Project: Make a Geodesic Dome Out of Newspaper

Figure 3-13 *This geodesic dome would make a cool place to hold storytime at the library.*

Geodesic domes don't just look cool. They're also way stronger than regular building shapes. Like tetrahedrons, they're made completely of triangles. But they also have the strength of rounded arches. And they don't need any internal walls or supports to hold them up, so they use a minimum of materials. Geodesic domes are so strong and compact, they're used to house radar equipment near the North Pole. But they're also used as futuristic buildings in places like Disney World in Florida.

Materials

- Enough floor space to assemble your dome, at least 10-12 feet across
- 65 full-size sheets of newspaper (double or triple that number if you want to make your structure sturdier)
- Masking tape (two different colors, or use colored markers)
- Bamboo barbeque skewers, 1/8 inch diameter dowels, or round toothpicks (can be left in or reused)
- Yard stick
- Scissors

Figure 3-14 *Use the corner of a table to help you roll your newspaper in a straight line, starting with the corner.*

Step 1

Lay a sheet of newspaper on the table. (Use two or three sheets if you want to make your struts extra strong.) Place a toothpick or skewer at one corner, and tuck the corner of the newspaper under it. Then use it to help you roll the sheet up as tightly as you can to form a strut.

Tip: To help you roll at the correct angle, place the corner of the newspaper on the corner of your work surface, and roll straight ahead.

As you roll, gently slide your hands apart to keep the ends nice and tight. When you reach the other corner of the newspaper, wrap it tightly around the middle with a piece of masking tape. Repeat until you have 65 struts.

Step 2

Next, use the scissors to trim about an inch off one end of each strut. Then use a yardstick to measure the struts to the proper length and trim off the other end. You will need:

- 35 long struts that are 28 inches (71 cm) each
- 30 short struts that are 26 inches (66 cm) each

Mark the long struts and the short struts with different color tape or markers so you can tell the two sizes apart.

Step 3

Now, begin to build your dome. Take three long struts and tape them together at the ends to form a triangle. Make four more triangles, for a total of five. These are the long triangles.

Step 4

Make five more triangles the same way, but use one long strut for the base and two short struts for the sides. These are the short triangles.

Step 5

The base of the dome is a decagon with 10 sides. To make it, you will lay down all the triangles you just created so that their bases form a rough circle. Start by laying down one long triangle. Now lay a short triangle next to it, so that one end of the base (the long strut) is touching a corner of the other triangle. Continue alternating long and short triangles around the rough circle, tops pointing in toward the center, until they are all touching.

Figure 3-15 *Connect all the triangles around the decagon with the tape.*

Here's a diagram of that first row:

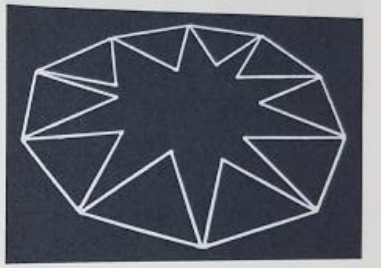

Figure 3-16

Step 6

Take a short strut and use it to connect the top corners of one triangle to the top corner of the one next to it. It helps to do this with a partner: one person to hold the strut, and one person to tape. Go around the dome and connect all the triangle tops the same way. The first level of the dome should now be standing up and leaning a bit toward the center.

Figure 3-17

Figure 3-18 *Use as much tape as needed to hold your joints together.*

Step 7

For the next level, tape one end of a short strut to the top of every short triangle:

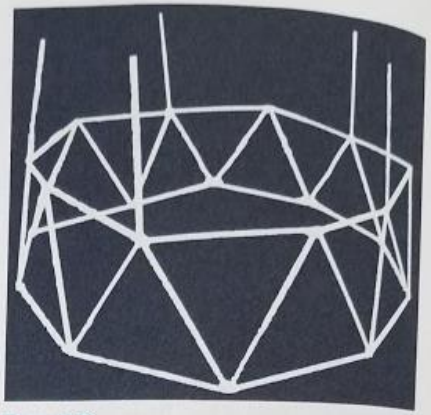

Figure 3-19

Then use two long struts to connect the top of the loose stick to the top of the triangle to the right and the left. Repeat all around the dome:

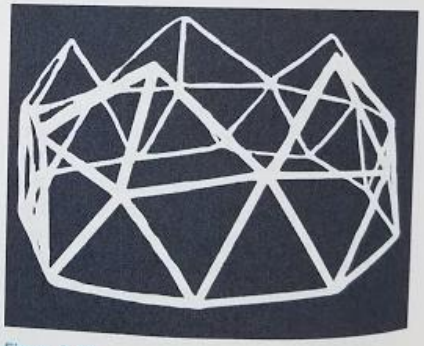

Figure 3-20

At this point, it's a good idea to inspect your dome for any broken or loose connections. Wherever corners of triangles meet, loop some tape through the openings from one triangle to another until every opening is secured.

Step 8

To make the last level, take five long struts and lay them end to end to form a pentagon. Tape them together. Then tape one short strut to each corner and let them flop into the middle. Take all the loose ends and connect them with more tape. Then fit the pentagon into the opening at the top of your dome. Secure everything with plenty of tape:

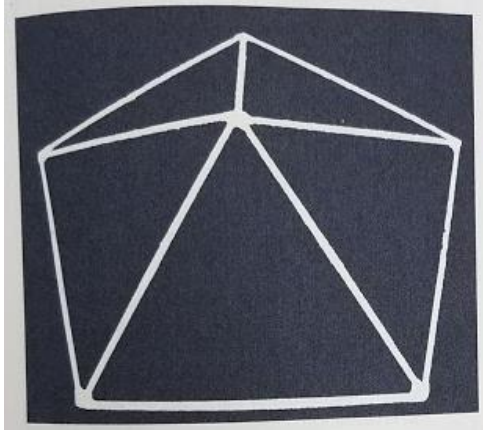

Figure 3-21

Step 9

If you like, you can cover your dome with flat sheets of newspaper to create a playhouse or shelter.

Buckminster Fuller

The geodesic dome was invented by an architect named Buckminster Fuller. To learn more about his designs, check out the tensegrity robot project in the book *Making Simple Robots*, also from Maker Media.

Paper Machines

Figure 3-22 *A prototype for an automaton uses masking tape instead of glue so parts can be easily changed around.*

Animated paper models are really paper machines. Another name for a moving paper model is an *automaton* (plural: automata). The word is also used for early wind-up robots built for entertainment. In Japan, moving mechanical paper toys are called *karakuri*. The first karakuri were made in the 1600s and are still popular today.

Most animated paper models are hand-powered. To make them move, you have to turn a shaft. A *shaft* is simply a rod that connects the "engine" of the machine to the parts that move. Almost any kind of moving part or mechanism can be created out of paper. These parts can make the paper model move up and down, rock back and forth, or spin around. Combining different mechanisms lets you create very interesting movement, and really make paper models come alive.

One of the simplest kinds of mechanisms is the cam. A *cam* is a disc that turns around the shaft and pushes or pulls on other moving parts of the machine. Cams can be shaped like circles, squares, triangles, or eggs. A snail cam looks something like a spiral snail shell. Cams can also have multiple points, like a star, or bumpy