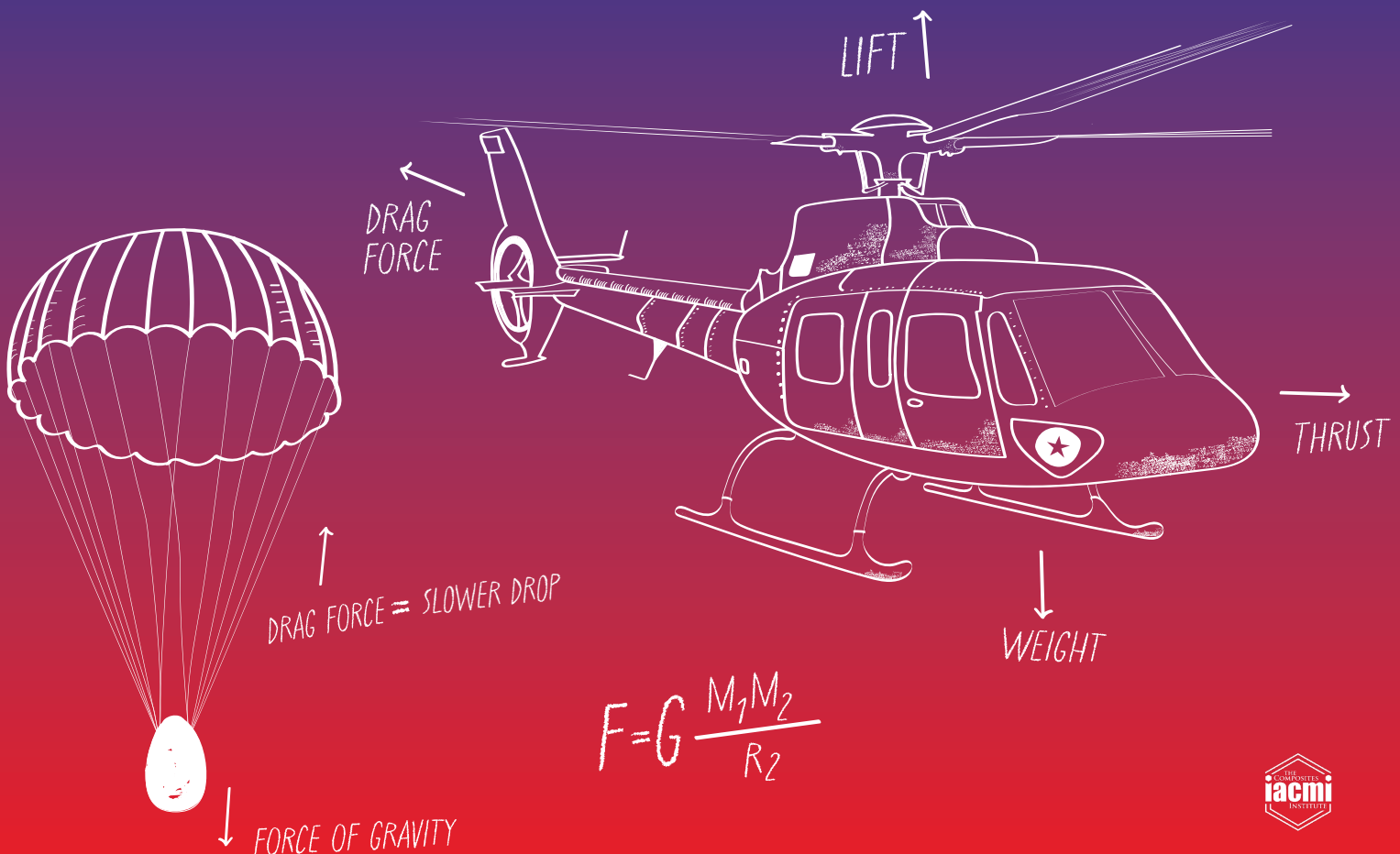


DREAM. BUILD. BECOME.

