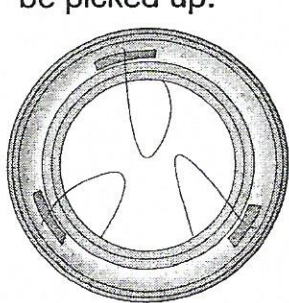
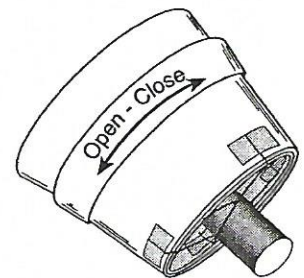
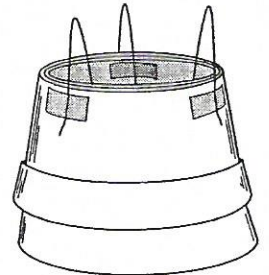
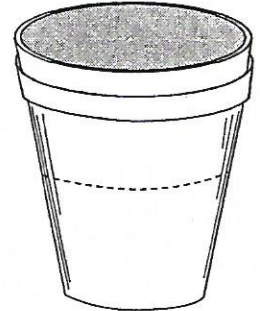


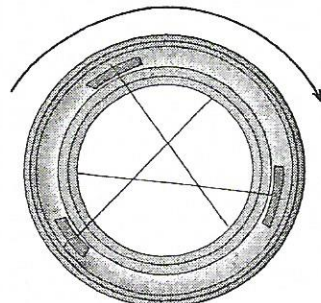
Space Shuttle - International Space Station Robot Arm End Effector

The 15.2-meter-long Remote Manipulator System robot arm used on the Space Shuttle and the 17-meter-long Space Station Remote Manipulator arm that will be used on the International Space Station both employ a wire snare device for grasping objects. This device, called an end effector, is placed over a post-like grapple fixture mounted on a satellite, an experiment module, or any device to be grasped. The end effector rotates, causing three metal cables to close tightly around the post. The wires come together in a manner similar to the way the diaphragm on a camera closes. This activity demonstrates how the end effector operates by constructing an end effector out of two styrofoam coffee cups, string, tape, scissors, metric ruler, and sand paper.

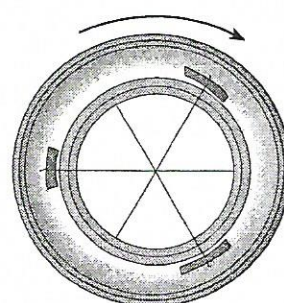
1. Nest the two cups together and cut through both cups where indicated in the diagram by the dashed line. Smooth the cut edges by running them over a piece of sand paper sitting on a table top.
2. Cut three pieces of string 12 centimeters long.
3. Tape the end of the first string to the inside of the inner coffee cup near where you cut the cup. Tape the other end of the string to the outside of the cup but do not press this piece of tape tightly yet.
4. Repeat step three twice more but place the strings about 1/3 of the way (120 degrees) around the cup from the first string.
5. While holding the rim of the inner cup, rotate the outer cup until the three strings cross each other. The strings will have some slack. Pull the end of the strings on the outside until they are straight and intersect exactly in the middle of the opening. Press the tape on the outside to hold the strings.
6. Use the end effector to pick up an object such as a pencil. Have someone hold the pencil upright. Open your end effector so that the strings are not crossing each other. Slip the end effector over the pencil. Rotate the outer cup until the strings grasp the pencil. Pick up the pencil.
7. You may find that the pencil is too slippery to be picked up. How might you modify the pencil so that it can be held? Design a standard grapple fixture that can be mounted to other objects so that they can be picked up.



Open Position



Rotate Outer Cup



Continue Rotating to
Close Snares

The Space Shuttle and International Space Station robot arms were developed by the Canadian Space Agency.