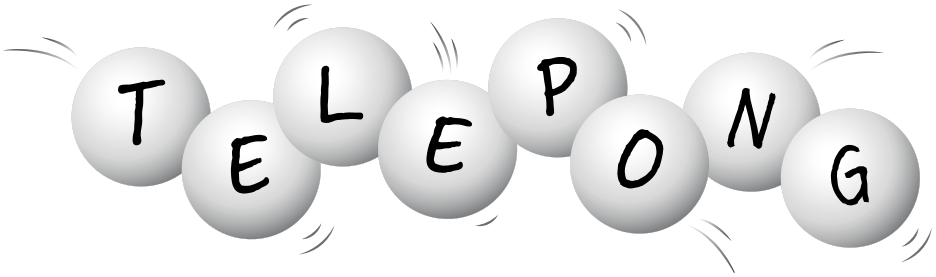
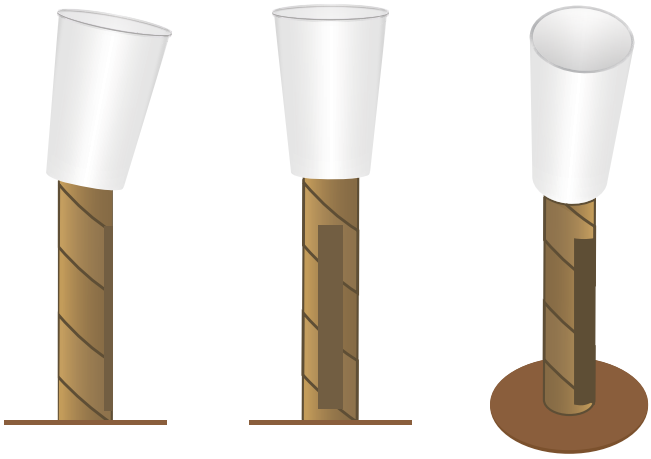
National Aeronautics and Space Administration



PART 3:
Quick Start Receiver Construction Guide

This guide is intended for teachers interested in starting the communications activity in Telepong Part 2 as quickly as possible.

Refer to Telepong Part 1 and Telepong Part 2 for complete activity instructions.



GRADES:
5+

DURATION:
25-45 minutes

PREP TIME:
20 minutes

MATERIALS

- 12-16” tubes (Paper towel tubes work just fine, but clear tubes are best. Many packing-products vendors sell 1.5” diameter plastic mailing tubes).
- Clean cardboard boxes
- Plastic containers, washed and dried
- Packing materials
- Card stock
- Other craft supplies: pipe cleaners, floral wire, paint stirrers, etc.
- Ruler
- Masking tape or hot-melt glue gun[1]
- Scissors, hobby knife, or box cutter
- Durable cutting surface

NGS Standards

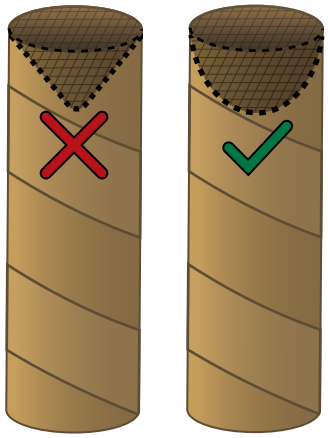
Performance Expectations
MS-PS4-1, *-ETS1

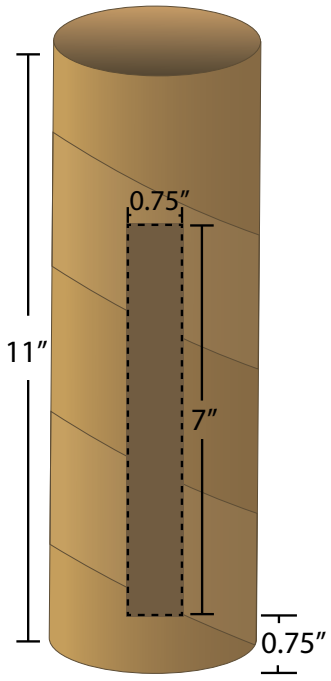
Science and Engineering Practices
- Planning and Carrying Out Investigations
- Constructing Explanations and Designing Solution

Cross-Cutting Concepts
- Patterns
- Cause and Effect: Mechanism and Prediction
- Structure and Function

Disciplinary Core Ideas
- Information Technologies and Instrumentation
- Defining and Delimiting Engineering Problems
- Developing Possible Solutions
- Optimizing the Design Solution

[1] Adult supervision required for all activities which involve cutting or using hot glue. Use appropriate cutting implements on proper cutting surfaces.



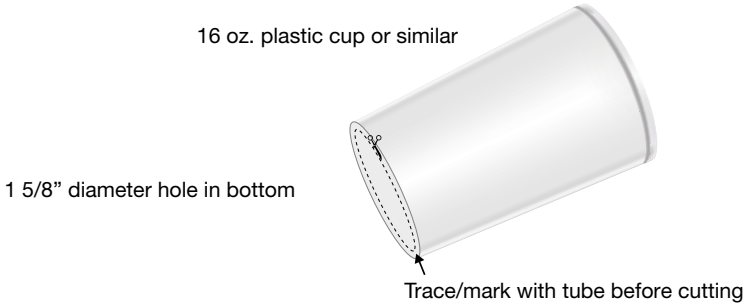


Optional: If using cardboard, use a blade to cut a viewing window in the front of your tube. Recommended dimensions are a 0.75” by 7” slot, positioned 0.75” from one end of the tube. This will help learners quickly read (“decode”) the stored message as it comes in.

