Draft 1/2013

Engineering Adventures

To the Rescue: Engineering Aid Drop Packages

Package Engineering for Kids
in Out-of-School Time

Written by the Engineering is Elementary Team
Illustrated by Ross Sullivan-Wiley

EiE Engineering is Elementary®
Developed by the Museum of Science, Boston

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Pilot Sites for To The Rescue:

This unit would not be possible without the valuable feedback from our pilot sites!

- All Stars CUSD After School Program, Carpinteria, CA
- Amana Academy, Alpharetta, GA
- Building Educated Leaders for Life Young Achievers Academy, Dorchester, MA
- Bowie School, Chicopee, MA
- Boys and Girls Club of Laguna Beach, Laguna Beach, CA
- Brayton Elementary, North Adams, MA
- Burnsville Area Learning Center, Eagan, MN
- Community Schools, Somerville, MA
- Cummings Elementary 21st Century Afterschool, Winthrop, MA
- Emmanuel College and Mission Grammar, Boston, MA
- Girls, Inc., Lynn, MA
- Haverhill Public Schools Discovery Club, Haverhill, MA
- The Hockaday School, Dallas, TX
- Huntington Avenue YMCA, Boston, MA
- Imaginarium Science Center, Fort Myers, FL
- Jenny Lind School, Minneapolis, MN
- Lambert-Lavoie Elementary School, Chicopee,MA
- Malden YMCA and the Malden Housing Authority, Malden, MA
- Malden YMCA and Willis Community Center, Medford, MA
- Melissa ISD, Melissa, TX
- Metrowest YMCA and Potter Road Elementary, Framingham, MA
- Metrowest YMCA and Miriam McCarthy Elementary, Framingham, MA
- MGH Youth Programs and the Charlestown Boys and Girls Club, Charlestown, MA
- Missouri River Education Cooperative Extended School Program, Mandan, ND
- Michigan Technological University, Houghton, MI
- NYPENN Pathways Brownie Troop 50240, Pottsdam, NY
- Roberts Family Development Center, Sacramento, CA
- United South End Settlements, Boston, MA
- Sacramento START, Sacramento, CA
- St. Paul Public Schools, St. Paul, MN
- Salvation Army Kids Club, Chelsea, MA
- Samuel Kennedy Elementary, Sacramento, CA
- Seashore Learning Center, Corpus Christi, TX
- Sierra Madre Elementary, Sierra Madre, CA
- South Boston Boys and Girls Club, Boston, MA
- Sumner G. Whittier School, For Kids Only, Everett, MA
- Tully Elementary, Louisville, KY
- UCLA
- Wauwatosa STEM School, Wauwatosa, WI
- Wilson Community School, Philadelphia, PA
- Yawkey Boys and Girls Club, Roxbury, MA
- Yuba City Unified School District - Bridge Street School, Yuba City, CA
- YWCA Southeastern Massachusetts, New Bedford, MA

Unit Map

Here's an overview of the order of the adventures in this unit and how they all fit together.

Prep Adventure 1: What is Engineering?
Kids engineer a tower and are introduced to the Engineering Design Process as a problem solving tool.

Prep Adventure 2: What is Technology?
Kids explore the idea that they, as engineers, can design and improve technology.

Adventure 1: Aid Drops
Kids are introduced to the problem: how can you make sure an aid drop package can protect its contents? Kids test hard casings and soft paddings.

Adventure 2: Incoming!
Kids test ways to slow down the package as it falls, by using parachutes, wings, and canopies.

Adventure 2a: Packing an Aid Package
Kids consider what should be packed in their aid drop packages to help people who are in a flood zone and need supplies.

Adventure 3: Making it Clear
Kids figure out how they can make sure their package is easy to spot after it is dropped, and how they can communicate what is inside their package.

Adventure 4: Creating an Aid Drop Package
Using their knowledge of how to protect aid drop supplies, how to make sure packages can be seen, and how to communicate what is inside, kids use the steps of the Engineering Design Process to engineer their own aid drop packages.

Adventure 5: Improving an Aid Drop Package
Kids continue using the steps of the Engineering Design Process as they create their aid drop packages and improve their designs.

Adventure 6: Engineering Showcase
Kids present their aid drop designs and explain how they used the Engineering Design Process.

Table of Contents

Introduction

Adventures

Note: Starred activities represent extensions to the core curriculum.

About Engineering is Elementary

Engineering is Elementary® (EiE) fosters engineering and technological literacy among children. Most humans spend over 95% of their time interacting with technology. Pencils, chairs, water filters, toothbrushes, cell phones, and buildings are all technologies—solutions designed by engineers to fulfill human needs or wants. To understand the world we live in, it is vital that we foster engineering and technological literacy among all people, even young children! Fortunately, children are born engineers. They are fascinated with building, taking things apart, and how things work. Engineering is Elementary harnesses children's natural curiosity to promote the learning of engineering and technology concepts.

The EiE program has four primary goals:
Goal 1: Increase children's technological literacy.
Goal 2: Increase educators' abilities to teach engineering and technology to elementary students.
Goal 3: Increase the number of schools and out-of-school time programs in the U.S. that include engineering at the elementary level.
Goal 4: Conduct research and assessment to further the first three goals and contribute knowledge about engineering teaching and learning at the elementary level.

The first product developed by the EiE program was the Engineering is Elementary curriculum series. This curriculum, designed specifically for use in elementary school classrooms, is research-based, standards-driven, and classroom-tested. The EiE curriculum integrates engineering and technology concepts and skills with elementary science topics and promotes K-12 science, technology, engineering, and mathematics (STEM) learning. For more information about EiE, visit: eie.org.

In 2011, EiE began development of Engineering Adventures (EA), a curriculum specifically for use in out-of-school time settings. While many of the underlying principles of the EiE and EA curricula are the same, EA is designed to address the unique challenges and advantages of the OST setting. More information about EA can be found on the next page, or online at: engineeringadventures.org.

Engineering is Elementary is a part of The National Center for Technological Literacy (NCTL) at the Museum of Science, Boston. The NCTL aims to enhance knowledge of technology and inspire the next generation of engineers, inventors, and innovators. Unique in recognizing that a 21st century curriculum must include today's human-made world, the NCTL's goal is to introduce engineering as early as elementary school and continue it through high school, college, and beyond. For more information about the NCTL, visit: nctl.org.

About Engineering Adventures

The mission of Engineering Adventures is to create exciting out-of-school time activities and experiences that allow *all* learners to act as engineers and engage in the engineering design process. Our goal is to positively impact children's attitudes about their abilities to engineer by providing materials uniquely appropriate for the varied landscapes of out-of-school time settings.

The main ideas that guide the developers of EA are listed below.

We believe kids will best learn engineering when they:

- engage in activities that are fun, exciting, and connect to the world in which they live.
- choose their path through open-ended challenges that have multiple solutions.
- have the opportunity to succeed in engineering challenges.
- communicate and collaborate in innovative, active, problem solving.

Through EA units, kids will learn that:

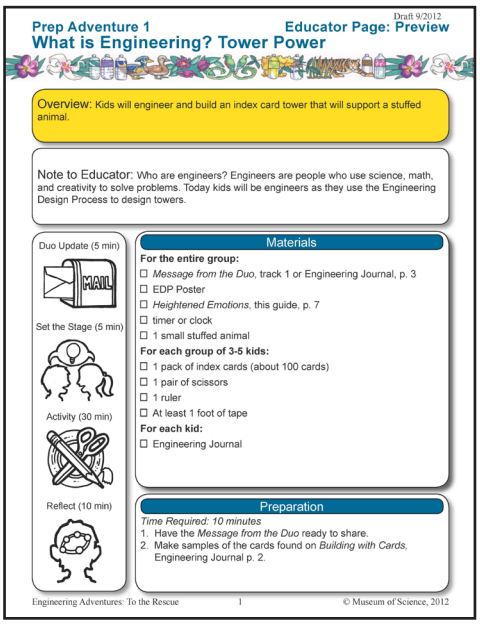
- they can use the Engineering Design Process to help solve problems.
- engineers design technologies to help people and solve problems.
- they have talent and potential for designing and improving technologies.
- they, too, are engineers.

As kids work through their engineering design challenges, they will have the opportunity to build their problem solving, teamwork, communication, and creative thinking skills. Most importantly, this curriculum is designed to provide a fun learning opportunity for kids!

For more information on Engineering Adventures, please visit: engineeringadventures.org.

Each Engineering Adventure Includes

A **Preview Page** with relevant background information, materials list, prep, and a preview of the journal pages needed.


Draft 9/2012

Prep Adventure 1 — Educator Page: Preview

What is Engineering? Tower Power

Overview: Kids will engineer and build an index card tower that will support a stuffed animal.

Note to Educator: Who are engineers? Engineers are people who use science, math, and creativity to solve problems. Today kids will be engineers as they use the Engineering Design Process to design towers.

Duo Update (5 min) — Set the Stage (5 min) — Activity (30 min) — Reflect (10 min)

Materials

For the entire group:
- ☐ *Message from the Duo*, track 1 or Engineering Journal, p. 3
- ☐ EDP Poster
- ☐ *Heightened Emotions*, this guide, p. 7
- ☐ timer or clock
- ☐ 1 small stuffed animal

For each group of 3-5 kids:
- ☐ 1 pack of index cards (about 100 cards)
- ☐ 1 pair of scissors
- ☐ 1 ruler
- ☐ At least 1 foot of tape

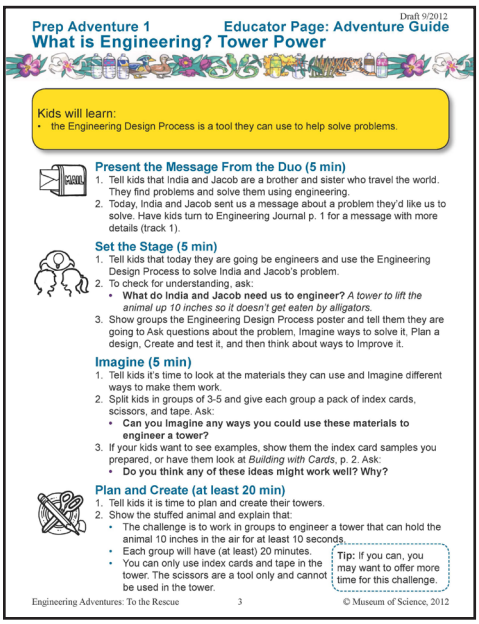
For each kid:
- ☐ Engineering Journal

Preparation

Time Required: 10 minutes
1. Have the *Message from the Duo* ready to share.
2. Make samples of the cards found on *Building with Cards*, Engineering Journal p. 2.

Engineering Adventures: To the Rescue 1 © Museum of Science, 2012

An **Adventure Guide** with step-by-step instructions, including discussion questions, extension ideas, and tips.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Prep Adventure 1 — Educator Page: Adventure Guide

What is Engineering? Tower Power

Kids will learn:
- the Engineering Design Process is a tool they can use to help solve problems.

Present the Message From the Duo (5 min)
1. Tell kids that India and Jacob are a brother and sister who travel the world. They find problems and solve them using engineering.
2. Today, India and Jacob sent us a message about a problem they'd like us to solve. Have kids turn to Engineering Journal p. 1 for a message with more details (track 1).

Set the Stage (5 min)
1. Tell kids that today they are going be engineers and use the Engineering Design Process to solve India and Jacob's problem.
2. To check for understanding, ask:
   - **What do India and Jacob need us to engineer?** *A tower to lift the animal up 10 inches so it doesn't get eaten by alligators.*
3. Show groups the Engineering Design Process poster and tell them they are going to Ask questions about the problem, Imagine ways to solve it, Plan a design, Create and test it, and then think about ways to Improve it.

