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**Findley Oaks STEM Connect**

**3rd Grade Design Brief**

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| **Challenge**  Invisible Forces | **Unit**  Magnets |

**Standard:**

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| 3-PS2-1. | Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. |

Students should follow the **Engineering Design Process.**

**Background/Problem:**

To change a spacecraft's speed and direction, NASA engineers use a planet's or moon's gravity, a process called a "gravity assist." Many spacecrafts fly close by a planet or moon to use its gravitational pull to change speed and direction. This “gravity assist” also greatly reduces the fuel required to navigate a spacecraft.

In this video from *Design Squad Nation*, kids design and build systems that use magnets to control the speed and direction of a rolling ball.

As they build their systems, the kids use the engineering design process, apply a variety of science concepts (e.g., force, magnetic fields, inverse square law), and learn how NASA spacecraft use gravity to help them explore the solar system.

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**Design Challenge:**

Build a system that uses magnets to control the speed and direction of a rolling ball.

**Introduction:**

Explain that gravity is a force present in all things and that planets and moons exert a gravitational pull on spacecraft that pass close by.

Spacecraft use small onboard rockets to make minor course corrections.

Big corrections require a lot of fuel, which is heavy to carry. Instead of using rockets, NASA engineers use a planet’s or moon’s gravity to increase a spacecraft’s speed and “steer” it by changing its direction. This process is called a “gravity assist.”

• Tell kids that today they will do something similar to what NASA does, but instead of using gravity to steer a ball, they’ll use a magnetic force. Then show kids the Invisible Force video.

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**Constraints:**

Make sure you have a design plan before you start.

Materials:

Paper cup (6- to 8-ounce)

• Strip of index card (2.5 x 12.5 centimeters) [1 X 5 inches])

• 30-centimeter (12-inch length of flexible rope/clothesline)

• 1 steel ball (60-millimeter [quarter inch] ball bearing)

• 1 strong magnet The best magnets for this activity are the silver, three-inch-long, oblong magnets sometimes called “cow” or “snake-egg” magnets.

• 1 target (e.g., “X” of tape on the table or an object to hit)

• Tape (any kind)

* Paper/pencil for design planning

Tools:

Scissors

Crazy scissors

Staplers

Hole punch

Rulers

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