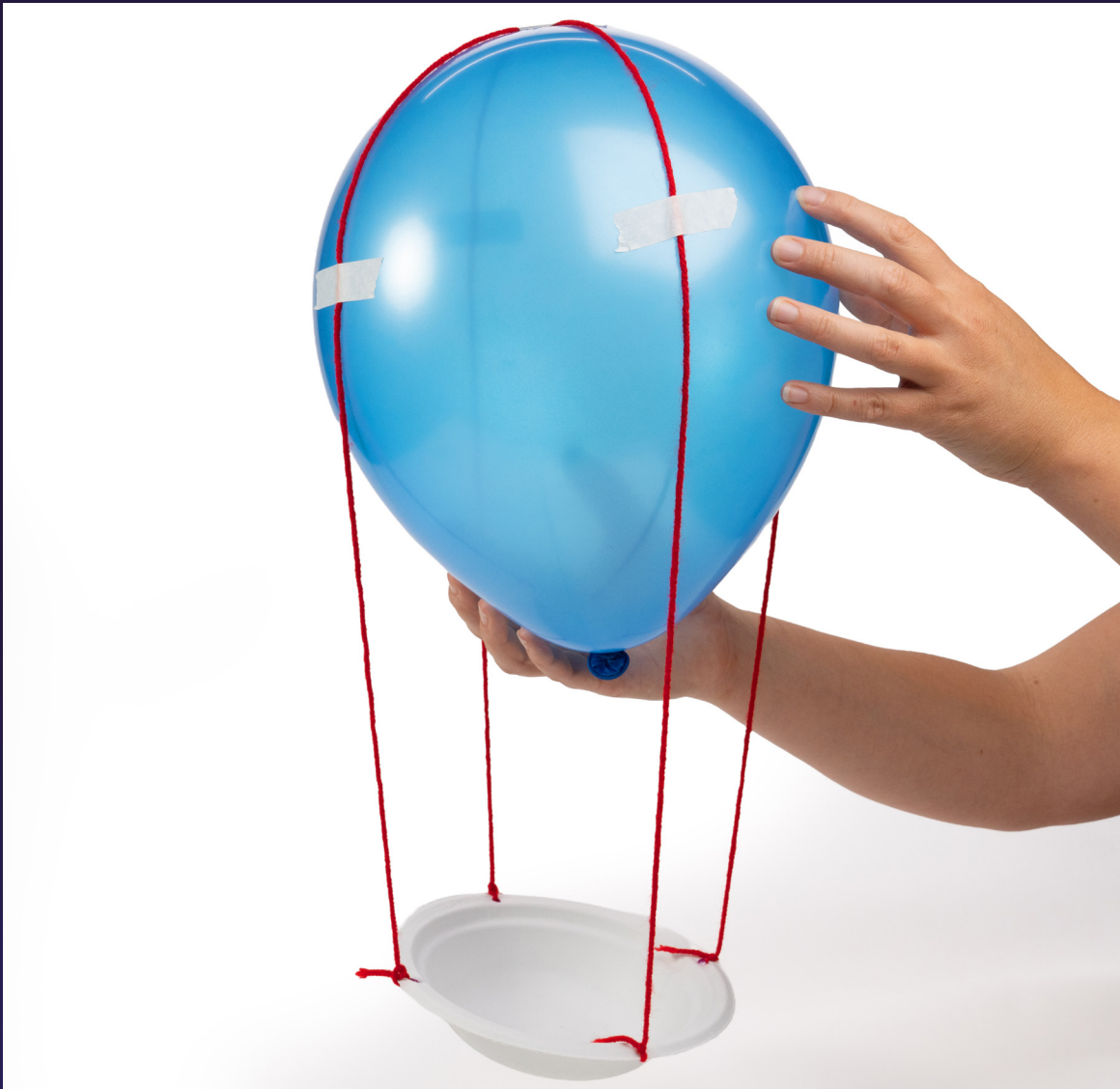
ACE METAL FOUNDATIONS

By IACMI

Controlled Descent



Controlled Descent



Prior Knowledge

This activity requires little prior knowledge. To ensure success, students should understand the basics of clock-face positions, as we use 12 o'clock, 3 o'clock, 6 o'clock, and 9 o'clock as points of reference for spacing holes and attachments. Students must also have the ability to follow multi-step directions. Lastly, students should have a basic understanding of balance and evenness, and everyday experience with falling objects.

Controlled Descent

Lesson Overview

In this lesson, students explore how gravity affects objects in motion and how thoughtful design can reduce damage when an object falls. Using simple materials, students design and test a parachute system intended to slow the descent of a small object and protect it on landing.

This activity introduces students to foundational engineering ideas that are essential in manufacturing, including designing for gravity, protecting products during movement, and testing and improving physical systems. Rather than focusing on technical physics vocabulary, the lesson emphasizes observable cause-and-effect relationships and the role of design decisions in real-world problem solving.

Students will build, test, observe, and revise a parachute design, developing an early understanding that engineers do not eliminate gravity, they design solutions that work with it.

Vocabulary

Gravity: The force that pulls objects down towards Earth

Air Resistance: The push from the air that slows an object down as it moves or falls

Controlled Motion: Moving something in a careful way so it doesn't go too fast or hit too hard

Design: A plan for how something will be built or made to solve a problem



Figure 1: Army helicopter demonstrating the use of air resistance and lift, and thrust to stay airborne.



Figure 2: Sky divers demonstrating how parachutes use air resistance to slow their descent to the ground.

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The Foundations of Designing for Gravity

Have you ever wondered why things fall to the ground? Gravity pulls everything on Earth downward, but engineers design ways to control how fast objects fall and how they land.

