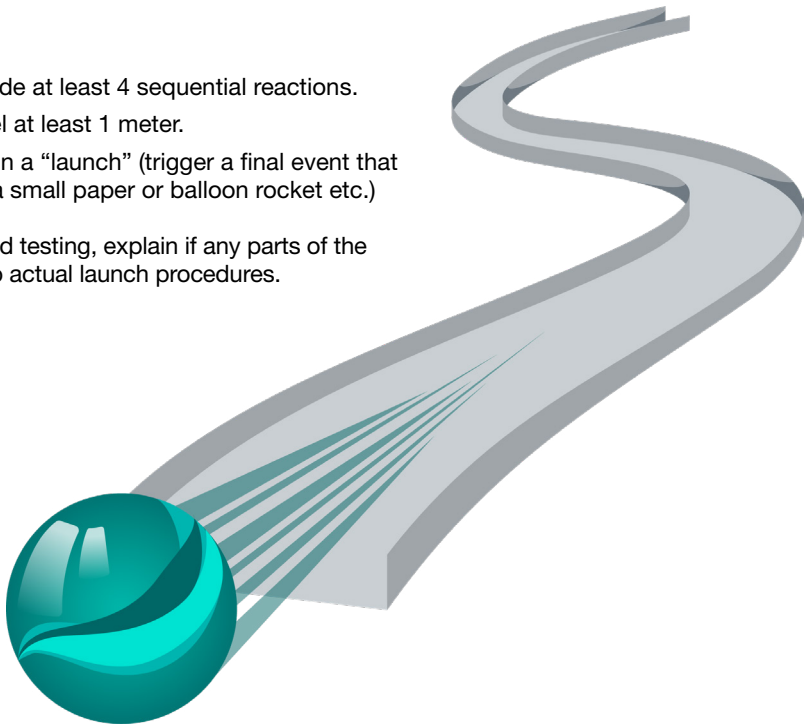
- Dominoes, marbles, ramps, cups, string, paper towel tubes, ping-pong balls, toy cars, scrap cardboard, paper, balloons, tape, straws, etc.
- Timer and measuring tape
- **Chain Reaction Rube Goldberg Machine** video from the Guinness World Records (see a Rube Goldberg Machine in action!)

Your Task: Design a chain reaction contraption (Rube Goldberg-style) to simulate a rocket launch. The goal is to trigger a final event that launches a small paper or balloon rocket. For balloon rocket ideas, check out this free **Mini Mission: Flight Data Sensing**.

Challenges:

- Must include at least 4 sequential reactions.
- Must travel at least 1 meter.
- Must end in a “launch” (trigger a final event that launches a small paper or balloon rocket etc.)

After building and testing, explain if any parts of the process relate to actual launch procedures.



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MINI LIQUID-FUEL ROCKET EXPERIMENT

Objective: Demonstrate the concept of fuel mixing and thrust in a simple, safe way.

Materials:

- Safety glasses
- Small plastic film canisters
- Vinegar, baking soda, facial tissue
- Measuring spoons

Your Task:

A. Predict how different ratios of "fuel" (vinegar and baking soda) will affect thrust.
B. Put on safety glasses, load canisters, seal tightly, and launch (preferably outside).
C. Measure and record:
   - Time to launch
   - Height/distance traveled
D. Graph results to identify optimal fuel ratio.

Use this to explain how Goddard's shift to liquid fuel gave greater control over thrust and timing than black powder or solid fuels.

DESIGN A MONUMENT TO GODDARD

Objective: Honor the historical significance of Robert Goddard through creativity and critical thinking.

Materials:

- Art supplies, clay or building blocks, poster paper, 3D printing, etc.

Your Task: Design a public monument or museum exhibit celebrating Robert Goddard's contributions. Decide where you are going to put your monument (the Moon, Mars, etc.)

Make sure to:

- Include a statue, plaque, or interactive exhibit feature
- Explain what moment or idea from Goddard's life it represents
- Create a short presentation about why your design is meaningful

