

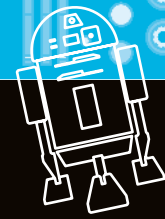
R2-D2 HOLOPROJECTOR

MAKE A CELL PHONE BOX PROJECTOR

Need to send a message across the galaxy? Just switch on a holoprojector! These gadgets use light to create three-dimensional (3D) holograms. You can build your own projector and use light to display 2D images. All you need is a cell phone, cardboard boxes, a magnifying glass, and a few household items to project your own images... just like R2-D2!



DIFFICULTY
Tricky



The light from the cell phone passes through a magnifying glass lens placed over a hole in the front of the box.

IN A GALAXY FAR, FAR AWAY....



Holoprojectors create 3D images by manipulating beams of light. They can display static images, recorded messages, and live audio-visual feeds. Due to the large amount of power they use, most holoprojectors display a blue-and-white image. They come in various sizes, from astromech-mounted units to simple handheld devices.

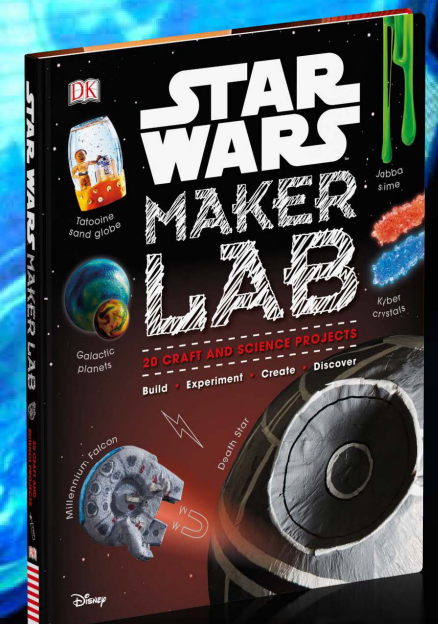


WHAT YOU NEED



The picture on the cell phone is projected onto a wall or a screen.

Content from *Star Wars Maker Lab* (DK)



START HERE



1 Securely tape the bottom of the large box, leaving the top open. On one of the small sides of the box trace around the magnifying glass lens with a pencil. Draw a smaller circle within this circle.



2 Use scissors to cut out the inner circle, then set aside the cardboard disk. On the inside of the box, stick the lens against the hole with strong tape. Make sure you tape over any gaps.



3 Next, use scissors to cut two slits in the top flaps of the box about $\frac{2}{3}$ of the way down from the lens and fold them out. Then seal together the longer flaps with strong tape.



4 Create R2-D2's dome. Place plastic wrap around the outside of a bowl that is a bit larger than the small side of the box. Papier-mâché the bowl.

Cutting out the lens hole is tricky, so ask an adult for help.



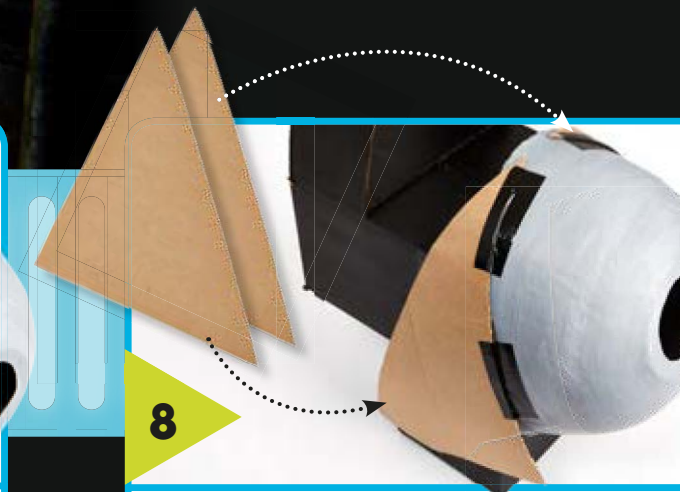
5 Once the papier-mâché dome is dry, paint it gray. Then use the cardboard disk you set aside to trace a circle on the top of the dome. Cut out the circle to make a lens hole.