How Falling Objects Behave

When an object falls:

- Gravity pulls it toward the ground
- The object moves faster as it falls
- When it hits the ground, it can be damaged

If nothing slows the object down, it can hit the ground hard. That's why engineers think carefully about how things move through the air and how they land.

How Air can Slow Things Down

As an object moves through the air, the air pushes back on it, this is called air resistance. This push can help slow the object down.

Whether air slows something a little or a lot depends on:

- **Size** – bigger surfaces push against more air
- **Shape** – wide, flat shapes slow down more than small ones
- **Materials** – some materials catch more air than others

A parachute is a design that uses air to slow down a falling object. Instead of falling straight down quickly, the parachute spreads out and lets air push against it, helping the object fall more slowly.

In manufacturing, engineers design around gravity every day. Products are lifted, lowered, stacked, packed, and shipped, and gravity always pulls them downward. Engineers cannot eliminate gravity, but they can design systems that control how objects move so they do not fall too quickly or hit too hard.

Air can also play an important role in these designs. When an object moves through the air, the air pushes back on it and can help slow it down. Engineers use this idea when designing packaging, safety systems, and equipment that protects products while they are moving. Just like a parachute slows a falling object using air, manufacturers design real-world solutions that control motion and reduce damage. In the parachute egg drop activity, you are exploring these same ideas by using air to slow a falling object and designing a system that controls motion to reduce damage—just like engineers do in manufacturing.

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Materials

Materials Supplied in Kit

Per Student

- 1 balloon
- 1 bowl
- 4 strips of yarn of equal length

Shared

- Tape



Materials Supplied by Teacher

- 1 pencil per student (to punch holes through the edge of paper bowls)

Activity Directions

Step 1: Make Even Tie-off Holes

- Look at the edge of your bowl like it is the face of a clock
- Punch four holes around the edge of the bowl using a pencil:
 - One hole at 12 o'clock
 - One hole at 3 o'clock
 - One hole at 6 o'clock
 - One hole at 9 o'clock
- Check that the holes are spaced evenly around the bowl
- Make sure the holes are big enough for the string or yarn to fit through



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Activity Directions Continued

Step 2: Attach the Strings

- Cut or gather 4 pieces of yarn of equal length
- Put one string through each hole in the bowl
- Tie each string tightly so it stays attached
- Hold the bowl up by all 4 strings to ensure that it hangs flat, and level. If not, adjust the strings until it does.



Step 3: Inflate your balloon

- Inflate your balloon and tie it. This will serve as your parachute.

Step 4: Attach the Parachute to the Strings

- Gather the loose ends of all four strings
- Use the tape provided to secure one string at the 12 o'clock position, another at the 3 o'clock position, another at the 6 o'clock position, and the last at the 9 o'clock position
- Gently lift the balloon to check that all 4 strings are securely attached



Step 5: Add the Object/Payload

- Place an item into the bowl and hold the parachute system up by the balloon to ensure that the bowl still hangs relatively level

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Activity Directions Continued

Step 6: Test the Parachute

- Grab your parachute system by the balloon and take it to the drop location
- Release the parachute system and watch it fall
- Observe what happens as it moves through the air

Step 7: Observe and Hypothesize

- After testing your parachute, look closely at what happened
- Compare your parachute with others in class:
 - Some balloons may be larger or smaller
 - Some objects may be heavier or lighter
 - Some parachutes may fall slower or faster
- Use your observations to form a “hypothesis,” an educated guess or explanation. You can explain your thinking by finishing this sentence: “I think this parachute worked better because...”



Figure 3: Sky divers parachuting from a plane.

Discussion Prompts or Reflection

- How was your parachute similar to or different from others’ parachutes?
- Which parachutes seemed to fall the slowest? What do they have in common?
- Which design features helped control the fall of the parachute the best, and why?
- Did larger or smaller balloons seem better at creating air resistance?

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Variations and Enrichment

- This activity can be enriched by taking the parachute systems outside on a breezy day. Contrary to test drops in a controlled environment like a classroom, students may find that air resistance doesn't just slow the fall of objects, it can also push things sideways. Engineers must think about air in all directions, not just downward motion
- Variation can be introduced by intentionally directing some students to use larger or smaller balloons, or heavier or more lightweight payloads
- The use of a teacher's phone as a stopwatch can add another observable variable by timing the drop

Foundation Exploration

- **Packaging Engineers** design boxes and containers that protect products during shipping. They must think about gravity when boxes are stacked or dropped, and design packaging that absorbs impact, just like your parachute protects the object inside the bowl
- **Manufacturing Technicians** work with machines that lift, move, and lower parts onto factory floors. They help ensure that parts do not move too quickly, or crash into each other as they move through a system
- **Safety Engineers** design systems that slow things down to keep people and equipment safe. They consider how fast objects move, how they stop, and what happens when something fails
- **Aerospace or Flight Engineers** design parachutes, aircraft, and landing systems. These individuals must carefully study how air pushes on objects.