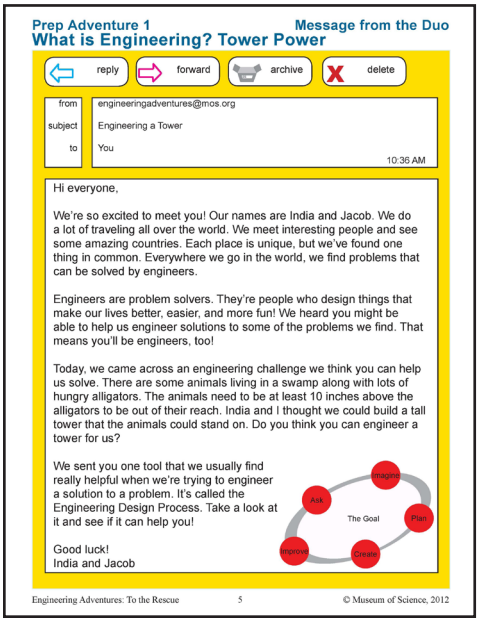
Imagine (5 min)
1. Tell kids it's time to look at the materials they can use and Imagine different ways to make them work.
2. Split kids in groups of 3-5 and give each group a pack of index cards, scissors, and tape. Ask:
   - **Can you Imagine any ways you could use these materials to engineer a tower?**
3. If your kids want to see examples, show them the index card samples you prepared, or have them look at *Building with Cards*, p. 2. Ask:
   - **Do you think any of these ideas might work well? Why?**

Plan and Create (at least 20 min)
1. Tell kids it is time to plan and create their towers.
2. Show the stuffed animal and explain that:
   - The challenge is to work in groups to engineer a tower that can hold the animal 10 inches in the air for at least 10 seconds.
   - Each group will have (at least) 20 minutes.
   - You can only use index cards and tape in the tower. The scissors are a tool only and cannot be used in the tower.

Tip: If you can, you may want to offer more time for this challenge.

Engineering Adventures: To the Rescue 3 © Museum of Science, 2012

A **Message from the Duo**, India and Jacob, with information about the day's activity.


Prep Adventure 1 — Message from the Duo

What is Engineering? Tower Power

reply | forward | archive | delete

from: engineeringadventures@mos.org
subject: Engineering a Tower
to: You
10:36 AM

Hi everyone,

We're so excited to meet you! Our names are India and Jacob. We do a lot of traveling all over the world. We meet interesting people and see some amazing countries. Each place is unique, but we've found one thing in common. Everywhere we go in the world, we find problems that can be solved by engineers.

Engineers are problem solvers. They're people who design things that make our lives better, easier, and more fun! We heard you might be able to help us engineer solutions to some of the problems we find. That means you'll be engineers, too!

Today, we came across an engineering challenge we think you can help us solve. There are some animals living in a swamp along with lots of hungry alligators. The animals need to be at least 10 inches above the alligators to be out of their reach. India and I thought we could build a tall tower that the animals could stand on. Do you think you can engineer a tower for us?

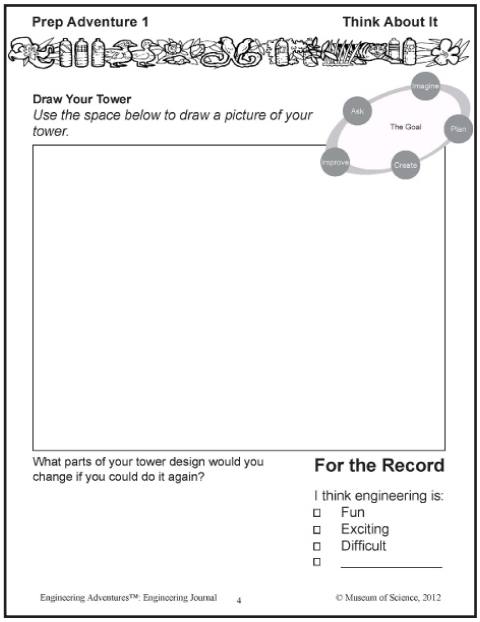
We sent you one tool that we usually find really helpful when we're trying to engineer a solution to a problem. It's called the Engineering Design Process. Take a look at it and see if it can help you!

Imagine, Ask, The Goal, Plan, Create, Improve

Good luck!
India and Jacob

Engineering Adventures: To the Rescue 5 © Museum of Science, 2012

Engineering Journal pages that allow kids to record findings and reflect on their learning.


Prep Adventure 1 — Think About It

Draw Your Tower

Use the space below to draw a picture of your tower.

Imagine, Ask, The Goal, Plan, Improve, Create

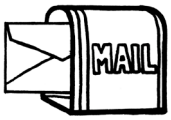
What parts of your tower design would you change if you could do it again?

For the Record

I think engineering is:
- ☐ Fun
- ☐ Exciting
- ☐ Difficult
- ☐ _____

Engineering Adventures™: Engineering Journal 4 © Museum of Science, 2012

The Sections of the Adventures



Messages from the Duo

Messages from India and Jacob, a world-traveling brother and sister Duo, are provided as a quick, exciting way to present the real-world context for the unit's engineering challenge. Providing a context helps kids to understand the challenge and motivates them to find solutions. If you have access to a CD or MP3 player, we strongly suggest using the audio recordings, although reading the emails aloud will convey the same information.

Set the Stage (or Ask)

The Set the Stage, or Ask, part of each adventure provides important information and questions that prepare kids for the main activity. During this section, you might ask questions prompting kids to share their prior knowledge, have them predict what they will find, or remind them of criteria that will help them as they engineer. This sets your kids up to succeed and feel confident in their ability to engineer.

Activities

The activities are designed to get kids thinking and working together to solve the unit's engineering design challenge. As the educator, it is your role to guide kids through these activities by encouraging them to pursue and communicate their own ideas, even if you think they may not work. In engineering, there are no right or wrong answers! Every problem has many possible solutions and multiple ways to reach them.

Reflect

Each adventure includes five to ten minutes at the end for kids to communicate with their peers by sharing their work. This gives kids the chance to discuss new ideas, think about their own work and the work of others, and reflect on what was learned. Group reflection can help reduce competition by encouraging kids to support each other as they move through the Engineering Design Process. For more individual reflection, each adventure also includes time for kids to record thoughts and ideas in their Engineering Journal.

Engineering Journals

Copy an Engineering Journal for each kid as you begin working on this EA unit. Kids will use them as directed in the Adventure Guide during every adventure.

The Engineering Journal is a central location for kids to record their thoughts and ideas as they move through the unit. It includes recording pages that will guide kids through the Engineering Design Process, poses questions, and prompts kids to reflect on their learning. The 5-10 minutes kids spend with their journals during each adventure will allow them to create a personalized record of their engineering learning.

The back page of each Engineering Journal is a passport page from the country or state in which the unit takes place. Kids are encouraged to stamp the passport page when they finish a unit and collect the pages from all of the units they've completed. A full passport can be found online at: www.mos.org/eie/engineeringadventures/passport.

What You Need to Know **Before** Teaching an EA Unit

Engineering is fun.

The EA team hears this from many OST educators and kids. Engineering is really a way of problem solving—a way of thinking about the world—that is often very fun and creative. Any time you need to solve a problem in order to reach a goal, you are engineering.

There are no right or wrong answers.

There are often many great ways to solve the same problem. Not only is this a good engineering lesson for the kids in your program, it's a good life lesson.

It's okay to try it out!

It can be very helpful to try out the engineering challenge yourself—either beforehand or right alongside the kids in your program as they work through the adventures. This can help you understand the challenges the kids might face.

Scheduling the Adventures

Each adventure requires 45-60 minutes of teaching time. We recommend that you budget at least 8-12 hours in order to complete this unit, as some adventures may occasionally go longer than expected.

You can schedule this unit in several ways: once a week, several times a week, or daily. It is also possible to group certain adventures together. The chart below shows which adventures are easiy taught together. Use this chart to help you plan your schedule.

Prep Adventure 1: What is Engineering? Tower Power Prep Adventure 2: What is Technology? Technology Detectives	2-3 hours
Adventure 1: Aid Drops Adventure 2: Incoming!	2-3 hours
*Adventure 2a: Packing an Aid Package Adventure 3: Making it Clear	2-3 hours
Adventure 4: Creating an Aid Drop Package Adventure 5: Improving an Aid Drop Package	2-3 hours
Adventure 6: Engineering Showcase: That's a Wrap!	1-1.5 hours

Tips and Tricks for Teaching the Unit

Post a Daily Agenda

Giving kids a sense of the day's adventure will help them to plan ahead and manage their time during the activity.

Facilitate Teamwork

Being able to work well in teams is an important skill for any engineer. You may want to assign team roles to help kids if they struggle with teamwork. Possible roles include: the recorder, the materials gatherer, the tester, and the presenter.

Invite Others to the Showcase

The showcase, always the last adventure in the unit, is a big deal! This is a chance for kids to highlight the engineering they've done and share their accomplishments with others. Consider inviting families, program staff, and other kids to come to the showcase.

Background

Package Engineering

Package engineering involves the design, development, and production of packages. Packages are all around us in the form of boxes, envelopes, food containers, and medicine bottles, just to name a few. Most people don't take a lot of time to think about all of the engineering that goes into the packages we see around us every day.

There are seven main functions (or jobs) of packages that packaging engineers need to think about. These functions include: contain, communicate, carry, display, dispense, protect, and preserve. In this unit, kids will focus on the protect, display, and communicate functions of packages as they design an aid drop package. They will need to be sure that the supplies inside are not damaged (protect), the package is easy to see when it lands (display), and the package lets people know what is inside (communicate).

Humanitarian Aid Drops

When people are cut off from essential supplies, sometimes the only way to quickly deliver food, water, medicine, and other necessities is through humanitarian airdrops (called "aid drops" in this unit). Aid drops are generally short-term projects, since dropping aid from the air can be more difficult to coordinate than delivering aid using trucks or person-to-person delivery. Aid drops can also be very expensive.

Aid drops have been used in Thailand to deliver aid to people living in areas isolated by flood waters during monsoon season. Aid drops have also been implemented in Afghanistan after the landslide in 2010, and in Haiti after the 2010 earthquake.

The same types of problems kids are presented with in this unit affect aid drops in real life. If package supplies are not properly protected, they can be damaged upon impact. If the people who need the supplies cannot easily find the aid drop packages, or are not certain that what is inside is safe and meant to help them, the supplies may go to waste.

Online Resources:

For links to online video resources about package engineering, visit:
www.mos.org/eie/engineeringadventures/package

Vocabulary

Engineer: Someone who uses his or her creativity and knowledge of math and science to design technologies that solve problems.

Engineering Design Process: The steps that engineers use to design something to solve a problem.

Package: A covering or container.

Packaging engineer: An engineer who designs packages for many different types of objects. Functions of the package often include containing, carrying, preserving, protecting, displaying, dispensing, and communicating information about what is inside.

Technology: Any thing designed by humans to help solve a problem.

Materials List

(This kit is prepared for 8 groups of 3 children)

Quantity	Item
Non-consumable Items	
1	Duo Audio CD or access to a computer
1	EDP Poster
1	stuffed animal toy, small, about 6” tall
8	dry erase markers, small
8	rulers
8	scissors
8	sheet protectors, clear
Consumable Items	
2	boxes of farfalle pasta*
2	string, rolls
8	cellophane tape rolls
16	small carboard boxes, about 4”x4”x2”
20	water balloons
20	flat marbles (or small stones or hex nuts)
30	craft foam sheets
30	cups, paper, about 3oz. size
30	plastic grocery bags
32	bags, sandwich size
40	twist ties, paper, 7”
100	coffee stirrers, 7” plastic
100	paper plates, 8” diameter
200	construction paper sheets
200	pipe cleaners
200	craft sticks
250	pompoms
800	index cards, 3”x5”
NOT INCLUDED IN KIT	
1	CD player
1	chart paper pad
1	clock/timepiece
8	bottles, clear, plastic, .5L or smaller will work
30	markers/crayons

*Please note, farfalle pasta is suggested because the EA team tested many varieties, and found this one showed damage best.

National Education Standards

		Prep Activity 2: What is Engineering? Tower Power	Prep Activity 1: What is Technology? Technology Detectives	Adventure 1: Aid Drops	Adventure 2: Incoming!	Adventure 2a: Packing an Aid Package	Adventure 3: Making it Clear	Adventure 4: Creating an Aid Drop Package	Adventure 5: Improving an Aid Drop Package	Adventure 6: Engineering Showcase: That's a Wrap!
National Science Education Standards	Science as Inquiry	✓		✓	✓			✓	✓	
	Physical Science				✓			✓	✓	
	Life Science					✓	✓			
	Earth and Space Science									
	Science and Technology	✓		✓	✓		✓	✓	✓	✓
	Science in Personal and Social Perspectives			✓		✓		✓	✓	
	History and Nature of Science									
ITEEA	The Nature of Technology		✓	✓				✓	✓	✓
	Technology and Society			✓		✓		✓	✓	✓
	Design	✓			✓		✓	✓	✓	✓
	Abilities for a Technological World	✓						✓	✓	✓
	The Designed World									

Dear Family, Date: _____

We are beginning an engineering unit called To the Rescue: Engineering Aid Drop Packages, which is part of the Engineering Adventures curriculum developed by the Museum of Science, Boston. Engineering Adventures is a curricular program that introduces children to engineering and the engineering design process. Throughout this unit, children will learn about package engineering and work to engineer aid packages. The unit is set in a real-world context: children will learn about the monsoon season in Thailand and the need for aid drops during the rainy season.