6 Use strong tape to fully seal the small box. Paint both boxes black, including the inside of the larger box's flaps. You may need two coats of paint to make the boxes very black.



7 Tape the larger lens box to the small box so that it overhangs a little. Then securely tape the dome to the front of the lens box, making sure the hole lines up with the lens.



8 Cut out two large triangles of lightweight cardboard. Wrap them around both sides of the dome and both boxes. Secure the triangles firmly to the dome with strong tape.

R2-D2 accesses a holomap providing a full blueprint of General Grievous's command ship, the *Invisible Hand*.

"HELP ME
OBI-WAN
KENOBI.
YOU'RE MY
ONLY HOPE."

Princess Leia





9

Cut out and tape a large rectangular strip of cardboard around the bottom of the dome so it hides the boxes. Cover any gaps at the front of your model with small cardboard triangles.



10

Once all the pieces of cardboard have been securely taped in place, paint your model to look like R2-D2's head. Use the photo above as a guide to the astromech's design.

Put your phone on its brightest setting.

11

Save a *Star Wars* image to your phone. Turn off auto screen rotation and flip the image landscape. Put the phone into the box sideways, with the image upside down. Secure it with adhesive putty.



12

Close the flaps with an elastic band to keep out light. Point the projector at a plain wall. Turn out the lights and focus your picture by moving the projector closer to or farther away from the wall.

YOU'VE
DONE IT!

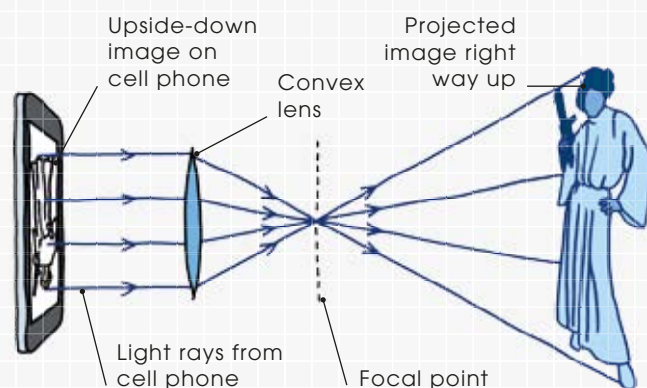
HOW IT WORKS

LIGHT BENDERS

A lens is a piece of transparent material that is used for forming an image by focusing light. Lenses are used in magnifying glasses, microscopes, and telescopes. They can bend light rays and refocus them to enable us to see things too small for the naked eye, or view faraway objects such as planets.

PROJECTING IMAGES

Projectors use a convex lens, which bulges out in the center. When light rays pass through it they are bent inward and meet at a spot known as the focal point. Past the focal point a projected image is flipped upside down and enlarged when it makes contact with a screen or wall.



Rebel Alliance leaders discuss strategy around a holoprojection of the Death Star, a planet-destroying battle station built by the Galactic Empire.

IN OUR GALAXY...

THE BIGGER PICTURE

When you go to the movies, small images on a reel of film, or digital images, are projected through a powerful lens that magnifies them onto the big screen. Many images are displayed each second one after the other, to give the illusion of moving scenes.





DIFFICULTY
Medium

SUPER SPEEDER BIKE

MAKE A HIGH-FLYING HOOP GLIDER

Zoom into action with your very own speeder bike! As fast as they are dangerous, speeder bikes are small enough to go where other vehicles can't. With these "hoop gliders," you can re-create the thrilling flight of a speeder bike using straws and paper.



IN A GALAXY FAR, FAR AWAY....