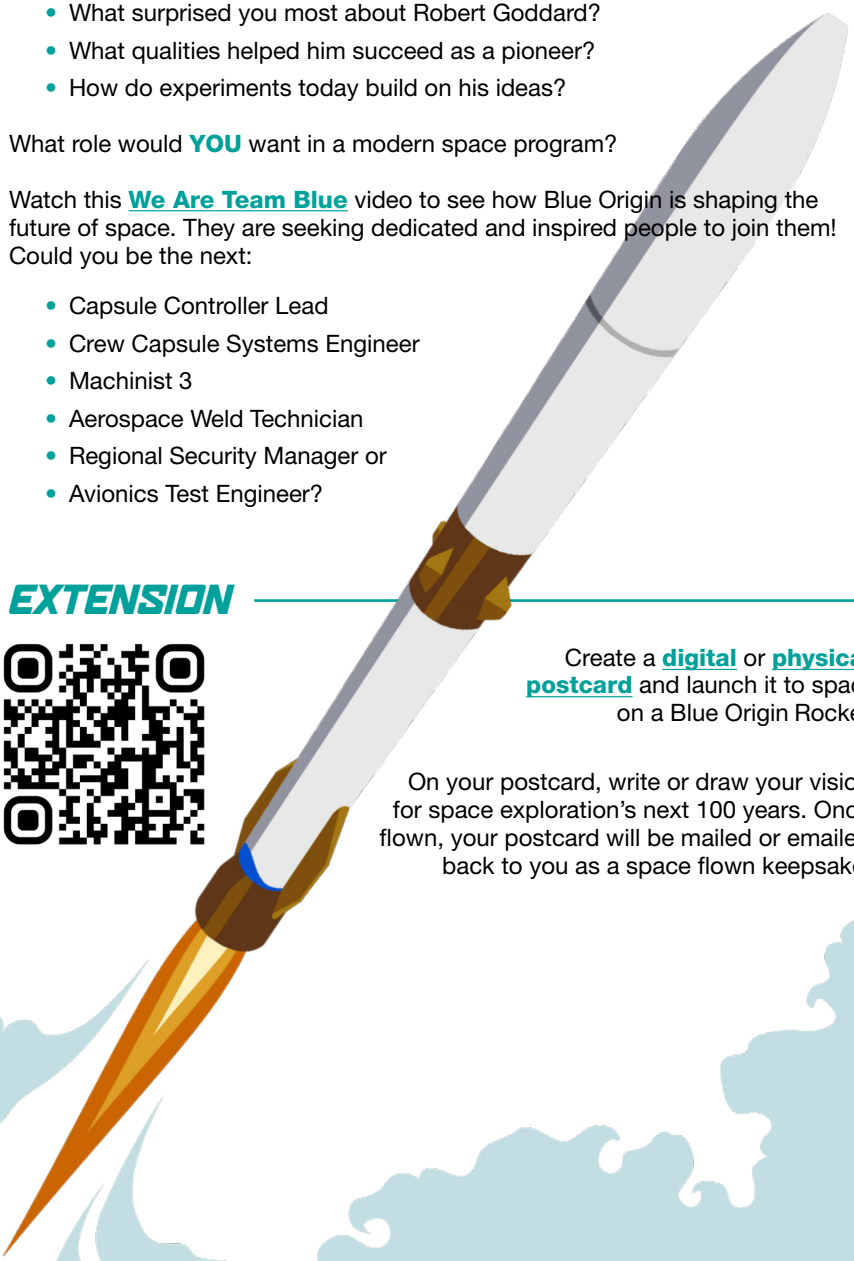
STEM MISSION DEBRIEF

- What surprised you most about Robert Goddard?
- What qualities helped him succeed as a pioneer?
- How do experiments today build on his ideas?

What role would **YOU** want in a modern space program?

Watch this **We Are Team Blue** video to see how Blue Origin is shaping the future of space. They are seeking dedicated and inspired people to join them! Could you be the next:

- Capsule Controller Lead
- Crew Capsule Systems Engineer
- Machinist 3
- Aerospace Weld Technician
- Regional Security Manager or
- Avionics Test Engineer?



EXTENSION

Create a **digital** or **physical postcard** and launch it to space on a Blue Origin Rocket!

On your postcard, write or draw your vision for space exploration's next 100 years. Once flown, your postcard will be mailed or emailed back to you as a space flown keepsake!

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HOST YOUR OWN GODDARD ROCKET LAUNCH

BEFORE LAUNCH

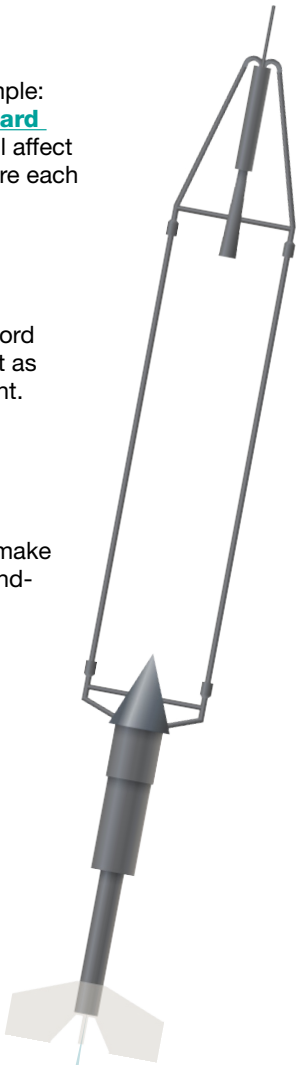
Plan your mission by selecting a rocket type (for example: straw rocket, **stomp rocket**, or **Estes Robert Goddard Rocket**) and predict how design and launch angle will affect flight. This mirrors Goddard's careful preparation before each test.

DURING LAUNCH

Conduct your launch, observe flight behavior, and record simple data such as distance, height, or stability – just as Goddard collected observations from every experiment.

AFTER LAUNCH

Reflect on your results, compare outcomes to your predictions, and identify one modification you would make to improve performance, modeling Goddard's build-and-improve approach to innovation.



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ACTIVITY STANDARDS

Activity 1: Common Core State Standards for English Language Arts
CCSS.ELA-LITERACY.W.3–5.3
CCSS.ELA-LITERACY.W.6–8.3
CCSS.ELA-LITERACY.W.9–10.3

Activity 2: Next Generation Science Standards
3–5-ETS1-1
3–5-ETS1-2
3–5-ETS1-3
MS-ETS1-1
MS-ETS1-2
MS-ETS1-3
MS-ETS1-4
HS-ETS1-2
HS-ETS1-3
HS-ETS1-4

Activity 3: Next Generation Science Standards
3–5-ETS1-1
3–5-ETS1-3
MS-ETS1-2
MS-ETS1-3
HS-ETS1-2
HS-ETS1-3

Activity 4: Common Core State Standards for English Language Arts
CCSS.ELA-LITERACY.SL.3-5.6
CCSS.ELA-LITERACY.SL.6-8.6
CCSS.ELA-LITERACY.SL.9.6, SL.10.6
CCSS.ELA-LITERACY.SL.11.6, SL.12.6

ANSWER KEY FOR ROBERT GODDARD: PIONEER OF ROCKET SCIENCE QUIZ

1. B
2. C
3. C
4. D
5. A
6. B
7. B
8. C
9. C
10. B