

## activity six

# *The Helicopter — A Classroom “How-It-Flies” Demonstrator*

**OBJECTIVE** – This is a classroom hands-on project designed to demonstrate how a helicopter can fly in about any direction.



### NATIONAL STANDARDS

#### Science Standards:

- Standard B: Physical Science
  - Position and motion of objects
- Standard E: Science and Technology
  - Abilities of technological design
  - Understanding about science and technology
- Unifying Concepts and Processes
  - Evidence, models, and explanation

### BACKGROUND

The first evidence of a helicopter in history came from the notebooks of Leonardo da Vinci in 1480. He designed a device that was supposed to fly vertically with power from a primitive clockwork motor. It was stated that a model was built, but it was not successful.

In November of 1927, Paul Cornu was the first person in history to actually fly a craft that lifted from the ground with no tethering line. It had two large propeller-like “rotors” at the end of a frame that was connected to a 24 h.p. motor mounted in the center “fuselage.”

Historians give Russian-born American designer, Igor Sikorsky, credit for the first true helicopter. It was designated the VS-300 and had both a main and tail rotor. The tail rotor was used to counteract the turning tendency (torque) when the main rotor turned. The VS-300 had a full three axis control and this gave it the ability to take off, hover (stand still in the air) and move in any direction.

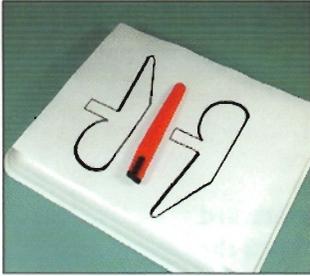
## MATERIALS

### LET'S BUILD A LITTLE HELICOPTER CLASSROOM DEMONSTRATOR

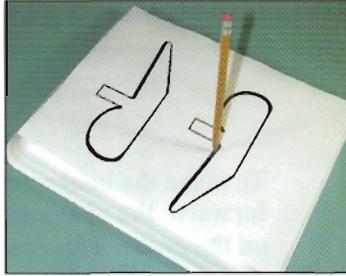
1. The teacher will need a compact disk (CD) for every child.
2. Film can lids are used for the tail rotor. One will be needed for each child.
3. Thick meat trays are recommended, however cardboard can be used as a substitute.
4. Snap knives will be needed, usually one per team.
5. Several hot glue guns.
6. Soda straws are used for the landing gear.

## EXTENSIONS

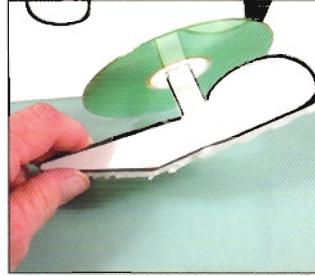
1. Have a pilot fly in a real helicopter and show the children the collective and the cyclic. Have the pilot show how these devices help control the helicopter.
2. Have students research the many ways helicopters are used and write a short story entitled "An Adventure in a Helicopter."
3. How Helicopters Work web site: <http://www.howstuff-works.com/helicopter.htm>



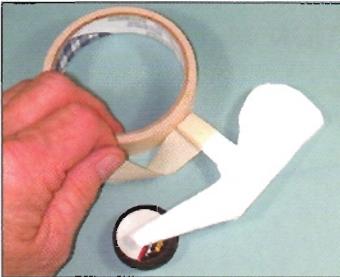
The thicker meat trays are recommended. By using the double template, two or more helicopters can be cut from one tray. For cutting, the safer snap-knives are recommended.



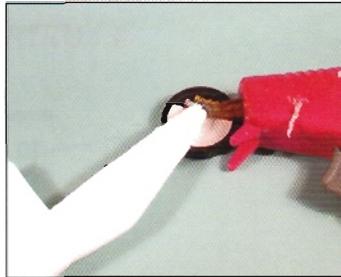
If a teacher is reluctant to use snap knives, there is another method. Using a sharp pencil and make a series of punches very close together all around the line drawing. The figure will pop out and then a sanding stick can be used to clean up the edges. This takes a bit longer, but eliminates the problems some administrators have with knives in classrooms.



This is the most critical part. Tell the children that the part (rotor head) that holds the CD must be cut so that the hole in the center of CD fits tightly onto the rotor head.



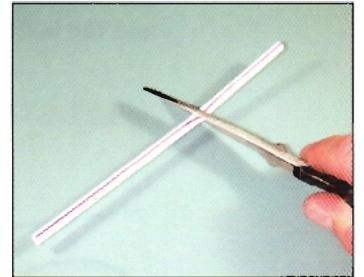
Sometimes, tape can be used to make the CD fit better.



A film can lid is hot-glued to the tail. This is our simulated "tail rotor."



The landing gear mounts are cut from the foam tray and mounted into the position shown.