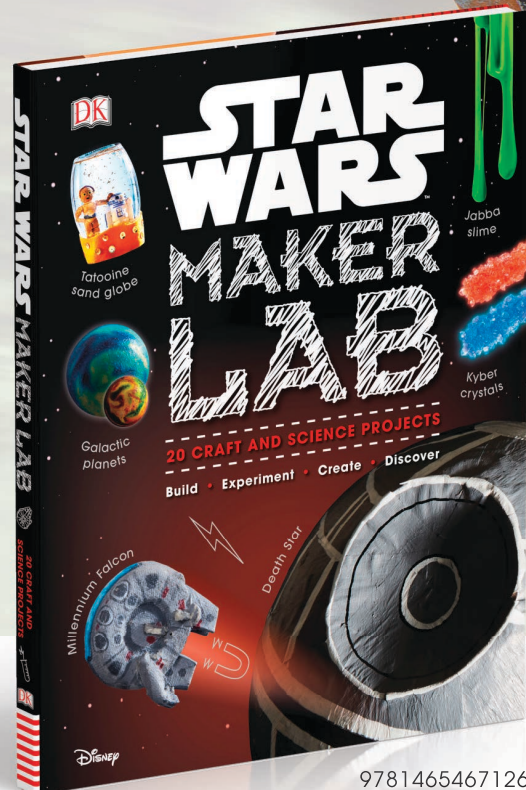
Speeder bikes are used for scouting and escort missions. During the Clone Wars, Biker Advanced Recon Commando (BARC) speeders are piloted by specially trained clone troopers. Flying a few feet off the ground, the BARC speeder can reach speeds of more than 500 kph (310 mph).

The Empire uses modified speeder bikes. Stripped down to the bare essentials, the 74-Z speeder is lighter, which allows its pilot to reach even greater speeds.



Sponge on paint to create a rusted look for your speeder bike.

Draw extra details with a metallic pen.



9781465467126

WHAT YOU NEED



Double-sided tape (regular tape will work, too)



Glue stick



Paperclips



2 plastic straws



Scissors



Paint



Construction paper



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START HERE



1 Use the template on page 120 to cut out the shapes for your hoop glider from construction paper. You could decorate your glider with paint, marker pens, or colored paper and glue.



2 Once any painted decoration is dry, bend the large piece of construction paper into a loop and stick the edges together using double-sided tape. (Regular tape will work just as well.)



3 Bend the smaller piece of construction paper into a loop and secure the edges with tape. Next, stick on the two small steering vane pieces—one on either side of the loop.

IN OUR GALAXY...

GLIDING HIGH

Gliders are aircraft without engines, which gain lift from their wings and fly using air currents. They are lightweight and sleek, designed to travel through the air with as little air resistance (called drag) as possible.

SPACE GLIDERS

NASA's space shuttles used rocket engines to lift off into space, but returned to Earth as gliders. They had to be flown back to NASA piggyback on specially designed shuttle-carrier aircraft.



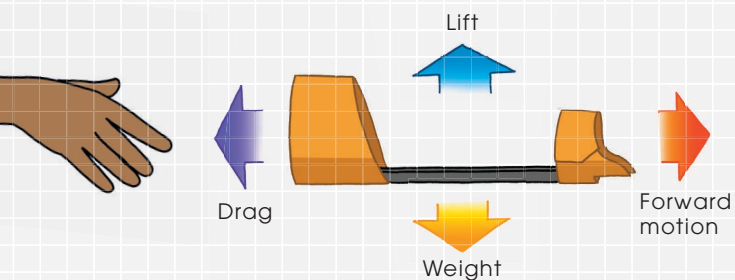
HOW IT WORKS

GETTING A LIFT

In flight, four main forces affect airplanes: lift (upward force), thrust (propulsive force), weight (gravity's pull), and drag (air resistance). The design of the wing is one of the major factors that influence lift. Air moves faster over the curved top of an airplane wing than its flatter underside. This reduces air pressure and produces lift.

