ROCKET-POWERED SKI LIFT

GOAL

Kids explore the benefits of testing with models.

GRADE LEVEL

Upper elementary to middle school.

MATERIALS

For the passenger compartment:

Clear tape, stapler, scissors, string, cups, craft sticks, paper, paper plates, milk cartons, and other found items.

For the rocket-powered ski lift assembly:

- 12-inch long balloons
- Plastic straws, nonflexible, cut in half
- Nylon fishing line, 3-4 pieces, each at least 6 feet long
- Pennies (for passengers)
- Clothespins with springs

DISCUSSION

Making models of inventions before creating them helps engineers see how well their ideas will work without taking unnecessary risks, and can help save money and time. In this activity, kids make a model of a carrier (gondola compartment) for a ski lift and test it out to be sure passengers can get to the top of the mountain safely.

ACTIVITY

Before starting, prepare the "test tracks." Attach one end of the nylon fishing lines to high points on a wall or window at least 3 to 4 feet apart. Attach the other end of each to the launch table and secure them with either tape or a heavy book.

Step 1: Getting Started

Divide kids into groups of 2 or 3. Tell them they will invent a passenger carrier for a ski lift and then design, build, and test a model.

Step 2: Rocket Power

Demonstrate how the "Rocket Power" lift works. Run one of the "track" strings through a precut straw and reattach the end to the launch table. Inflate a balloon and secure it closed with a clothespin. Being sure the balloon's opening points toward the launch table, tape the balloon to the straw, then release the clip. As the balloon deflates, it will push the straw to the top of the string.

Step 3: Build the Carrier

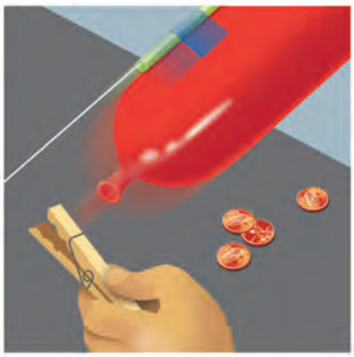
Each group should first make a DESIGN PLAN—a list of parts or a sketch—and decide how many passengers (pennies) they want their compartment to carry. Next they follow their design and BUILD the model carrier.

Step 4: Testing the Model

Using the "track" setups, have groups thread the end of a string through their straw and tape their inflated balloon to the straw. Then they should attach their passenger carrier to the lift in any way they choose, and add "passengers."

To launch: While one child gently pulls the string taut, another lets the air out of the balloon so the lift can shoot up the string to the "summit." Only one person in each group should blow up the balloon!

WHAT HAPPENED?



To help the groups judge how well their models performed, ask questions: What was the problem? (Didn't travel all the way to the summit; traveled too fast and crashed; passengers fell out of the compartment.) What changes could you make to your model to fix the problem? (Change the position or size of the compartment; change the angle of the track.) What did you learn from your model that could help make the real thing safer/faster/ stronger, etc?

CONNECT TO ENGINEERING

Invite kids to discuss with the group which models worked best, and why. If time allows, have kids make changes incorporating these "best practices" and retest as needed. Close by pointing out that real engineers work as part of a team; this way, they learn new ideas and approaches from each other.

FURTHER EXPLORATION

Depending on age group this activity can also be used as a demonstration of Newton's Third Law of Motion: *For every action there is an equal and opposite reaction.* This law is one that is very important to space flight (rocket power!). If you push on anything, it pushes back; something will go forward if it is pushing matter behind itself. The air in the balloon

pushes out the back, pushing the balloon in the opposite direction.

Other examples of Newton's Third Law: If you jump off a skateboard it is pushed one way and you will be pushed the other way. While swimming or rowing, your hands/oars push the water behind, while the water pushes you in the opposite (forward) direction.

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