FOUR CORNERS

YOUR CHALLENGE

To operate efficiently, machines need their parts to fit precisely and to work together smoothly. Your challenge is to build a machine out of cardboard that runs smoothly and dependably. Here's a hint—be precise, be very precise.

MATERIALS

- Chart paper
- Marker
- Tape (masking or duct)
- 1 wooden skewer
- Scissors
- Ruler and pencil
- Corrugated cardboard
  - Base: one piece at least 6 x 6 inches (could be bigger)
  - Corners: four 5 x 1-inch strips*
  - Handle: one 4 x 1 ½-inch strip*
  - Paddles: two 2 x 1 ½-inch pieces*

* Cut the cardboard so the holes from the corrugation are visible along the long edge of every piece.

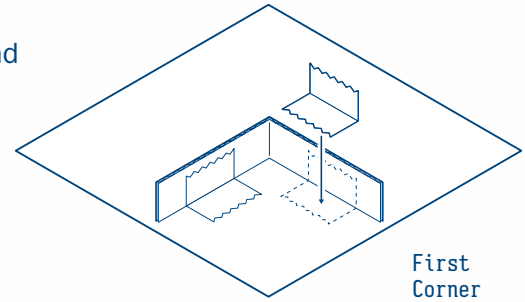
BUILD

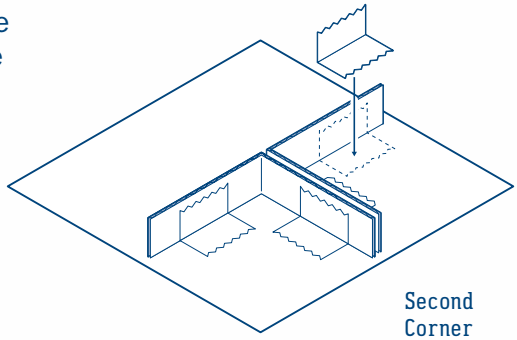
1. **Measure and cut** the cardboard to make your base, corners, handle, and paddles. Make sure the corrugation runs parallel to the short side.

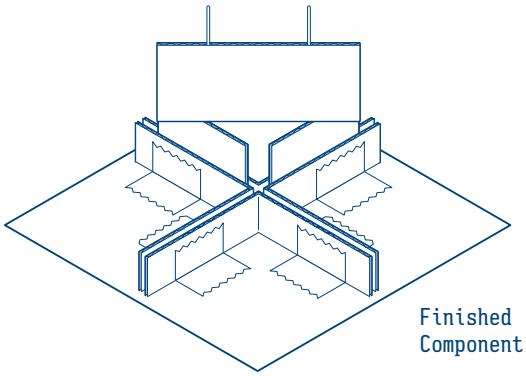
2. **Make your track.**
   - Bend your first corner (5 x 1-inch piece) precisely in half.
   - Tape your first corner to the base. Keep the tape on the side facing the outside of your base
   - Bend your second corner in half. Line up a second bent strip next to the first one. Create a track by leaving a narrow gap between the two pieces—that's where the paddles will go.
   - Bend your third and fourth corners in half. Use your ruler to make sure that the tracks are all ¼-inch wide. Make sure your creation looks like the illustration of the four corners.

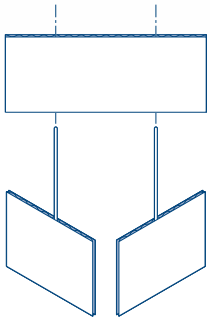
3. **Make your paddles.**
   Break your skewer in half. Slide one piece through the center corrugation of one of the paddles (2 x 1 ½-inch piece of cardboard). Repeat for the second paddle. Make sure the skewers turn easily.

4. **Add your handle to the two paddles.** Set the paddles and the handle in the track as shown in the Finished Component illustration. Slide the handle onto the two skewers that are sticking up. Twist the handle so the paddles slide along the track.

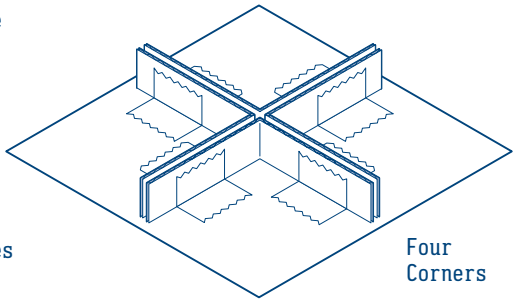

First Corner


Second Corner


Finished Component


Handle

Paddles


Four Corners

FOUR CORNERS CONTINUED

TEST

To work smoothly, all machines, including the one you just made, need to be made with great precision. That way, all the parts can work efficiently together to produce the same motion over and over again. Test how smoothly everything's working.

REDESIGN

You've just built a **component**, which is a part of a system. Examples of components include motors, light bulbs, computer chips, gears, sinks, and roofs. A component can't do much by itself, but put it together with other components and you've got something impressive, like a car, house, or spacecraft! But just what exactly is your component a part of? That's where your creativity comes in. How could the Four Corners component be used as part of something else? Is it a chopper? A puller? You decide. Brainstorm some ideas and write them down.

INSIDE THE ENGINEERING

Faced with a design challenge, engineers try to make a job go faster and cost less by using readily available parts whenever possible. Did you know that NASA engineers used many "off-the-shelf" parts to build the Mars Pathfinder spacecraft? For example, the control and guidance systems used common computer chips. Cameras developed for medical and scientific imaging—not outer space—took the pictures of the martian landscape. One communication system used radio modems developed for pagers. The end result was a spacecraft that was built quickly—38 months from concept to touchdown—and was inexpensive—Pathfinder cost about one-twentieth as much as earlier Mars missions. Imagination and creativity are important parts of engineering. Innovative engineers and designers often imagine new ways of combining and using standardized parts, which lets them produce quality products more quickly and cheaply.

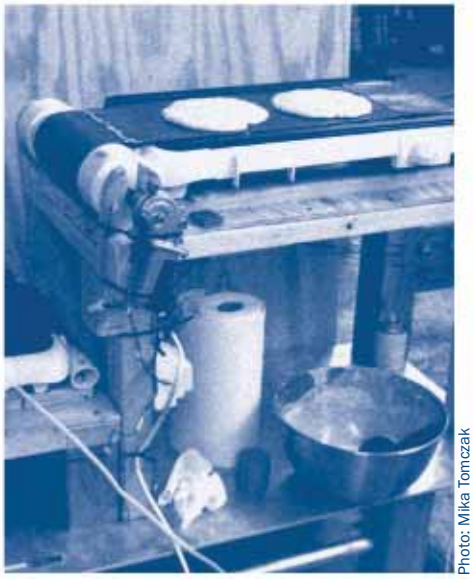


Photo: Mika Tomczak

When the *Design Squad* cast created pancake-making machines, they relied on commonly available components. This pancake machine relied on windshield wiper motors to drive the conveyor belt rollers over ordinary electric griddles to cook the pancakes.

If you liked this challenge, go to **pbskidsgo.org/designsquad** to download more challenges to try at home.

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