STAYING ALOFT

Although a hoop glider doesn't have airplane-shaped wings, its curved hoops produce differences in air pressure that enable it to fly. After the glider is thrust forward, air speeds over the top of the hoops. The hoops' paper-thin edges create little forward drag, while their wide surfaces push down on the air, which pushes back up with an equal and opposite force. This generates lift for your glider.



4 Using double-sided tape, stick the loops to either end of two straws. Place two or three paperclips at the base of the smaller loop, to add weight to your hoop glider.



5 Cut out the scout trooper from black paper using the template. Fold the middle bar as shown above, then place it between the glider's straws. Tape the middle bar to the base of both straws.



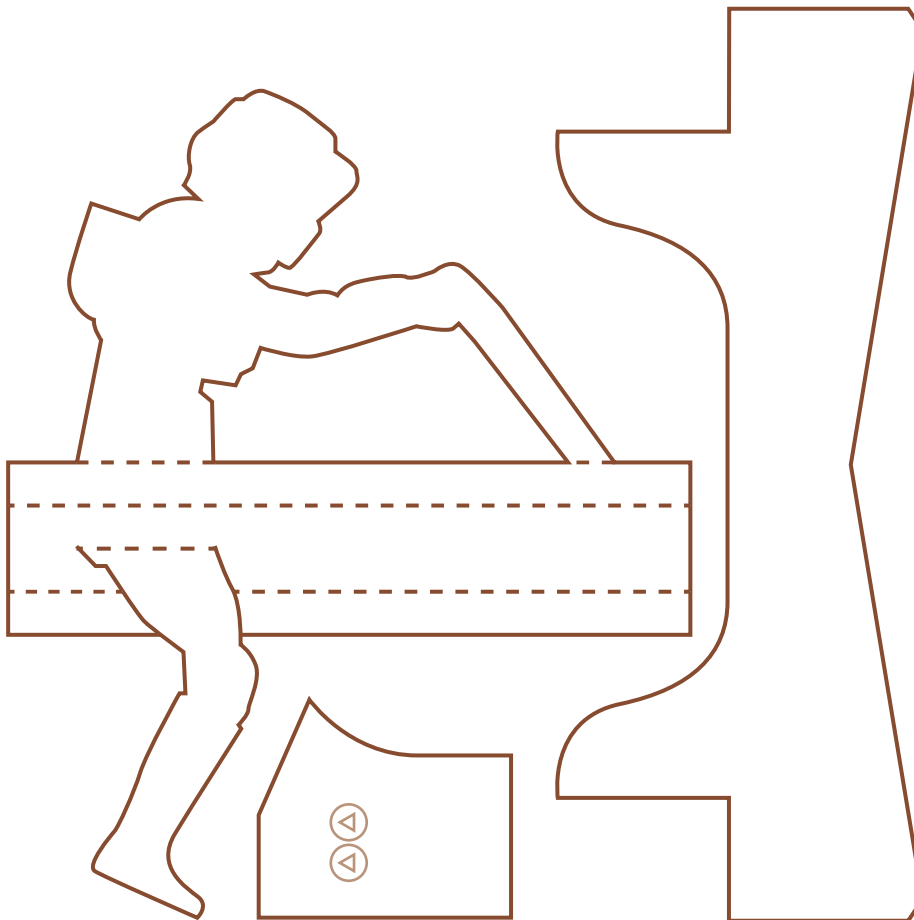
6 Grasp the center of the straws and throw your speeder bike. It should glide through the air! You may want to try adding another paperclip or two in order to get the best flight.

Anakin flies a speedy Zephyr-G swoop bike across Tatooine in search of his mother.

TEMPLATES

SCORING

When using these templates it is useful to score your cardboard before you fold it. To do this, run a ballpoint pen that has run out of ink along the edge of a ruler using the dashed line on the template (see key) as a guide. It is important to fold all your scored lines before you glue or tape any of the pieces.



Steering vanes: 2 pieces (flip one over to make the right and left vanes)