There are many reasons to introduce children to engineering:

- **Engineering projects reinforce topics children are learning in school.** Engaging students in hands-on, real-world engineering experiences can enliven math, science, and other content areas.
- **Engineering fosters problem-solving skills**, including problem formulation, creativity, planning, and testing of alternative solutions.
- **Children are fascinated with building and with taking things apart to see how they work.** By encouraging these explorations, we can keep these interests alive. Describing their activities as "engineering" when children are engaged in the natural design process can help them develop positive associations with engineering, and increase their desire to pursue such activities in the future.
- **Engineering and technological literacy are necessary for the 21st century.** As our society increasingly depends on engineering and technology, our citizens need to understand these fields.

Because engineering projects are hands-on, materials are often required. Several materials necessary to this unit are listed below. If you have any of these materials available, please consider donating them to us.

If you have expertise about package engineering or Thailand, or have any general questions or comments about the engineering and design unit we are about to begin, please let me know.

Sincerely,

If you have any of the following materials available and would like to donate them, I would greatly appreciate having them by the following date: _____ . Thank you!

_____ _____
_____ _____
_____ _____

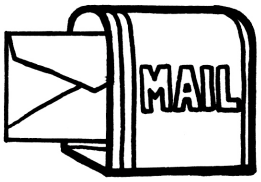
Prep Adventure 1 — Educator Page: Preview

What is Engineering? Tower Power

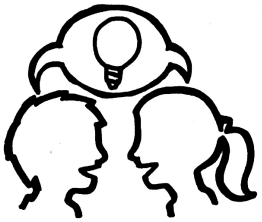
Overview: Kids will engineer an index card tower that will support a stuffed animal.

Note to Educator: Who are engineers? Engineers are people who use science, math, and creativity to solve problems. Today kids will be engineers as they use the Engineering Design Process to design towers.

Duo Update (5 min)

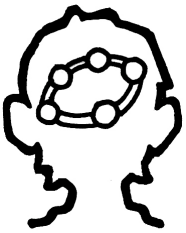


Set the Stage (10 min)



Activity (30 min)

Reflect (5 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 1 or Engineering Journal, p. 1
- ☐ EDP Poster
- ☐ *Heightened Emotions*, this guide, p. 7
- ☐ timer or clock
- ☐ 1 small stuffed animal

For each group of 3-5 kids:

- ☐ 1 pack of index cards (about 100 cards)
- ☐ 1 pair of scissors
- ☐ 1 ruler
- ☐ At least 1 foot of tape

For each kid:

- ☐ Engineering Journal

Preparation

Time Required: 10 minutes

1. Have the *Message from the Duo* ready to share.
2. Make samples of the cards found on *Building with Cards,* Engineering Journal p. 2.

Journal Pages for Prep Adventure 1

Message From the Duo, p. 1

Prep Adventure 1 **Message from the Duo**

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Engineering a Tower
to	You 10:36 AM

Hi everyone,

We're so excited to meet you! Our names are India and Jacob. We do a lot of traveling all over the world. We meet interesting people and see some amazing countries. Each place is unique, but we've found one thing in common. Everywhere we go in the world, we find problems that can be solved by engineers.

Engineers are problem solvers. They're people who design things that make our lives better, easier, and more fun! We heard you might be able to help us engineer solutions to some of the problems we find. That means you'll be engineers, too!

Today, we came across an engineering challenge we think you can help us solve. There are some animals living in a swamp along with lots of hungry alligators. The animals need to be at least 10 inches above the alligators to be out of their reach. India and I thought we could build a tall tower that the animals could stand on. Do you think you can engineer a tower to help?

We sent you one tool that we usually find really helpful when we're trying to engineer a solution to a problem. It's called the Engineering Design Process. Take a look at it and see if it can help you!

Good luck!
India and Jacob

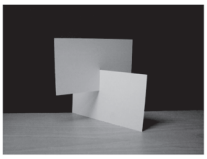
Building With Cards, p. 2

Prep Adventure 1 **Building With Cards**

Here are three ways to build with index cards.

Roll it!

Fold it!



Cut it!

Will any of these ideas help your group build a tower? What other ideas do you have?

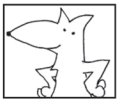
Talk with your group to figure it out!

Heightened Emotions, p. 3

Prep Adventure 1 **Heightened Emotions**

Fearless
8 inches and up

Confident
6-8 inches



Calm
4-6 inches

Nervous
2-4 inches

Terrified
0-2 inches

PANIC!

Think About It, p. 4

Prep Adventure 1 **Think About It**

Draw Your Tower
Use the space below to draw a picture of your tower.

What parts of your tower design would you change if you could do it again?

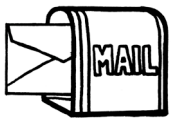
For the Record

I think engineering is:

- ☐ Fun
- ☐ Exciting
- ☐ Difficult
- ☐ _____

Prep Adventure 1 Educator Page: Adventure Guide
What is Engineering? Tower Power

Kids will learn:
- the Engineering Design Process is a tool they can use to help solve problems.



Present the Message From the Duo (5 min)

1. Tell kids that India and Jacob are a brother and sister who travel the world. They find problems and solve them using engineering.
2. Today, India and Jacob sent us a message about a problem they'd like us to solve. Have kids turn to Engineering Journal p. 1 for a message with more details (track 1).

Set the Stage (5 min)

1. Tell kids that today they are going be engineers and use the Engineering Design Process to solve India and Jacob's problem.
2. To check for understanding, ask:
   - **What do India and Jacob need us to engineer?** *A tower to lift the animal up 10 inches so it doesn't get eaten by alligators.*
3. Show groups the Engineering Design Process poster and tell them they are going to Ask questions about the problem, Imagine ways to solve it, Plan a design, Create and test it, and then think about ways to Improve it.

Imagine (5 min)

1. Tell kids it's time to look at the materials they can use and Imagine different ways to make them work.
2. Split kids in groups of 3-5 and give each group a pack of index cards, scissors, and tape. Ask:
   - **Can you Imagine any ways you could use these materials to engineer a tower?**
3. If your kids want to see examples, show them the index card samples you prepared, or have them look at *Building with Cards*, p. 2. Ask:
   - **Do you think any of these ideas might work well? Why?**

Plan and Create (at least 20 min)

1. Tell kids it is time to plan and create their towers.
2. Show the stuffed animal and explain that:
   - The challenge is to work in groups to engineer a tower that can hold the animal 10 inches in the air for at least 10 seconds.
   - Each group will have (at least) 20 minutes.
   - You can only use index cards and tape in the tower. The scissors are a tool only and cannot be used in the tower.

Tip: If you can, you may want to offer more time for this challenge.

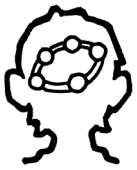
- You can hold the stuffed animal briefly, but you can't test it on your tower until the 20 minutes are up.

3. As groups work, circulate around the room. Ask questions like:
   - **Why do you think your design will work well?**
   - **Which step of the Engineering Design Process are you using right now? How do you know?**

Tip: You may choose to offer unlimited tape, or to challenge groups by limiting the tape to one or two feet.

Tower Showcase (10 min)

1. Have each group present their tower. Ask each group questions like:
   - **Can you tell me about your design?**
   - **Which steps of the Engineering Design Process did your group use?**
2. Use a ruler to measure the tower. Compare the measurement to the diagrams on *Heightened Emotions*. Give one kid the stuffed animal and have him or her place it on top of the tower. Count to 10 and observe what happens. Ask:
   - **What parts would you Improve if you could design your tower again? Why?**



Reflect (5 min)

1. Go through the Engineering Design Process poster with kids and have them talk about how they used each step to solve the problem. Ask questions like:
   - **How did you use this step of the Engineering Design Process to solve the problem?** *We Asked about the challenge; we Imagined ways to build with cards; we Planned when we decided what design to use; we Created and Improved when we built and fixed the tower.*
   - **Why do you think it's important to use these steps?** *It helps us keep track of our ideas and make sure we're meeting our goal.*
   - **Do you think you are an engineer?**
2. Tell kids that they've just used the same steps that engineers use to solve problems. This means that they are engineers, too! Tell kids they will have the opportunity to engineer solutions to even bigger problems with India and Jacob later on.
3. Give kids time to record their thoughts in their Engineering Journals on *Think About It,* p. 4.

What is Engineering? Tower Power

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Engineering a Tower
to	You
	10:36 AM

Hi everyone,

We're so excited to meet you! Our names are India and Jacob. We do a lot of traveling all over the world. We meet interesting people and see some amazing countries. Each place is unique, but we've found one thing in common. Everywhere we go in the world, we find problems that can be solved by engineers.

Engineers are problem solvers. They're people who design things that make our lives better, easier, and more fun! We heard you might be able to help us engineer solutions to some of the problems we find. That means you'll be engineers, too!

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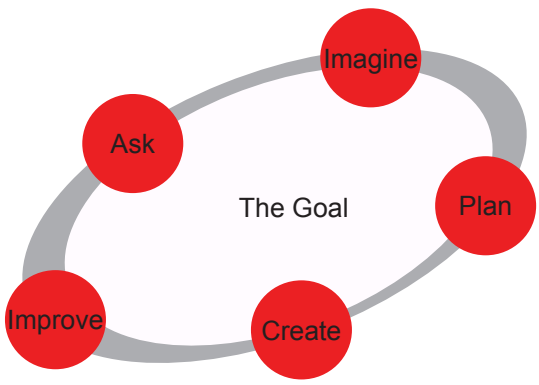
We sent you one tool that we usually find really helpful when we're trying to engineer a solution to a problem. It's called the Engineering Design Process. Take a look at it and see if it can help you!



Good luck!
India and Jacob

Heightened Emotions

Fearless
8 inches and up

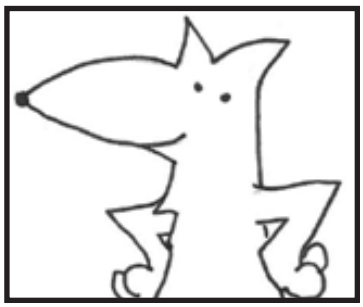
Confident
6-8 inches

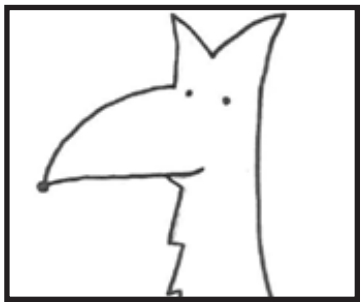
Calm
4-6 inches

Nervous
2-4 inches

Terrified
0-2 inches

PANIC!





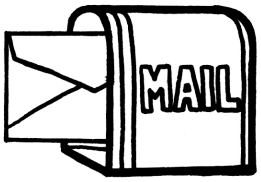
Prep Adventure 2 — Educator Page: Preview

What is Technology? Technology Detectives

Overview: Kids will examine some technologies and imagine ways to improve them.

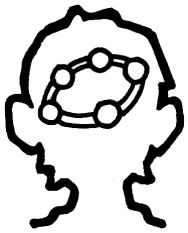
Note to Educator: Many people think of technologies as things that are only electronic or things that are "high-tech." Technology is actually anything designed by people to help solve a problem or meet a need.

