Exploring the Extreme
Jet Propulsion
Grades 5-8

OBJECTIVES
To build a model to demonstrate how thrust is created in a jet engine. The students construct a model of a jet engine, label each part, and describe what each part does.

PROCESS SKILLS
Observing
Communicating
Making Models
Controlling Variables
Collecting Data
Making Connections

BACKGROUND
A turbine engine works in four basic stages.
1. Outside air enters the engine through the air inlet.
2. The air then moves into the compression section of the engine. In this section the compressor increases the air pressure, which also increases its temperature.
3. From there the air is forced into the burner section, where the temperature is further increased by fuel combustion.
4. The hot, expanding air then moves into the turbine, which drives the compressor. The air expands through a tailpipe designed to discharge the exhaust gas at high velocity, producing thrust.
MATERIALS
- One cardboard paper towel
- One flexible straw
- Tape
- One 12-by-12-inch sheet of aluminum foil
- Four paper circles 1-1/2 inches in diameter
- One pair of scissors
- One copy of the Student Work Sheet Part 2

PREPARATION
This activity works best if the students work in pairs. Allow approximately 40-45 minutes to complete.

PROCEDURE
1. Cut the paper towel core in half lengthwise (figure 1).
2. Using the pencil, poke a hole in one side of the paper-towel core halfway down. Make the hole large enough for the straw to fit into it.
3. Cut the straw down so it is 1/4 inch long on one side of the flexible section and about 1 inch long on the other side.
4. Put the short end of the straw into the hole, bend the straw so the longer end lays flat against the paper towel core. Tape into place. This represents the fuel line (figure 2).
5. Fold the paper circles in half then into quarters. Open the circles.
6. Cut along the folds close to the center but do not cut through the center. Do this on the remaining circles too.
7. Bend one corner from each section so the circles resembles a fan. Do this for two more circles also (figure 3).
8. Straighten the paper clip. Then bend approximately 1/2 inch of the paper clip down on one end. This will keep the paper fans from sliding off the paper clip.
9. Push the end of the paper clip into the center of one fan. Slide the fan back so it is resting against the bent end of the paper clip. Wrap a narrow piece of tape around the paper clip to act as a spacer and to provide stability. Repeat this step with two of the three remaining fans.
10. Wrap a narrow piece of tape 1 inch from the straight end of the paper clip. Place the remaining fan onto the paper clip to serve as the turbine, wrap a final piece of tape around the paper clip to keep the fan in place (figure 4).
11. Install the compressor and turbine unit into the engine by placing glue inside the tube where the edge of the fans will touch the sides of the tube on the same side as where the hole was made for the fuel line. Hold the fans in until glue is partially dry (figure 5).
12. Tape the paper towel core shut.
13. Cut down the length of the paper cup and cut the bottom out of it.
14. Put the cup back together overlapping the edges.

PROCEDURE
15. Insert it into the paper towel roll, large end first. Ease the paper cup open until it snugly fits inside the toilet paper roll. Tape the edge of the cup on the inside to hold its shape. The cup will move easily but should not fall out. This represents the tailpipe and the movement of the tailpipe with thrust vectoring (figure 6).

**DISCUSSION**

**What is the purpose of each part of the engine?**
The air intake brings outside air into the engine. The compression section moves the air through a series of fans that compress, or squeeze, the air causing it to increase in speed. The combustion section heats the air by burning fuel. This causes the air to expand very rapidly and significantly increases its speed again. Finally, the turbine forces the heated, expanding air out the back of the engine, creating thrust.