

THE GODDARD ROCKET...

From Aerospace Education Excellence (AEX) Booklet

Objective: To introduce students to the man who pioneered liquid-propelled, controlled rocket flight. This activity also allows students to build an inexpensive flying model of Robert Goddard's 1931 rocket.

Materials: Template sheet for fins (reproduce for each student), one foam meat tray, one pipe insulation tube cut to a length of 14 inches. (Note foam pipe insulation tubes come in five foot lengths. You can get 4 rockets from one of these tubes. For a class of 30, you'll need 8 tubes. The cost varies, but the average is around one dollar per tube), one cable tie, one #64 rubber band, and one soda straw and then hot glue guns and snap knives for sharing. **Remember: safety. Use caution with snap knives, hot glue guns and shooting completed rockets.**

Background: Rockets have been known to exist for centuries, but all of the thrust devices employed in these primitive "fire arrows," as the Chinese called them, were made of solid materials and once ignited, were uncontrollable. Robert Hutchings Goddard, who is considered to be the Father of Modern Rocketry, was born in Worcester, Massachusetts, and as a boy developed an interest in space travel. Later, as a scientist, he pioneered the technology of using liquids for thrust power instead of the uncontrollable solid fuels. By using a combination of liquids, rather than solids, Goddard was able to vary the volume of fuel flow and thus, get control of the amount of thrust produced. This paved the way for manned, rocket-powered craft. In 1926, near Auburn, Massachusetts, Dr. Goddard suc-

cessfully launched the world's first liquid-fueled rocket the size of an automobile engine, produces approximately 3000 times more power. Goddard's research opened the "door to space flight." To be able to go into space, man had to first break the sound barrier. On October 14, 1947, Charles E. "Chuck" Yeager accomplished this feat when his rocket-powered Bell XS-1 exceeded the speed of sound.

During his lifetime, Robert Goddard's work received little attention from his country and from his fellow scientists; however, after his death, the government recognized his great contributions and awarded his family the Congressional Gold Medal.

National Science Standards:

Standard A: Science as Inquiry

Standard B: Physical Science

- Motions and forces

Standard E: Science and Technology

- Abilities of technological design

Standard G: History and Nature of Science

- History of Science (Historical Perspectives)

Unifying Concepts and Processes

- Evidence, models, and explanation

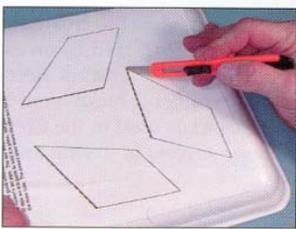
National Technology Standards

7. Understanding of the influence of technology on history

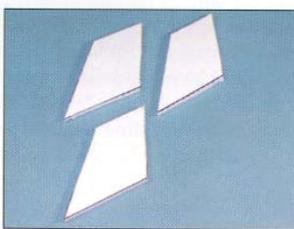
8. Understanding of the attributes of design

11. Ability to apply the design process

Procedure:



The template is positioned on the meat tray and the fins are cut out using a snap knife.

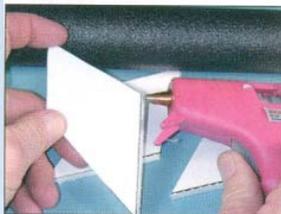


The fins may be left as is or sanded for a more aerodynamic shape.



A piece of pipe foam insulation is cut to a length of 14 inches.

Civil Air Patrol
Aerospace Education
www.gocivilairpatrol.com/ae
Contact: ae@capnhq.gov



Hot glue is applied to the edge of the fin, not to the pipe foam.



The fin is now placed on the pipe foam covering the seam. This seam acts as a positioning guide.



The fin guide is wrapped around the pipe foam as shown. It is designed to wrap around the tube end to end at the seam.



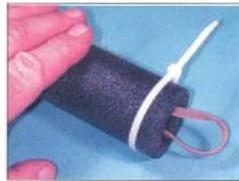
The small arrows show the builder where the other fins are to be mounted.



You are now ready to work on the power source. Tie a soda straw around a #64 rubber band.



The rubber band and soda straw are now stuffed into the nose of the foam tube.



A cable tie is wrapped around the opening back about 3/8ths inch. Notice how much rubber band is left outside of the opening.



The cable tie is cinched down with force. Make it tight.

Testing and Modifying the Goddard Rocket
 Consider different variables that could affect the flight of your rocket such as weather (humid vs. dry), weight, angle of arc, stretch of rubber band, etc. Record the conditions for flight #1 and change one variable several times. Record the distance your rocket traveled and any problems you encountered with your tests. Compare your results with a partner's results. Create a chart to record the results.



The tail is trimmed off of the cable tie. Make sure that no sharp edges remain.



A big blob of hot glue is squeezed on to the cable tie head. This adds a measure of safety to the construction.

To Fly the Rocket

- Put one thumb into the "tailpipe" and hold the tail firmly.
- Put the other thumb into the rubber band.
- Stretch the rubber band to about 4 inches.
- When you launch the rocket, pitch it forward in a slight arc.

Note: This foam tube and meat tray rocket was created by Ben Millsbaugh. It is copyright protected and permission is granted only for classroom use where no fees are charged for admission.

Fin Template Version for Robert Goddard's Liquid Fueled Rocket



Fin Placement Guide