Duo Update (5 min)



Activity (15 min)

Reflect (20 min)



Materials

For the whole group:

- ☐ *Message from the Duo*, track 2 or Engineering Journal, p. 5
- ☐ EDP Poster
- ☐ large sheet of paper or other writing space
- ☐ a small rock or leaf
- ☐ a cloth or bag large enough to cover all technologies

Technologies (choose 8):

- ☐ electronic device, like a cell phone or calculator
- ☐ water bottle
- ☐ roll of tape
- ☐ ruler
- ☐ construction paper
- ☐ stuffed animal
- ☐ hat
- ☐ scissors
- ☐ sweater
- ☐ dice
- ☐ juicebox
- ☐ bag
- ☐ hair clip
- ☐ button
- ☐ spoon
- ☐ key
- ☐ book
- ☐ stapler
- ☐ glue stick

For each kid:

- ☐ Engineering Journal

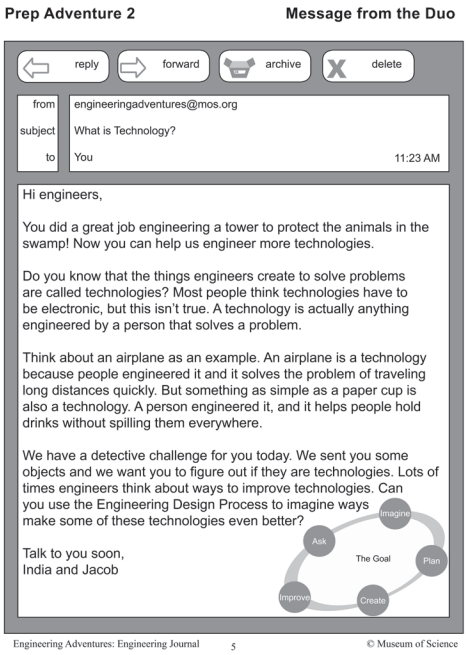
Preparation

Time Required: 10 minutes

1. Have the *Message from the Duo* ready to share.
2. Place the eight technologies (see above) on a table or floor and cover with a cloth or bag. Do not put the rock or leaf under the cover.
3. On a sheet of large paper, make the *Technology Detective Tool* chart as shown on the next page.

Journal Pages for Prep Adventure 2

Message From the Duo, p. 5



Prep Adventure 2 — Message from the Duo

reply | forward | archive | delete

from: engineeringadventures@mos.org
subject: What is Technology?
to: You — 11:23 AM

Hi engineers,

You did a great job engineering a tower to protect the animals in the swamp! Now you can help us engineer more technologies.

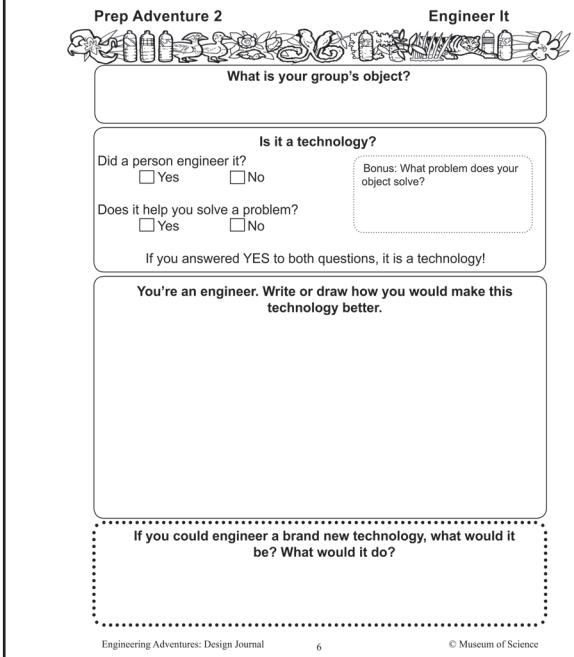
Do you know that the things engineers create to solve problems are called technologies? Most people think technologies have to be electronic, but this isn't true. A technology is actually anything engineered by a person that solves a problem.

Think about an airplane as an example. An airplane is a technology because people engineered it and it solves the problem of traveling long distances quickly. But something as simple as a paper cup is also a technology. A person engineered it, and it helps people hold drinks without spilling them everywhere.

We have a detective challenge for you today. We sent you some objects and we want you to figure out if they are technologies. Lots of times engineers think about ways to improve technologies. Can you use the Engineering Design Process to imagine ways make some of these technologies even better?

Talk to you soon,
India and Jacob

Engineer It, p. 6



Prep Adventure 2 — Engineer It

What is your group's object?

Is it a technology?

Did a person engineer it? ☐ Yes ☐ No

Does it help you solve a problem? ☐ Yes ☐ No

Bonus: What problem does your object solve?

If you answered YES to both questions, it is a technology!

You're an engineer. Write or draw how you would make this technology better.

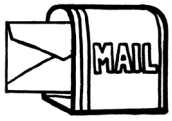
If you could engineer a brand new technology, what would it be? What would it do?

Chart for Prep Adventure 2

Technology Detective Tool
Did a person engineer it?
Does it help you solve a problem?
If you answered YES to both, it is a technology!

Prep Adventure 2 Educator Page: Adventure Guide
What is Technology? Technology Detectives

Kids will learn:
- technology is anything designed by people to help solve a problem or meet a need.
- engineers design and improve technologies.



Present the Message From the Duo (5 min)

1. Tell kids that India and Jacob sent them a message with more information about what engineers do. Have kids turn to p. 5 of their Engineering Journals to follow along and play track 2. To check for understanding, ask:
   - **India and Jacob said that a technology is anything designed by people to solve a problem. What are some technologies you can think of?** *Accept all answers at this point.*
2. Give the kids about 1 minute to name all the technologies they can think of. If kids are only naming electronics, remind kids that India and Jacob mentioned that things like paper cups are also technology.

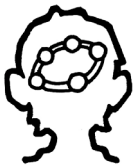
Tip: You may want to write down what the kids say is technology, so you can refer back to it at the end of the adventure.

Undercover Detectives (15 min)

1. Explain to kids that now they'll get the chance to think about more technologies—some that might surprise them.
2. Tell kids that under the cover on the table are some objects that might be technologies, or might not. They will use detective skills and teamwork to figure out which objects are technologies and what problems they solve.
3. Split kids into groups of 3-5.
4. Show them the *Technology Detective Tool* and explain they can use it to help figure out if the objects are technologies.
5. Pull the cloth and give groups a minute to decide what object they will take.
6. Have each group choose one object they would like to focus on in their groups.
7. Tell kids that they will now think like an engineer. They will use the *Technology Detective Tool* to decide whether their object is a technology. Then they will imagine ways to improve the object they chose.
8. Have kids open their Engineering Journals to *Engineer It,* p. 6. Give groups about 10 minutes to complete the first three boxes. If groups are struggling, ask:

Tip: If kids are having trouble understanding what it means to engineer something, let them know that words like invent, design, and improve have a similar meaning.The more you use the term engineer, the more comfortable they will become with it!

- **How can you make your technology more fun?**
- **How can you make your technology easier to use?**



Reflect (20 min)

1. Tell kids they are going to present their ideas about their technologies to their fellow detectives. Encourage them to use the *Technology Detective Tool* and *Engineer It* to help them present. Ask each group:
   - **What is your technology?**
   - **How do you know it is a technology?** *Refer to theTechnology Detective Tool.*
2. After all groups have presented, check for understanding about technology. Ask:
   - **Were all the objects you saw technologies? Why or why not?** *Yes, because people engineered them, and they help solve a problem.*
3. Tell kids you have one more object for them to think about. Show them the rock/leaf. Ask:
   - **Is this a technology? Why or why not?** *No, because a person did not engineer it.*
4. Tell kids that they engineered today by thinking about technologies that already exist and how to improve them. Engineers also think about brand new technologies that no one has thought of before!
5. Have kids think about the engineering they've already done. Ask:
   - **Why do you think the tower you made before was a technology?**
6. Tell kids that in this unit they will be working in groups to engineer technologies that will help solve a problem.
7. Give kids a few moments to complete the last box on *Engineer It.* Thinking about things they might engineer in the future will help kids see themselves as engineers.

Tip: A rock, leaf, or other natural objects on their own are not technologies. If people turn those objects into tools, however, they could become technologies! For example, using a rock to grind corn or making it into an arrow head makes the rock a technology.

Tip: If you have enough time, encourage kids to share their ideas with a partner.

What is Technology? Technology Detectives

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	What is technology?
to	You
	11:23 AM

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Talk to you soon,
India and Jacob

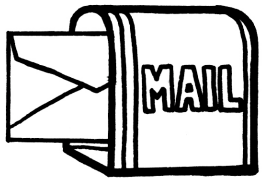
Adventure 1
Aid Drops

Educator Page: Preview

Overview: Kids will model how supplies are delivered to people who are isolated because of flooding or other natural disasters. They will then explore some materials that might help them engineer better aid drop packages.

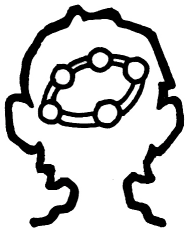
Note to Educator: Thailand is often affected by flooding from the annual monsoon rains. Aid drop packages have been used as a way to get supplies to stranded people in Thailand.

Duo Update (5 min)



Ask (30 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 3 or Engineering Journal p. 7
- ☐ EDP poster
- ☐ *Hard Casing Directions*, this guide p. 21
- ☐ *Soft Padding Directions*, this guide p. 23
- ☐ ruler or tape measure
- ☐ 2 rolls of tape
- ☐ 8 paper cups
- ☐ 8 sandwich bags
- ☐ 8 sheets of foam
- ☐ 8 small boxes
- ☐ 100 pom poms

For each group of 3-5 kids:

- ☐ 1 sandwich bag
- ☐ 1 twist tie
- ☐ 2 flat marbles
- ☐ 40+ pieces of farfalle pasta

For each kid:

- ☐ Engineering Journal

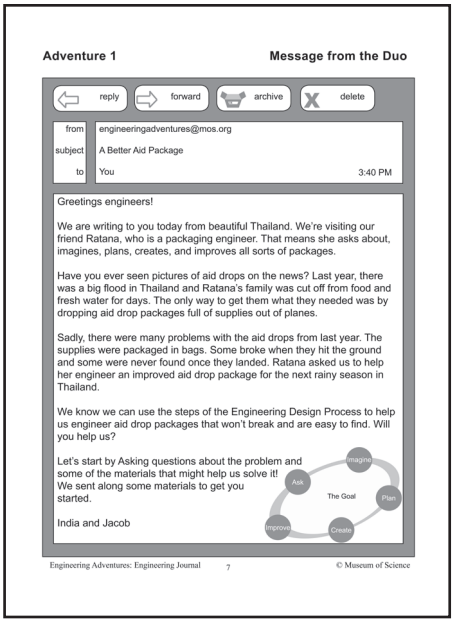
Preparation

Time Required: 15 minutes

1. Have the *Message from the Duo* ready to share.
2. Set up two stations with the following materials:
   - Hard Casing: boxes, cups, tape, *Hard Casing Directions*
   - Soft Padding: pom poms, foam, tape, sandwich bags, *Soft Padding Directions*
3. Place a tape mark 5 feet from the ground to mark the drop height at each station (note you could use a higher drop height if you think your kids would enjoy the additional challenge).
4. Make a *Results Chart* as shown on the next page.

Journal Pages for Adventure 1

Message From the Duo, p. 7 *World Map*, p. 8 *Damage Meter*, p. 9



Adventure 1 Message from the Duo

reply forward archive delete

from engineeringadventures@mos.org
subject A Better Aid Package
to You 3:40 PM

Greetings engineers!

We are writing to you today from beautiful Thailand. We're visiting our friend Ratana, who is a packaging engineer. That means she asks about, imagines, plans, creates, and improves all sorts of packages.

Have you ever seen pictures of aid drops on the news? Last year, there was a big flood in Thailand and Ratana's family was cut off from food and fresh water for days. The only way to get them what they needed was by dropping aid drop packages full of supplies out of planes.

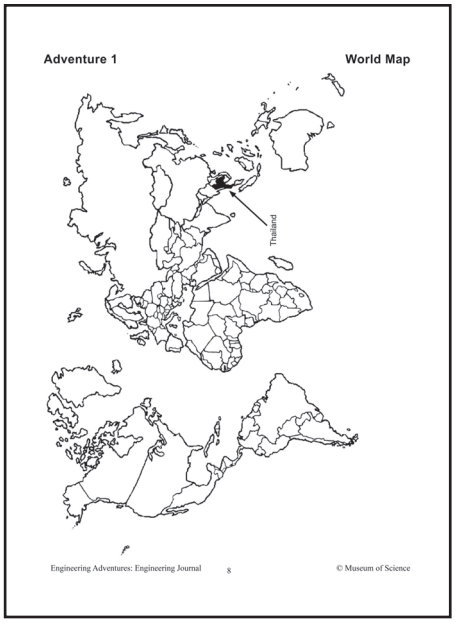
Sadly, there were many problems with the aid drops from last year. The supplies were packaged in bags. Some broke when they hit the ground and some were never found once they landed. Ratana asked us to help her engineer an improved aid drop package for the next rainy season in Thailand.

