MAKING IT REAL:
DRIVING HOME THE BREEZY BLIMPS UNIT

Overview: Students take their work beyond the walls of the classroom, using a combination of presentations, videos, and discussion. They present their blimps, discuss how they demonstrate the unit's science concepts, point out how they are thinking and working like engineers and discuss how engineering is a field centered on making the world a better place.

Preparation

☐ Visit pbs.org/designsquad and download the following video clips from the "Teacher's Guide" page: ***Design Process: Teamwork*** (1½ minutes), ***Design Process: Testing & Redesign*** (30 seconds), ***Band Cam Judging*** (4 minutes), and the ***Mark Caylao*** engineer profile (2½ minutes). Be prepared to project them.

1 **Raise student awareness of engineering** (5 minutes)

Our world is molded by the engineering that surrounds us. Yet, many students are unaware of what engineers do. Probe students' ideas about engineering. Ask:

- What do engineers do? *(List students' ideas.)*
- Then ask: What things in this room were probably designed or made by engineers? *(There is very little in the room other than the people, plants, and dirt that does not bear the mark of an engineer.)*

2 **Relate students' work to science and engineering** (25 minutes)

View ***Band Cam Judging***, in which team members discuss how to meet the *Band Cam* challenge. Then ask:

- How did the teams create lift? *(Varied the amount of helium; reduced the frame's weight; added propellers; redesigned based on testing; etc.)*
- How could the teams redesign their faulty blimp? *(Balance the weight better; adjust propellers to provide more balanced thrust; make sure it's neutrally buoyant; increase the axis of rotation to reduce spin; lighten the load; etc.)*
- How is the process you followed similar to the one the kids on *Design Squad* did? *(Both the students and the teams brainstormed lots of ideas, then built, tested, and revised their blimps, and presented their designs to others.)*

Show ***Design Process: Teamwork***, in which the *Design Squad* teams discuss frustrations inherent in teamwork. Then show ***Design Process: Testing & Redesign***, in which the Green Team, formerly at odds in *Teamwork*, works together to come up with an effective solution to a problem. Have students present their blimps. Use the following questions to explore key points in the video and unit:

- What could you suggest to help the Green Team work effectively together? *(Listen to each other; adjust one's style to help things work smoothly; get input from each team member; agree on a plan; choose roles; assign tasks; use people's strengths; etc.)*
- What were some problems you solved as you built and tested your blimp?
- Was it harder to get a blimp to travel straight or to travel far? Why?
- What are some general characteristics that help a blimp work well? *(Lightweight; neutrally buoyant; long axis and fins to prevent spinning; streamlined to minimize air resistance; etc.)*

DESIGN SQUAD

SHOW KIDS THE RELATED TV EPISODE

Show students *Band Cam*, the full-length *Design Squad* TV episode related to the *Breezy Blimps* unit, where the *Design Squad* teams design and build a remote-controlled aerial camera system to film a live concert. Watch it online at: **pbs.org/designsquad**.

"My students loved the hands-on aspect of this and really rose up to the challenges. I learned that I should not be afraid to challenge my kids, and I should do more open-ended projects with them."

Harini A.
Belle Haven Elementary School
Menlo Park, CA

Students develop a working knowledge of force in *Sky Floater*, take their understanding further in *Sky Glider*, and explore the relevance of the science and engineering in *Making It Real*.

3 Meet an engineer (10 minutes)

- View the ***Mark Caylao*** video to introduce students to an engaging young engineer involved in designing, building, and running one of the world's largest blimps. Of engineering, he says, "It's the best job you can have. I love it!"
- Mark mentions that every day he uses things he learned in high school. Ask: What subjects might you study to prepare to do the things Mark does? *(Math, science, and tech. ed. would help you understand how blimps work, and how to design, build, operate, navigate, and maintain one.)*
- What were some of the things Mark mentioned liking about being an engineer? *(He calls it the perfect job because he likes the traveling; being able to fly; being part of the team that designs, builds, and operates blimps; and doing important work, such as testing air quality and monitoring whales.)*

4 Make the engineering real (10 minutes)

Use the following questions to help students see how the work they did relates to engineering and see that engineers design things that improve people's lives.

- Who might be interested in using blimps? *(Blimps provide quiet, energy-efficient transportation and can carry heavy loads and hover easily. They can be used in logging operations, in search-and-rescue missions, and to carry cameras to observe wildlife, conduct surveillance, and film TV broadcasts.)*
- How might engineers be involved with blimps? *(Designing sturdy, aerodynamic blimps and efficient propulsion systems; inventing new, sturdy, lightweight materials for making blimps; designing blimp-based transportation systems and infrastructure, such as terminals, hangars, and manufacturing systems; finding sources of gas to fill blimps; etc.)*
- In what ways did you think and work like an engineer as you made your blimp? *(Used creativity; followed the design process to design, build, and test an aerodynamic blimp that travels a straight path; applied science concepts—buoyancy, force, and Newton's laws; made a prototype of something people want—an efficient mode of transportation; etc.)*

Extension Ideas

- Share photos of your students' designs and see what others have made. Visit DS XCHANGE, *Design Squad*'s online community at **pbs.org/designsquad**.
- Using photos, contrast the design—the form and function—of a stunt plane (built for sharp turns and quick maneuvers), supersonic jet (speed), and blimp (distance, hovering, fuel economy). Focus on overall shape, axis of rotation (short for stunts, long for steady flight), streamlining, fins and wings, and the size and location of the cockpit or cabin.

Interdisciplinary Connections

- *Math:* Calculate how big a spherical balloon has to be to lift a pound, given that the lift of helium is one ounce per cubic foot. Since the volume of this sphere must be at least 16 cubic feet, then: $\frac{4}{3} r^3 = 16$ cubic feet; r = 1.56 feet. *(The diameter must be at least 3.12 feet.)*
- *Social Studies:* Research the history and current use of blimps in travel, law enforcement, warfare, wildlife studies, search and rescue, and other fields.

TELL US WHAT YOU THINK

Take our quick online survey, and we'll send you a *Design Squad* class pack (while supplies last—see back cover for details).