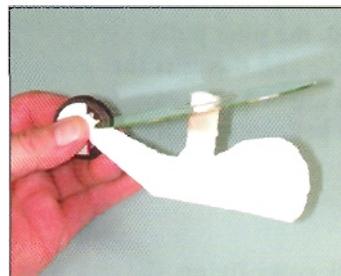
A soda straw is cut to make the two skids.



The skids are hot glued to the landing gear mounts.



To demo how it flies forward, tilt the CD in that direction.



To demo how it flies backward tilt the CD in that direction



For sideways, tilt the CD right or left. For hover, make the CD perpendicular to the rotor head. When all done, the CD can be hot glued into position and the helicopter becomes a cute model for display.

# ROCKET SCIENCE

## Teaching students how a helicopter flies

**Illustration #1** – When a pilot wants to go straight up, as in a take off from the ground, he/she lifts up on a device called the *collective*. This changes the angle of the main rotor blades and, as power is added, this creates vertical lift. After the model featured in this activity is built, have the children hold the CD “rotor” level and rise from the table top. (To demonstrate this, hold the CD level with floor or table top)

**Illustration #2** – When the pilot wants to go forward, the

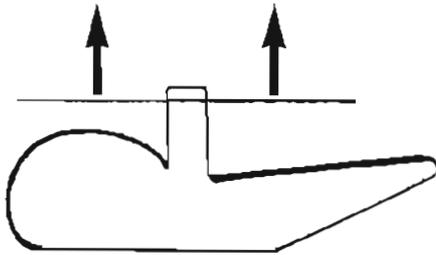
whole rotor “disk” is tilted forward. This is done by pushing forward on the joystick-looking control called the *cyclic*. (This is shown by tilting the CD forward)

**Illustration #3** – If a pilot wants to fly backward, the rotor is tilted in that direction. This is shown to the children by slanting the disk backward. (Tilt the CD toward the rear)

**Illustration #4** – Just like above, to go sideways, the pilot moves the cyclic to the right or left. This tilts the rotor in the correct direction. (Tilt the CD to the right or to the left)

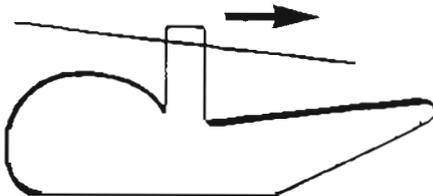
When the pilot is through flying, he/she moves the helicopter to the landing zone. The craft is again brought to a hover and the *collective* is lowered slowly to bring the helicopter back to Earth. (Have the children level the CD disk and gently lower it back to the desk or floor)

**ILLUSTRATION #1**



To make the helicopter go upward, the pilot pulls up on a control called the *collective*. This changes the pitch (angle) of the rotor blade and the helicopter climbs upward.

**ILLUSTRATION #3**



To go backward, the pilot pulls back on the *cyclic* and this tilts the rotor (CD disk) toward the rear. This causes the helicopter to fly backward.

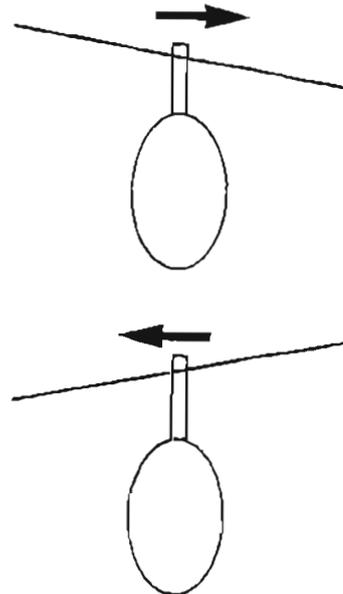
To keep the helicopter flying, the pilot keeps the *collective* in the up position. When the pilot wants to bring the helicopter down, he/she lowers the *collective* until the craft settles to the ground.

**ILLUSTRATION #2**

To make the helicopter go forward, the pilot pushes forward on the *cyclic*. This control tilts the rotor (CD disk) forward and the helicopter moves in that direction.



**ILLUSTRATION #4**



To go sideways, the helicopter pilot moves the *cyclic* either right or left. This tilts the rotor (CD disk) in that direction.