We know we can use the steps of the Engineering Design Process to help us engineer aid drop packages that won't break and are easy to find. Will you help us?

Let's start by Asking questions about the problem and some of the materials that might help us solve it! We sent along some materials to get you started.

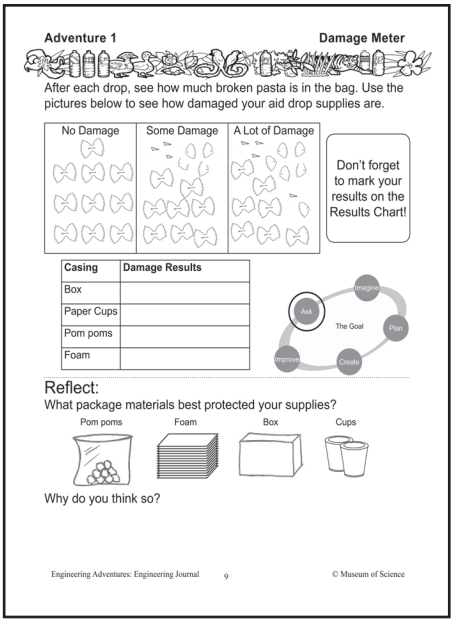
India and Jacob

Engineering Adventures: Engineering Journal 7 © Museum of Science



Adventure 1 World Map

Engineering Adventures: Engineering Journal 8 © Museum of Science



Adventure 1 Damage Meter

After each drop, see how much broken pasta is in the bag. Use the pictures below to see how damaged your aid drop supplies are.

No Damage | Some Damage | A Lot of Damage

Don't forget to mark your results on the Results Chart!

Casing	Damage Results
Box	
Paper Cups	
Pom poms	
Foam	

Reflect:
What package materials best protected your supplies?

Pom poms Foam Box Cups

Why do you think so?

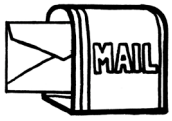
Engineering Adventures: Engineering Journal 9 © Museum of Science

Chart for Adventure 1

Results Chart			
	No Damage	Some Damage	A Lot of Damage
Hard Casing Box			
Paper Cups			
Soft Padding Pom poms			
Foam			

Adventure 1
Aid Drops

Kids will learn:
- when supplies are delivered by air, the supplies can become damaged.
- soft and hard packages might be used to help protect supplies.



Present the Message From the Duo (5 min)

1. Tell kids that India and Jacob need their help with an engineering problem they came across while in Thailand.
2. Have kids turn to Engineering Journal p. 7 and tell them you have a message with some more details. Play track 3.
3. To check for understanding, ask:
   - **What are India and Jacob asking you to do?** *Use the Engineering Design Process to engineer an aid drop package that will protect supplies.*
4. Have them look at the *World Map,* p. 8, so they can see where Thailand is located. Ask:
   - **What are some things you know about Thailand?** *Kids may or may not be familiar with Thailand. You may want to ask them to locate where they live in relation to Thailand.*

See It: If you have access to a computer, show exmaples of aid drops in Thailand. Visit eie.org/engineeringadventures/packagevideos.php for links.

Ask: Problems With Aid Drops (10 min)

1. Tell kids that they're going to model how aid packages are dropped. Ask:
   - **Do you remember the supplies in the aid package India and Jacob mentioned?** *Food and water.*
2. Separate kids into groups of 3 to 5. Pass out a sandwich bag, 10 pieces of pasta, 2 flat marbles, and a twist tie to each group. Have them put the pasta and marbles in the sandwich bag, and close it with a twist tie, being careful not to break any pasta.
2. Explain that the pasta and marbles are a model for the supplies being dropped. Since heavy and light things can be in one aid package, the pasta represents light items and marbles represent heavy items. Ask:
   - **What do you think will happen when we drop this model aid package?**
3. Have one group member go to the 5 foot drop height and drop the bag of pasta.
4. Each group should open the bag and look at the pieces of pasta. Ask:
   - **What happened to the supplies?** *The pasta broke into smaller pieces.*
5. Have kids look at the *Damage Meter,* p. 9, and decide how damaged their aid is. Ask:

- **How we might we be able to engineer a package to stop the supplies from being damaged?** *Encourage all ideas.*

6. Tell kids that now that they understand how supplies can get damaged during aid drops, they will start engineering a solution to this problem!

Ask: Hard and Soft Packages (20 min)

1. Tell kids Jacob and India have sent along a few materials to try.
2. Show kids one of the boxes and the pom poms. Ask:
   - **How do you think either of these materials could help protect our aid drop supplies?** *We could put the aid drop supplies inside the box, we could pad the aid drop supplies with the pom poms.*
3. Explain that kids will test multiple materials to see whether they help to protect the supplies.
4. Point out the hard casing station and the soft padding station. Tell kids there are testing directions at the stations.
5. After each test, kids should look at the *Damage Meter* and record their results by making a tally mark on the *Results Chart.* They should take out any broken pasta in between tests and make sure they have 10 complete pieces before moving on!
6. Have kids start testing. Encourage groups to test each material on its own first, and then if they have extra time at the end of the activity they can try combining materials.

Tip: Let groups know when half of their testing time is up so they can move to the next station.

Reflect (10 min)

1. Gather kids around the *Results Chart* and the Engineering Design Process poster to share what they found. Ask:
   - **How well did the hard casing protect our supplies?** *The supplies got damaged.*
   - **How well did the soft casing protect our supplies?** *If the pasta was surrounded it worked well, if the pasta fell to the bottom of the bag it still hit the floor and got damaged.*
   - **Do you have any ideas for ways to make these packages work better?** *Combine them! Some kids might also suggest adding parachutes or more/different kinds of padding.*
2. Have kids look at the Engineering Design Process poster. Ask:
   - **What step of the Engineering Design Process do you think you used today? How do you know?** *We used Ask because we asked questions about aid drops and how hard and soft packages work.*
3. Tell kids they'll get to explore more ways to protect the supplies in the next adventure.
4. Give kids time to complete the Reflect section of *Damage Meter*, p. 9. Taking time to record which materials worked best and why will help kids make informed decisions later on.

Message from the Duo

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	A Better Aid Package
to	You
	3:40 PM

Greetings engineers!

We are writing to you today from beautiful Thailand. We're visiting our friend Ratana, who is a packaging engineer. That means she asks about, imagines, plans, creates, and improves all sorts of packages.

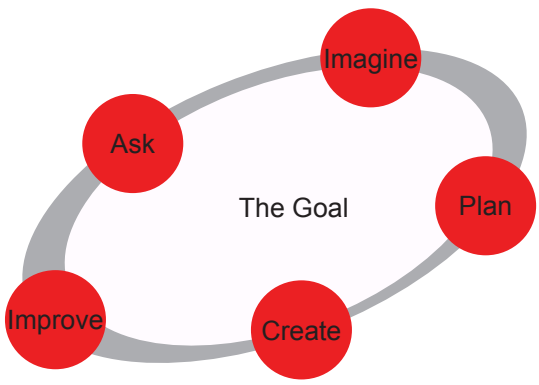
Have you ever seen pictures of aid drops on the news? Last year, there was a big flood in Thailand and Ratana's family was cut off from food and fresh water for days. The only way to get them what they needed was by dropping aid drop packages full of supplies out of planes.

Sadly, there were many problems with the aid drops from last year. The supplies were packaged in bags. Some broke when they hit the ground and some were never found once they landed. Ratana asked us to help her engineer an improved aid drop package for the next rainy season in Thailand.

We know we can use the steps of the Engineering Design Process to help us engineer aid drop packages that won't break and are easy to find. Will you help us?

Let's start by Asking questions about the problem and some of the materials that might help us solve it! We sent along some materials to get you started.

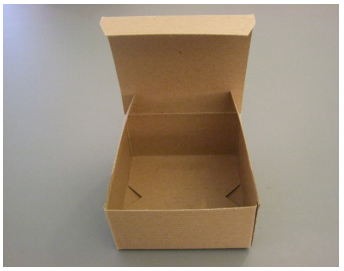
India and Jacob



Hard Casing Directions

Test 1:

1. Get a box.



2. Put your aid supplies (the bag with 10 pieces of pasta and 2 flat marbles) inside the box.

3. Close the box.

Test 2:

1. Put your aid supplies (the bag with 10 pieces of pasta and 2 flat marbles) inside a cup.

2. Place another cup on top, and tape them together with three small pieces of tape.

To test:

Make sure the ENTIRE package is over the 5 foot mark! Then drop the package.

How many broken pieces of pasta are there after you drop the bag?

Record results in your journal and on the Results Chart.

Soft Padding Directions

Test 1:

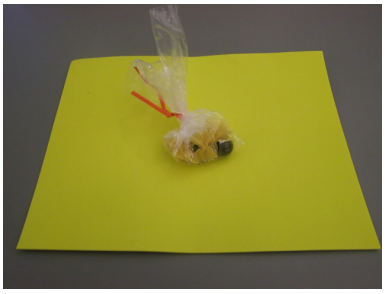
1. Fill a sandwich bag with 12 pom poms.

2. Put your aid supplies (the bag with 10 pieces of pasta and 2 flat marbles) on top of the pom poms.

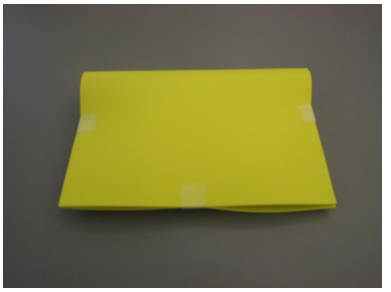
3. Fold the top bag over to hold everything inside.

Test 2:

1. Put your aid supplies (the bag with 10 pieces of pasta and 2 flat marbles) in the middle of a piece of foam.



2. Carefully fold the foam and tape each edge with a small piece of tape.



To test:

Make sure the ENTIRE package is over the 5 foot mark! Then drop the package.

How many broken pieces of pasta are there after you drop the bag?

Record the results in your journal and on the Results Chart.

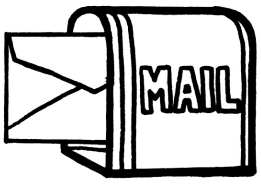
Adventure 2
Incoming!

Educator Page: Preview

Overview: Kids will perform test drops using materials that can be made into parachutes, canopies, or wings.

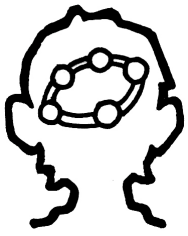
Note to Educator: Decide in advance how you'd like your group to move through the stations. Kids can start at different stations and then rotate through the remaining stations, or the whole group can complete each station at the same time.

Duo Update (5 min)



Ask (30 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 4 or Eng. Journal p. 10
- ☐ EDP poster
- ☐ *Direction Sheets*, this guide pp. 31-35
- ☐ 1 roll of string
- ☐ 1 roll of tape
- ☐ 3 pairs of scissors
- ☐ 3 rulers
- ☐ 10 plastic grocery bags
- ☐ 10 paper plates
- ☐ 10 sheets of construction paper
- ☐ 20 pipe cleaners

For each group of 3-5 kids:

- ☐ 1 sandwich bag
- ☐ 1 twist tie
- ☐ 2 flat marbles
- ☐ 30+ pieces of farfalle pasta

For each kid:

- ☐ Engineering Journal

Preparation

Time Required: 20 minutes

1. Have the *Message from the Duo* ready to share.
2. Create a *Results Chart* like the one shown on the next page.
3. Set up three stations with the following materials:
   - Parachutes: 10 plastic grocery bags, 10 pipe cleaners, *Directions*
   - Canopy: 10 paper plates, string, 3 rulers, tape, 3 pairs of scissors, *Directions*
   - Wings: 10 pieces of construction paper, 10 pipe cleaners, *Directions*
4. Place a tape mark at the 5 foot drop height at each station (note you could use a higher drop height if you think your kids would enjoy the additional challenge).

Journal Pages for Adventure 2

Message From the Duo, p. 10

Adventure 2 **Message from the Duo**

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Slowing It Down
to	You 9:20 AM

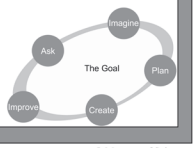
Hi everyone,

India and I have been visiting some parks while we're here in Thailand. There are some really colorful birds here. India had a great question while we were watching a giant hornbill fly by. What if we attached some wings to our aid drop packages? Maybe wings would help the packages slow down so they wouldn't hit the ground so hard. Then they wouldn't be as damaged.