TRIED-AND-TRUE RECEIVER CONSTRUCTION:

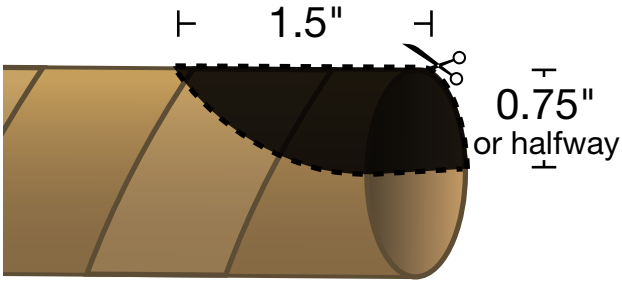
1. Cut a base out of cardboard; a ~6” square or circle is easiest. Does not need to be precise.

2. Take plastic cup and tube. Position tube outside on bottom of cup. Trace a hole around the **outside of the tube** you are using.

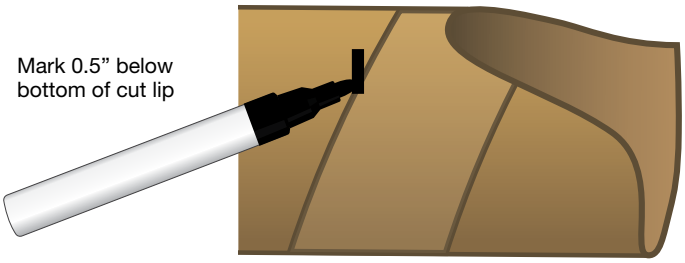


3. On bottom of cup, cut slightly **inside** your traced lines for best fit. Widen gradually until the tube fits snugly into the hole.

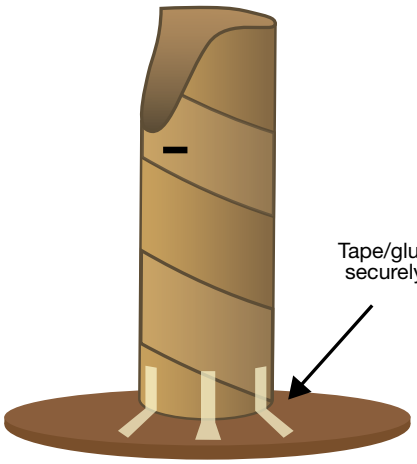
4. Cut a fingernail-shaped lip out of the rim of the tube. The sides of the fingernail should be diametrically opposed, curving together to meet 1.5” from the original end of the tube. **Cutting the lip into a rounded ‘scoop’ shape at the bottom is important.**

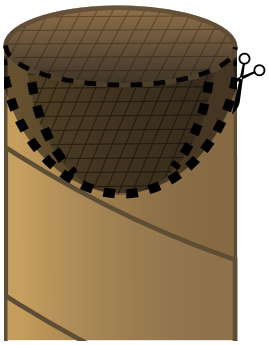


5. Mark 0.5” **below the bottom of the new scoop lip**. This will help us **initially** position the bottom of the cup in the next steps.



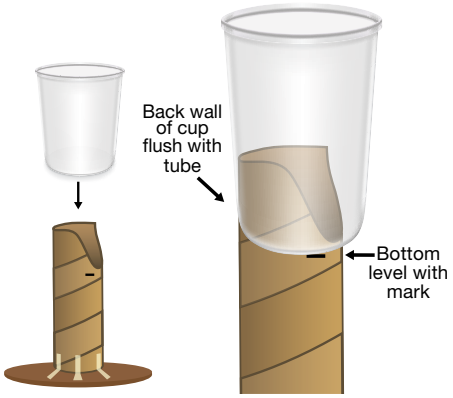
6. Tape or hot glue the tube in the center of the base, with the scoop-lip end pointing up.





Suggestion: If you're having trouble getting the balls to flow into the tube, consider widening the scoop lip.

7. While holding the cup in place, adjust the height & angle of cup until ping-pong balls which enter the cup **reliably** fall into the tube. Don't attach it permanently yet; make sure you're able to fine-tune the position.

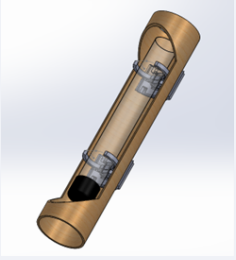


8. Test a few times with ping-pong balls until they tumble smoothly and reliably from the cup into the tube. **Once you are satisfied with the fit,** then hot glue or tape the cup to the tube.

CONGRATULATIONS!

You have made a simple communications ground station. Now you're ready to start receiving data from space; see our other activities to continue exploring the communications and engineering design processes.

For a more reusable option, contact gsfc-scan-engagement@gsfc.nasa.gov for instructions on constructing sturdier, more travel-friendly receivers which can accommodate multiple groups of learners. These receivers require more hardware, assembly, and access to a 3D printer.



FOR MORE SCAN ACTIVITIES, VISIT:

- Exploration and Space Communications Activities
- NASA Kahoot! Quizzes

Have feedback for us about any of these resources? Reach us at gsfc-scan-engagement@mail.nasa.gov. We especially love receiving pictures of your results in action!