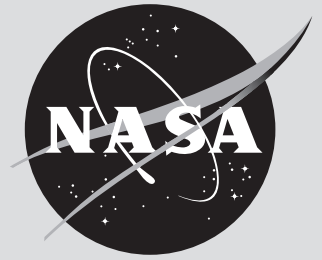


LAUNCH IT



Going to the moon? You'll need a rocket. The rockets NASA sends to the moon go up to 18,000 miles (29,000 km) per hour. But it still takes about three days to get there. So, sit back, relax, and enjoy the view.

WE CHALLENGE YOU TO...

...design and build an air-powered rocket that can hit a distant target.

BRAINSTORM AND DESIGN

Think about things that might affect how your air-powered rocket flies.

- How long will your rocket be?
- How many paper fins will your straw rocket have—0, 2, or more?
- How will adding weight to the straw's nose or having fins affect how it flies?
- When you launch your straw rocket, how does the launch angle affect where it lands?

BUILD

- 1. First, build a balloon-powered launcher.** Slide 1–2 inches (3–5 cm) of the thin straw into a balloon. Make a tight seal by taping the balloon to the straw.
- 2. Next, build a straw rocket.** Use the wide straw for the rocket. Seal one end. Either plug it with clay or fold the tip over and tape it down.
- 3. Now launch your rocket.** Blow into the thin straw to blow up the balloon. Slide the wide straw onto the thin straw. Aim. Launch!

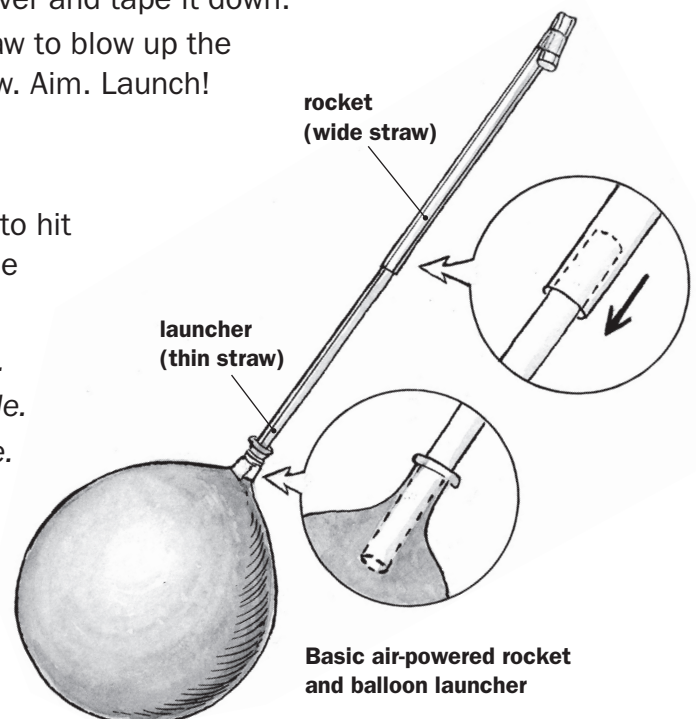
MATERIALS (per rocket)

- balloon
- small lump of clay
- paper
- 1 wide straw
- 1 thin straw that fits inside the wide straw
- tape
- target (box lid or paper with a bull's-eye drawn on)
- scissors

TEST, EVALUATE, AND REDESIGN

Set up a target. Stand 5 feet (1.5 m) away and try to hit it with your rocket. Can you make your rocket hit the target every time? Try these things if your rocket:

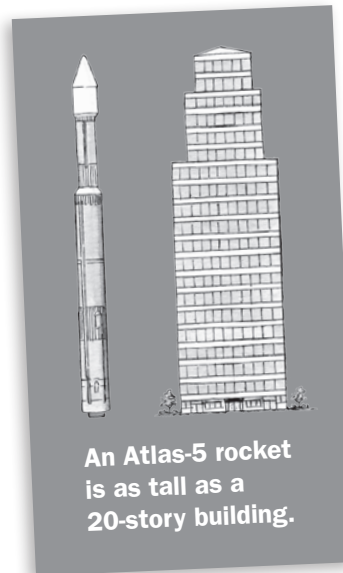
- **falls quickly to the ground**—*Reduce the weight.*
- **misses the target**—*Launch it at a different angle.*
- **won't fly straight**—*See if fins make a difference. Also, try adding weight to the rocket's nose.*
- **sticks to the launch straw**—*Make sure the launch straw is dry. If it isn't, wipe it dry. Also, try blowing up the balloon more.*