Last time, we thought about ways to protect the supplies when they fell. India's idea about the wings got us Imagining ways to slow down the package so it won't hit the ground hard.

Do you think can engineer a few different ways to help us slow down our packages? Let us know what you find out!

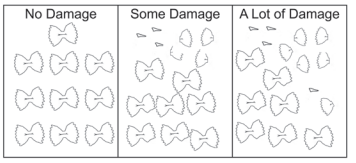
Jacob



Damage Meter, p. 11

Adventure 2 **Damage Meter**

After each drop, see how much broken pasta is in the bag. Use the pictures below to see how damaged your aid drop supplies are.



Don't forget to mark your results on the Results Chart!

Casing	Damage Results
Parachute	
Wings	
Canopy	

Reflect:
What package materials slowed down your package the most?

Why do you think so?

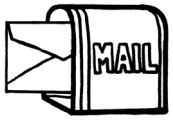
Chart for Adventure 2

Results Chart			
	No Damage	Some Damage	A Lot of Damage
Parachutes			
Wings			
Canopies			

Adventure 2
Incoming!

Educator Page: Adventure Guide

Kids will learn:
- parachutes, wings, or canopies can help slow down a package as it falls, protecting its supplies during an aid drop.



Present the Message From the Duo (5 min)

1. Tell kids that India and Jacob have been thinking about other ways to protect their their aid drop packages.
2. Have kids turn to p. 10 of their Engineering Journals and tell them Jacob sent a message with more details. Play track 4.
3. To check for understanding, ask:
   - **What does Jacob want us to do?** *Test some things like wings that catch air and might help slow down our aid drop packages as they fall.*

Ask: How Could We Use the Materials? (5 min)

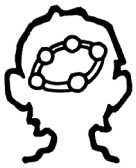
1. Tell kids that you're going to pass out some of the new materials India and Jacob sent along.
2. Show kids a plastic grocery bag, paper plate, construction paper, and string. Encourage kids to Imagine by asking:
   - **How could we use these materials to slow down our aid drop packages?** *Kids might suggest making some of the supplies into parachutes, or using them in different ways to create wings, paper airplanes, or canopies. For now, encourage all ideas.*
3. Give 10 pieces of pasta, 2 flat marbles, a twist tie, and a sandwich bag to each group. Tell kids that there are three stations where they can test how parachutes, canopies, and wings might help protect their aid drop packages.

Ask: Aid Drop Testing Stations (25 min)

1. Tell groups they will test the material at each station using the direction sheets to help them set up the test. After the test, they should check the *Damage Meter,* p. 11. and record their results on the *Results Chart*.
2. Have groups start testing.
3. If kids have extra time after testing at each of the stations, encourage them to try using the materials in different ways or combining materials to make bigger parachutes and canopies, or longer wings.
4. Let groups know when they have spent 5 minutes at a station so they can begin to wrap up their testing.

Tip: Remind kids to make sure they have 10 complete pieces of pasta before testing!

Tip: For an extra challenge, you could remove the *Directions* sheets from each station and let kids engineer their own wings, parachutes, or canopies.



Reflect (10 min)

1. Gather kids around the *Results Chart*. Ask the group:
   - **How well did the parachute work?**
   - **How well did the canopy work?**
   - **How well did the wings work?**
   - **What would you do to improve some of the things you tested today?**
     We could combine some of the things we tested, or add a casing or some padding around the supplies like we did during the last adventure.
2. Have kids look at the Engineering Design Process poster. Ask:
   - **What steps of the Engineering Design Process did you use today?**
     We used the Ask step because we asked questions about different ways to slow down the packages to protect them. We also used the Imagine step because we thought about how we could use these ideas in our own designs.
3. Give kids time to complete the Reflect section of *Damage Meter*, p. 11. Recording what they found will help support kids during the next adventure when they'll be able to alter and combine materials.

Message from the Duo

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Slowing It Down
to	You
	9:20 AM

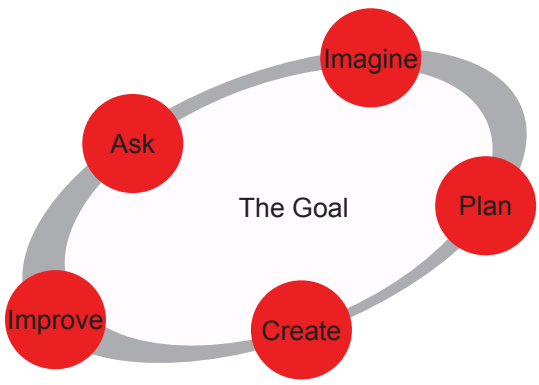
Hi everyone,

India and I have been visiting some parks while we're here in Thailand. There are some really colorful birds here. India had a great question while we were watching a giant hornbill fly by. What if we attached some wings to our aid drop packages? Maybe wings would help the packages slow down so they wouldn't hit the ground so hard. Then they wouldn't be as damaged.

Last time, we thought about ways to protect the supplies when they fell. India's idea about the wings got us Imagining ways to slow down the package so it won't hit the ground hard.

Do you think can engineer a few different ways to help us slow down our packages? Let us know what you find out!

Jacob



Parachute Directions

1. Put 10 pieces of pasta and 2 flat marbles in the sandwich bag. Close the bag with a twist tie.

2. Fluff open a plastic grocery bag and tie the handles with a pipe cleaner.

3. Wrap the rest of the pipe cleaner around the twist tie on the sandwich bag.

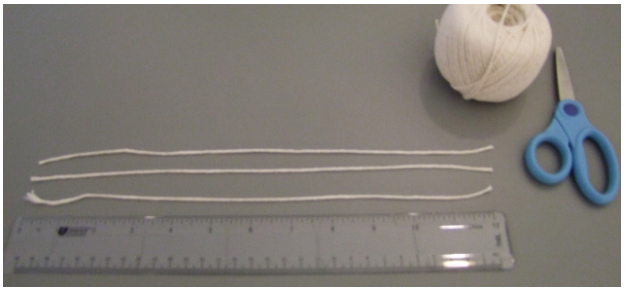
4. **Make sure the ENTIRE package is over the 5 foot mark! Then drop your package.**

5. **How many pieces of pasta are now in the sandwich bag?**

6. **Score the results in your journal and on the Results Chart using the Damage Meter.**

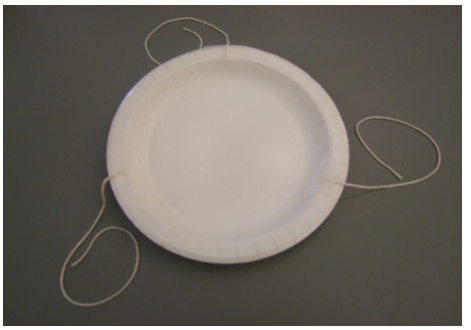
Canopy Directions

1. Put 10 full pieces of pasta and 2 flat marbles in the sandwich bag. Close the bag with a twist tie.



2. Cut three 12 inch pieces of string.

3. Tape each piece of string to the edge of a paper plate, equal distance from each other.



4. Tie the strings to the aid supplies bag by tightly wrapping a pipe cleaner around the strings and the twist tie. (You may want to tie the three strings together first.)

5. **Make sure the ENTIRE package is over the 5 foot mark! Then drop your package.**

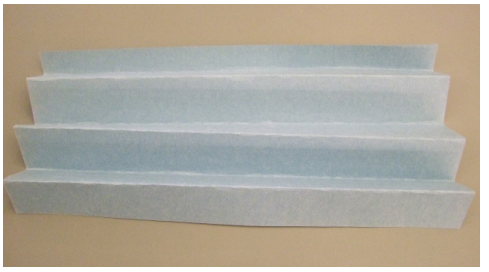
6. **How many pieces of pasta are now in the sandwich bag?**

7. **Score the results in your journal and on the Results Chart using the Damage Meter.**

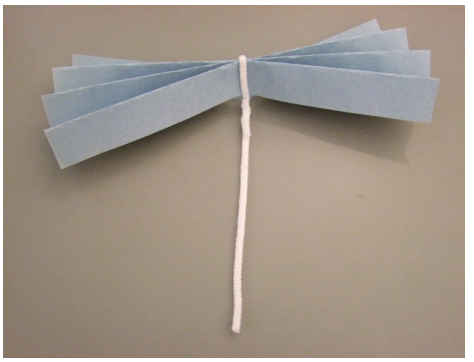
Wings Directions

1. Put 10 full pieces of pasta and 2 flat marbles in the sandwich bag. Close the bag with a twist tie.

2. Fold a piece of construction paper back and forth, accordian style, until the whole sheet is folded like a fan.



3. Wrap a pipe cleaner around the middle of the folded paper, and twist the end to hold it in place.



4. Wrap the rest of the pipe cleaner around the aid supplies bag close to the twist tie.

5. **Make sure the ENTIRE package is over the 5 foot mark! Then drop your package.**

6. **How many pieces of pasta are now in the sandwich bag?**

7. **Score the results in your journal and on the Results Chart using the Damage Meter.**

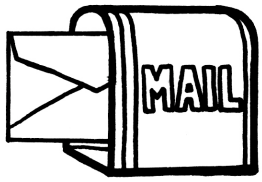
Adventure 2a (Optional) Packing an Aid Package

Educator Page: Preview

Overview: Kids will work together to decide what items they think are most important for human survival and how these items might be packed in an aid package.

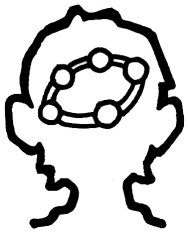
Note to Educator: When packing an aid drop package, it is important to select the most essential items and fit them into a limited amount of space.
Save the pamphlets your kids create so they can put them in the aid packages they engineer in Adventures 5 and 6!

Duo Update (5 min)



Ask (30 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 5 or Engineering Journal p. 12
- ☐ EDP poster
- ☐ 1 set of *Package Content Cards*, this guide, pp. 43-48
- ☐ *Master List of Package Content Cards*, this guide, p. 49

For each kid:

- ☐ Engineering Journal
- ☐ copy paper
- ☐ *Master List of Package Content Cards*, this guide, p. 49 (optional)

Preparation

Time Required: 10 minutes

1. Have the *Message from the Duo* ready to share.
2. Cut out the *Package Content Cards*.

Journal Pages for Adventure 2a

Message From the Duo, p. 12

Adventure 2a (Optional) **Message from the Duo**

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Packing an Aid Package
to	You 3:47 PM

Hello everyone!

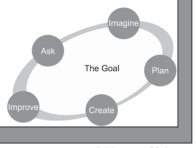
You've done a great job Asking questions about some of the materials you could use to engineer your package. Now we need to Ask about what supplies we are going to include in our aid drop packages.

Have you ever thought about the things you use every day? How many of those things do you absolutely need to have? Could you live without your basketball for a week? What about clean drinking water?

In a disaster, the people packing the aid drop packages have to choose the most important supplies to include. Since there are often lots of people who need to be helped, the packages have to be packed full of the supplies that people need most.

Can you use the Ask step of the Engineering Design Process to help us find out what supplies are most important? Then we will Imagine what we will pack into the aid drop packages we engineer.

India

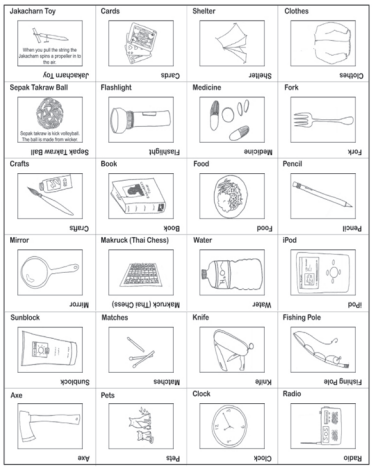


Engineering Adventures: Engineering Journal 12 © Museum of Science

My Aid Package, p. 13

Adventure 2a (Optional) **My Aid Package**

Circle the things you decided to include in your aid package.



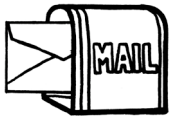
What do you think is the most important thing? Why?

Engineering Adventures: Engineering Journal 13 © Museum of Science

Adventure 2a (Optional) Packing an Aid Package

Educator Page: Preview

Kids will learn:
- aid drop packages usually contain supplies that people need to survive.



