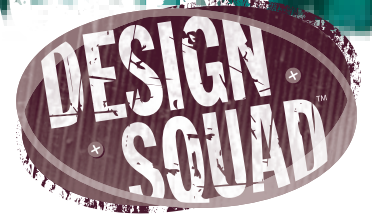


## CHALLENGE 2

# EXTREME KICKING MACHINE



## YOUR CHALLENGE

Modify your kicking machine. Have it either release the pendulum or rubber band when you're standing three feet away, or have it automatically feed balls into the kicking machine, one after another.

## MATERIALS\*

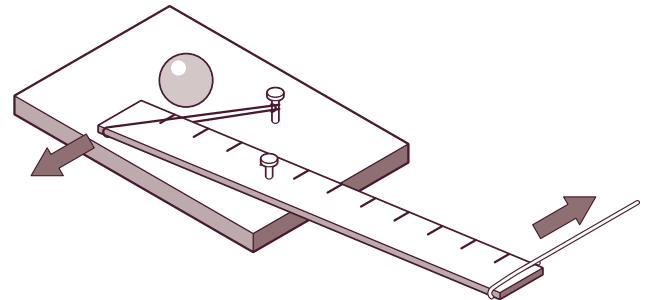
- Kicking machine from previous challenge
- Aluminum foil
- Corrugated cardboard
- Paper clips
- Paper cups, plates, and bowls
- Ping-Pong balls
- Popsicle sticks
- Rubber bands
- Ruler
- Scissors
- String
- Tape (masking or duct)
- Thin metal wire (optional)
- Wooden skewers

\* For information on where to get these materials, see page 6 or visit [pbskidsgo.org/designsquad/engineers](http://pbskidsgo.org/designsquad/engineers).

## BRAINSTORM AND DESIGN

Before you begin designing, brainstorm answers to the following questions. Record and sketch your ideas in your design notebook.

- Will I add a feature that lets me launch a ball remotely or one that lets me automatically feed balls into my kicking machine?
- For the remote-release feature, how will I release the pendulum or rubber band without touching it directly with my hand?
- For the automatic feeder, how will I get balls into position on the kicking machine's launch pad?
- What parts of my existing kicking machine do I have to change in order to add my new feature?



## BUILD, TEST, AND REDESIGN

As you add your new feature, make sure your kicking machine can still do its original task—getting a ball into a cup placed 12 inches away. When we made our machine, we had to debug some problems. For example, with our automatic feeder, the balls didn't fall perfectly into place. We found that our remote release didn't let go easily. If things like this happen to you, figure out a way to fix the problem so that your machine works every time.

# EXTREME KICKING MACHINE

## TAKE IT TO THE NEXT LEVEL

- Design a remote system that allows you to pull back the pendulum or rubber band and then release it.
- Design an automatic feeder that allows you to launch three balls in ten seconds.

### INSIDE THE ENGINEERING

#### ROBOTS TO THE RESCUE!

Meet BEAR. Cute and cuddly, he's not, but one day he might save you from a burning building. At six feet and 200 pounds, BEAR (Battlefield Extraction-Assist Robot™) is a silver robot with a bear-shaped head, big purple eyes, and paddle-like paws. It sports night vision and can climb stairs and travel 10 miles per hour. Designed by engineer Debbie Theobald, BEAR is built to go into dangerous places, like mines or battlefields, and find and carry up to 400 pounds-worth of people to safety. It's taken Debbie and her team of five engineers six years to develop BEAR. As Debbie says, "Why put people's lives at stake when you can send in a robot?"

Battlefield Extraction-Assist Robot is a trademark of Vecna Technologies, Inc.



Watch *Design Squad* on PBS (check local listings). Download more challenges at [pbskidsgo.org/designsquad](http://pbskidsgo.org/designsquad).



## TAKE IT ONLINE

How inventive are you? Design a new paper clip that can multitask and looks cool at the same time! Download *Build a Better Paper Clip* from Intel's *Design and Discovery* hands-on engineering program.

➔ [intel.com/education/designanddiscovery](http://intel.com/education/designanddiscovery)



Photo: Milka Tomczak

The *Design Squad* cast designed kicking machines to automatically feed a stream of soccer balls to a player at different angles and heights.



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