## THE HELICOPTER TEMPLATE

Place this on a meat tray and cut out on the lines. This template makes two models per tray.  
*(Do not cut out face, that is to be drawn on.)*

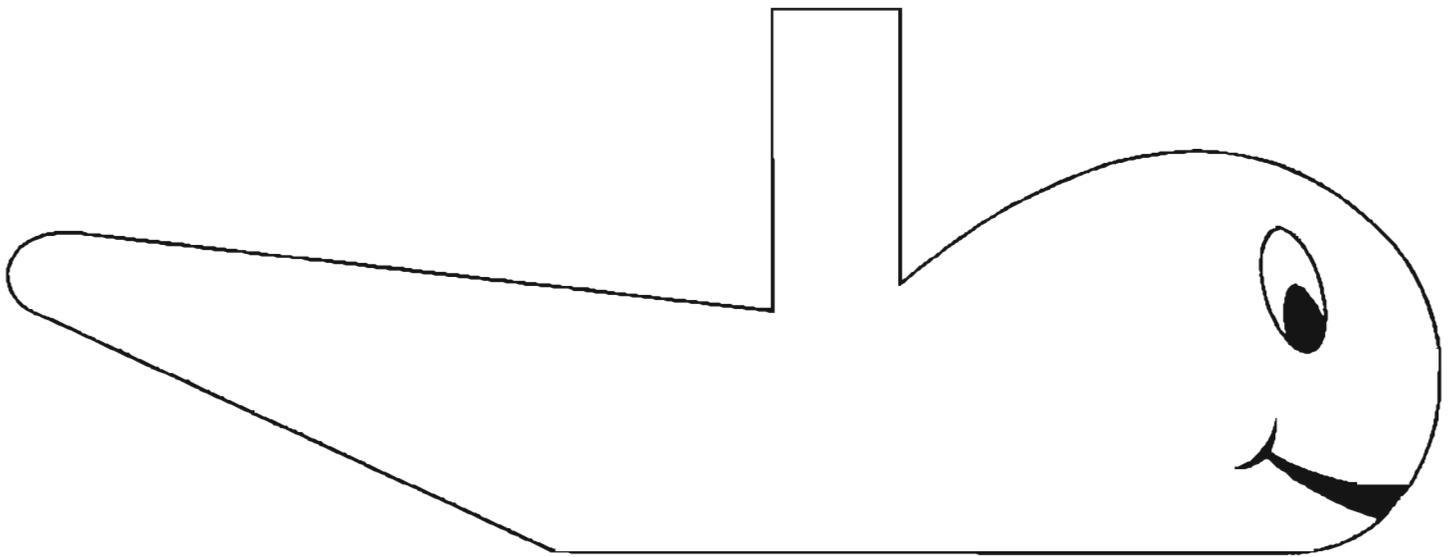
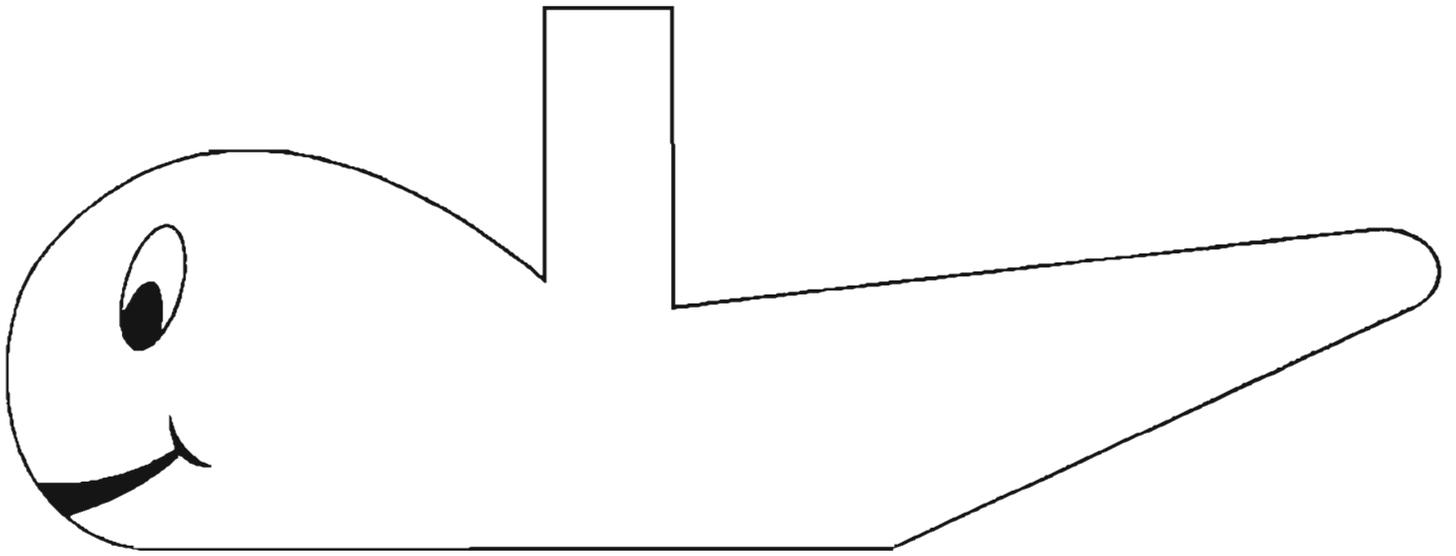


Illustration by Seth Stewart