Present the Message From the Duo (5 min)

1. Tell kids that today, instead of thinking about the package they'll be engineering, India and Jacob would like them to think about the most important things to put inside the package.
2. Have them turn to Engineering Journal p. 12 and tell them India has sent them a message with some more details. Play track 5.
3. To check for understanding, ask:
   - **What is India asking you to do?** *Choose the most important items to go in our aid drop package.*

Ask and Imagine: Pack the Package (30 min)

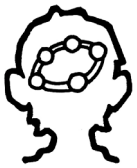
1. Explain that you're going to work together to decide on the most important things to pack in an aid drop package. Ask:
   - **If you were in a disaster, what are some items you think you couldn't live without?** *At this point, accept all answers. Kids will be able to revisit later.*
2. Pass out all 24 *Package Content Cards*, ensuring that everyone has at least one card. Have everyone read their card aloud to the group.

Tip: If you have a smaller group, you can have the group work together to arrange the cards on a table.

3. Explain that the space in aid drop packages is very limited. Only five things can fit in the package we're packing today. Ask:
   - **What items do you think are the most important? Why?** *Accept all responses, but guide kids to choose things they need everyday to survive.*
   - **What do you think we should take out?** *We should take out things that aren't the most important for survival.*
4. Give kids a few minutes to arrange themselves in a single line with items that are most important on one end and items that are least important on the other.
5. Instruct kids holding the five most important items to step forward. Ask the group:
   - **What supplies did you choose to put in your aid drop package?**
   - **Why did you choose these items?**
6. Tell kids they'll now create a pamphlet that records which items they chose.

They will put the sheet inside the final aid drop packages they will engineer. If you copied *Master List of Package Content Cards* for each kid, they can cut out the necessary cards and tape them onto their sheet.

Tip: Some of the items on the cards are unique to Thailand. If kids are interested, you might let them do some research to learn more about these toys and games.



Reflect (10 min)

1. Gather kids around the Engineering Design Process poster to share their thoughts. Ask:
   - **What item do you think was the most difficult to do away with?**
   - **What steps of the Engineering Design Process do you think you used today?** *We used Ask because we asked ourselves what supplies were the most important to put in the aid packages.*
2. Give kids time to complete their thoughts on *My Aid Package*, p. 13.

Tip: Let kids know that package engineers do need to think about what will be inside the package since what's inside can affect the criteria, or requirements, for the package they are engineering.

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Packing an Aid Package
to	You
	3:47 PM

Hello everyone!

You've done a great job Asking questions about some of the materials you could use to engineer your package. Now we need to Ask about what supplies we are going to include in our aid drop packages.

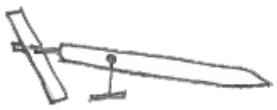
Have you ever thought about the things you use every day? How many of those things do you absolutely need to have? Could you live without your basketball for a week? What about clean drinking water?

In a disaster, the people packing the aid drop packages have to choose the most important supplies to include. Since there are often lots of people who need to be helped, the packages have to be packed full of the supplies that people need most.

Can you use the Ask step of the Engineering Design Process to help us find out what supplies are most important? Then we will Imagine what we will pack into the aid drop packages we engineer.

India

Jakacharn Toy



When you pull the string the Jakacharn spins a propeller in to the air.

Jakacharn Toy

Cards

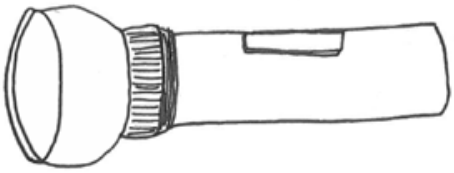
Cards

Sepak Takraw Ball

Sepak takraw is kick volleyball. The ball is made from wicker.

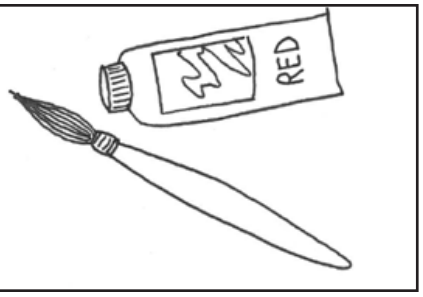
Sepak Takraw Ball

Flashlight



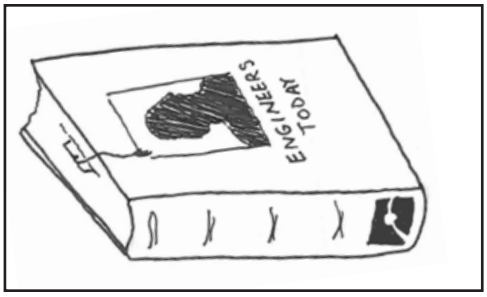
Flashlight

Crafts



Crafts

Book



Book

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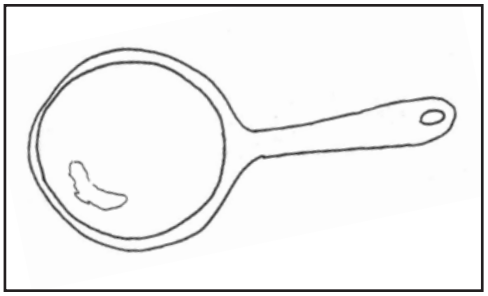
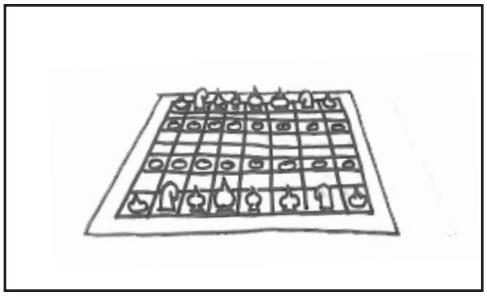
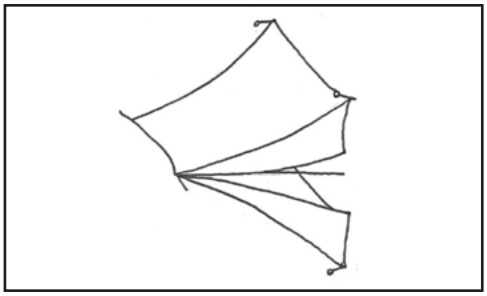
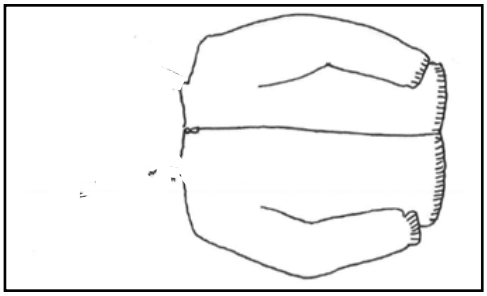
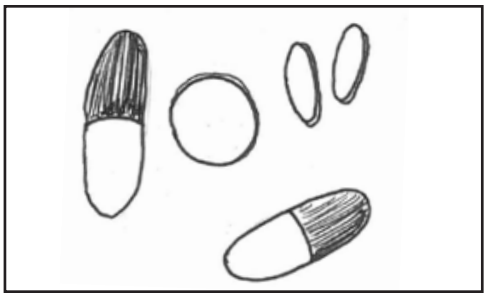
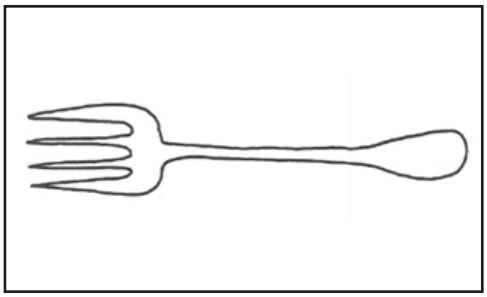
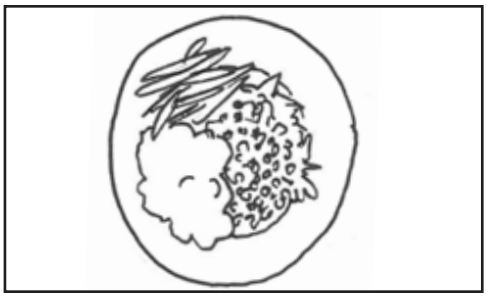
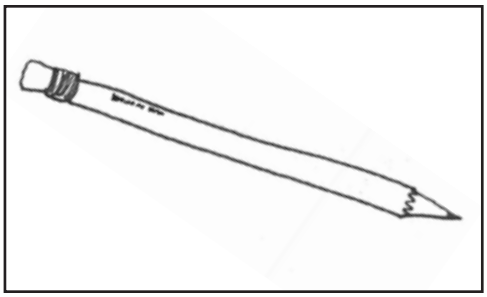
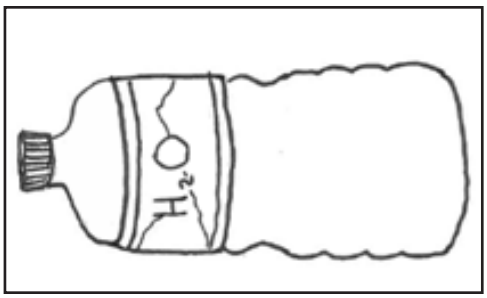
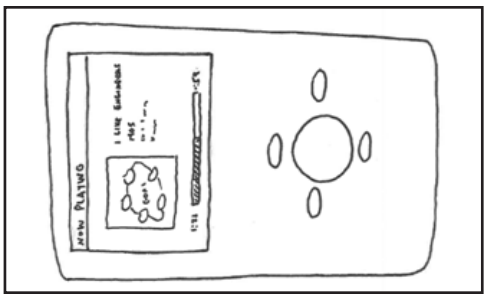


Mirror

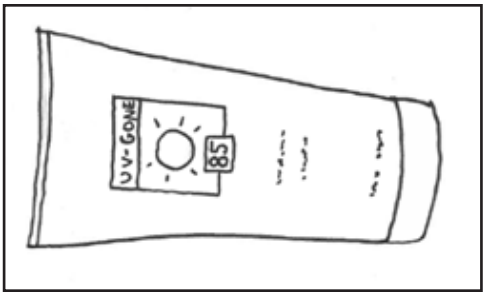
Makruck (Thai Chess)



Makruck (Thai Chess)

Shelter  Shelter	**Clothes**  Clothes
Medicine  Medicine	**Fork**  Fork
Food  Food	**Pencil**  Pencil
Water  Water	**iPod**  iPod

Sunblock



Sunblock

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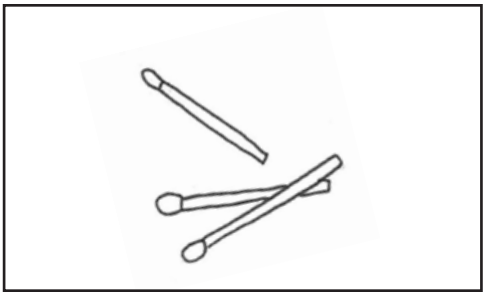
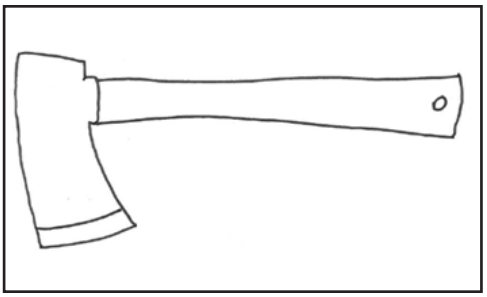


Matches

Axe



Axe

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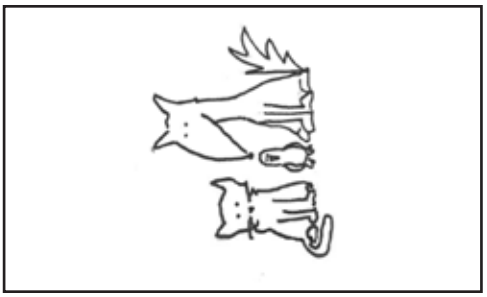

Pets

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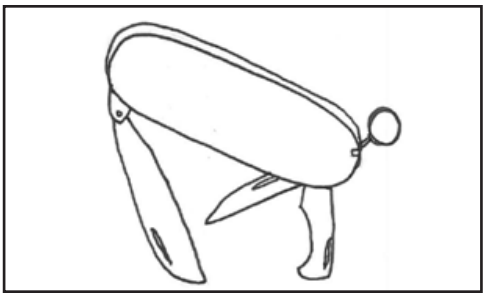
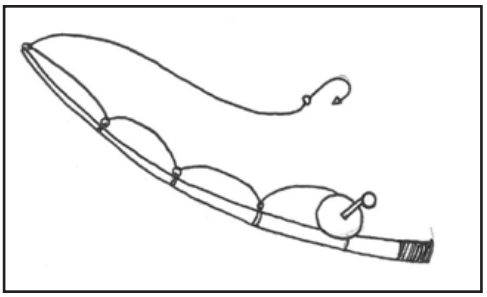