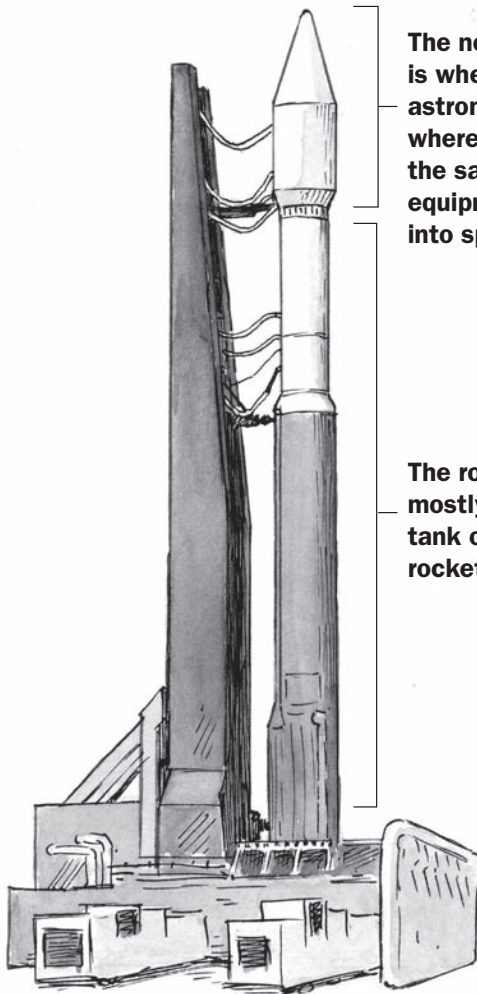
Basic air-powered rocket and balloon launcher

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.



Check out NASA's moon missions at moon.msfc.nasa.gov.

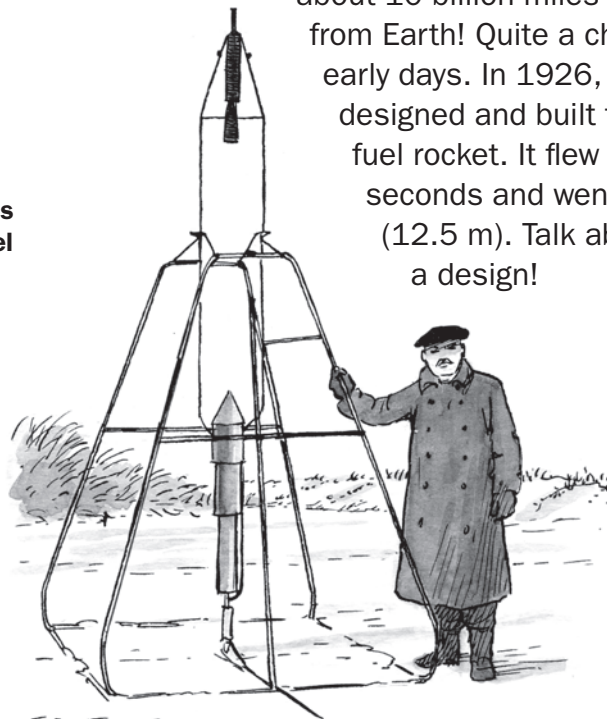


The nosecone is where the astronauts sit or where NASA stows the satellites or equipment it sends into space.

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

MY, HOW THINGS HAVE CHANGED!

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 (16 billion km) from Earth! Quite a change from the early days. In 1926, Robert Goddard designed and built the first liquid-fuel rocket. It flew for only 2½ seconds and went just 41 feet (12.5 m). Talk about improving a design!



Robert Goddard and the first liquid-fuel rocket

Watch **DESIGN SQUAD** on PBS or online at pbs.org/designsquad.



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