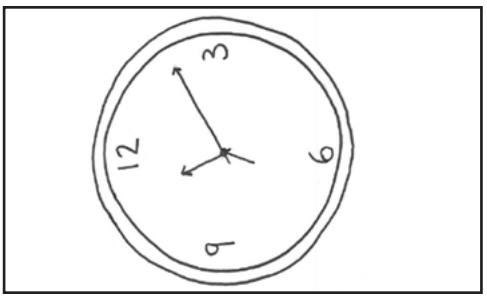
Knife

Fishing Pole



Fishing Pole

Clock



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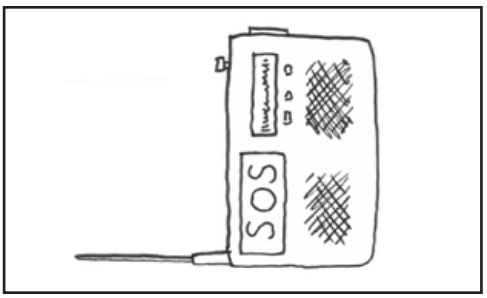
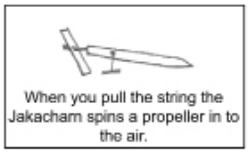
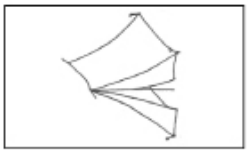
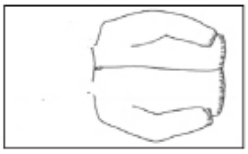
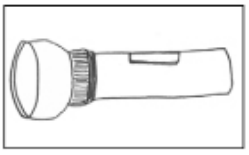
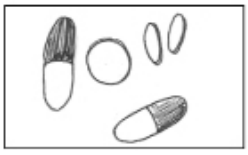
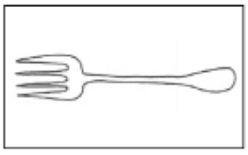
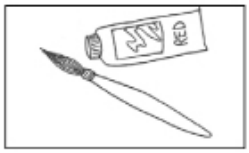
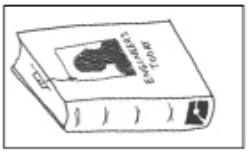
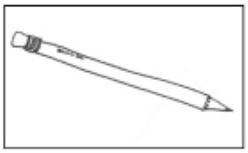
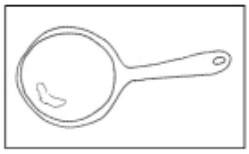
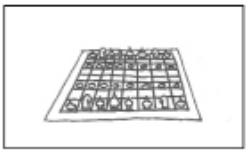
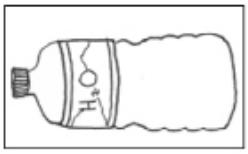
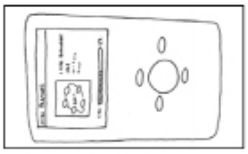
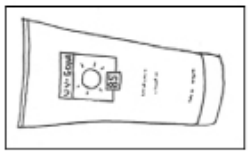
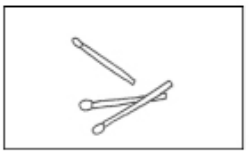
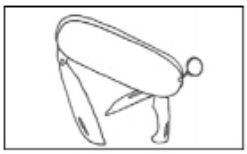
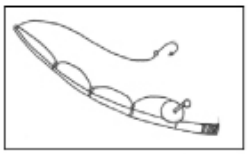
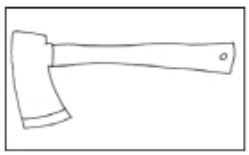
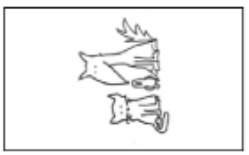
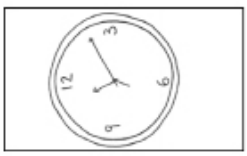
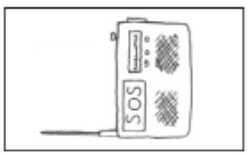


Packing an Aid Package

Jakacharn Toy  When you pull the string the Jakacham spins a propeller in to the air.	**Cards** 	**Shelter** 	**Clothes** 
Sepak Takraw Ball  Sepak takraw is kick volleyball. The ball is made from wicker.	**Flashlight** 	**Medicine** 	**Fork** 
Crafts 	**Book** 	**Food** 	**Pencil** 
Mirror 	**Makruck (Thai Chess)** 	**Water** 	**iPod** 
Sunblock 	**Matches** 	**Knife** 	**Fishing Pole** 
Axe 	**Pets** 	**Clock** 	**Radio** 

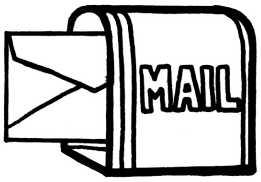
Adventure 3
Display: Making it Clear

Educator Page: Preview

Overview: Kids will design a label for a package so the package communicates what is inside and can be clearly seen when it is in a specific environment.

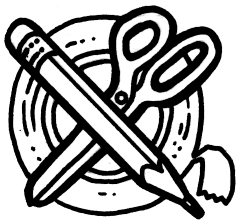
Note to Educator: Aid drop packages are often dropped in large, open areas. It is important for engineers to design packages so they are visible (this is the display function of a package) and let users know what is inside (the communicate function). **Before this activity, either collect or ask kids to bring in clean, clear plastic water bottles (1 liter or smaller). Also note that the Environment Pages, pp. 75-79 of this guide, will be used in the following adventures. Be sure to save them!**

Duo Update (5 min)

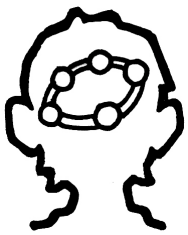


Ask (5 min)

Activity (20 min)



Reflect (15 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 6 or Engineering Journal p. 14
- ☐ EDP poster
- ☐ *Answer Key* p. 73
- ☐ 25 sheets of construction paper
- ☐ markers or crayons
- ☐ tape
- ☐ optional: other craft supplies

For each group of 3-5 kids:

- ☐ *Can You Find It?* this guide p. 57-71 (color copies)
- ☐ *Environment Page* of their choice, this guide pp. 75-79
- ☐ 1 plastic sleeve (8.5” x 11”)
- ☐ 1 dry erase marker
- ☐ 1 clean, clear plastic bottle (1 liter or smaller)
- ☐ scissors

For each kid:

- ☐ Engineering Journal

Preparation

Time Required: 10 minutes

1. Have the *Message from the Duo* ready to share.
2. Slide *Can You Find It?* pages into plastic sleeves.
3. Prepare one clear plastic bottle for each group by removing all labels.

Journal Pages for Adventure 3

Message From the Duo, p. 14

Adventure 3 **Message from the Duo**

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Making our packages pop!
to	You 11:46 AM

Hi everyone,

Ratana says we're doing a great job using the Engineering Design Process to help us engineer aid drop packages. She suggested Jacob and I think about what the outside of our aid drop package will look like. Ratana says we should make it easy for people to see the packages once they've landed. Sometimes the packages land in the middle of a forest, or a big field, so it's important that they're easy to spot. When it lands we also want to make sure it is easy to tell what is inside the package. This will help people organize what supplies are dropped. If there is medicine in the package, we want to make sure it quickly goes to the right person!

We think the Engineering Design Process can help us with this, just like it helped us think about how to protect what's inside the package.

First, Jacob and I thought of a fun way to Ask some questions about what colors and patterns stand out in a certain place, and why. We sent it to you, so you can try it out! Then we can create our own label. Don't forget to communicate what's inside the package!

India

Create Page, p. 15

Adventure 3 **Create Page**

Directions: Plan what your label will look like, and then create it. Place the bottle in front of the Environment Sheet your group chose and answer the questions below.

1. Circle the environment you chose:


Forest


Beach


Field

2. How clearly can you see your package? Mark it on the line.

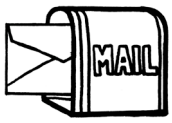
5 4 3 2 1
Very Clearly Not Clearly

3. How easy is it to tell what is inside? Mark it on the line.

5 4 3 2 1
Very Clearly Not Clearly

Adventure 3 Educator Page: Adventure Guide
Display: Making it Clear

Kids will learn:
- the colors of a package can cause it to stand out or blend into certain environments.
- packaging engineers need to think about how to let people know what is inside the package.



Present the Message From the Duo (5 min)

1. Tell kids that today they will be asked to think about the outside of their package and how to engineer an aid package that is easy to see and communicates information to people.
2. Have kids turn to Engineering Journal p. 14 and tell them India has sent a message with more details. Play track 6.
3. To check for understanding, ask:
   - **What does India want us to do?** *Create a label that tells people what is inside the package and makes the package easy to see.*

Ask and Imagine: What Do You See? (5 min)

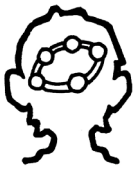
1. Tell kids they're first going to play the game that India mentioned to help them think about what colors they might want to use on the outside of their packages.
2. Split kids into groups of 3 to 5.
3. Give each group a *Can You Find It?* page and have them keep it face down.
4. Explain that they have 30 seconds to locate as many animals, fruits, and flowers on the page as they can.
5. Call "start" and have kids use dry erase markers to circle what they find.
6. After 30 seconds, call "stop" and post the *Answer Key*.
7. Have kids share what they found. Ask:
   - **What animals, fruits, and flowers did you find?**
   - **Are there any things shown in the *Answer Key* that you did not find?**
   - **What colors were the things that were easy to see?** *Bright colors, or colors different from the background.*
   - **Which things in this picture give you ideas for how to make your aid drop packages easy to see?** *The brighter ones, because we want our packages to be seen.*

Plan and Create: Engineer a Label (20 min)

1. Explain that kids will now get to use the ideas from the *Can You Find It?* game as they design their own label for a bottle of water.
2. The label needs to be visible in front of a particular *Environment Page,* and communicate clearly that there is water inside. Kids can use words, symbols, or pictures to communicate what is inside the bottle. Remind kids

that someone who does not understand the language they write in may find the package, and pictures are a language many people can understand.

3. Have each group choose one *Environment Page* and select their materials. As groups are working, ask:
   - **How are you going to design your label so it is easy to see?** *Encourage kids to think about colors different from those in their Environment Page background.*
   - **How will you tell people what is inside?**



Reflect (15 min)

1. Have groups place their labeled bottles in front of the *Environment Pages* they chose. Ask:
   - **Which packages are easy to see? Why do you think so?** *Packages with colors that stand out against the background are easiest to see.*
   - **Which packages have labels that tell you what is inside?**
2. Gather everyone around the Engineering Design Process Poster. Ask:
   - **Which steps of the Engineering Design Process did your group use?** *All of them! Ask when we asked about what things in nature are easy to see; Imagine and Plan when we thought about how to design our label; Create and Improve when we made and fixed our labels.*
   - **Do you think your label is a technology? Why?** *Yes! It solves the problem of making our bottle easy to see and communicating what is inside.*
3. Give kids time to complete the *Create Page*, p. 15. Recording how well their package communicated what was inside and how easy it was to see will support kids as they engineer their aid drop package in the next adventure.

Extension

Conduct the "What Do You See?" portion of this activity outside. Scatter colorful pom-poms (or other items you have handy, such as plastic eggs) in a grassy area. Scatter the same number of each color, being sure to include colors that might blend in with the grass. You may want to keep note of where you place everything! When kids arrive, tell them they will have 30 seconds to gather as many pom-poms as they can. Call "start" and let kids search for 30 seconds. Call "stop" and have kids count how many of each color they found. Ask:

- **Which color did you find first? How many of those did you find?**

Tally results. Kids probably found more of the colors that stood out in the grass than of the colors that blended in. Tell kids that you actually hid the same number of each! Ask:

- **Which colors were hardest to find? Why do you think so?** *The green ones blended into the grass. The other colors were really bight and easier to see.*
- **Do you think this give us any information about the colors we might want to use for our aid-drop packages?** *We should use colors that are bright and do not blend into the area where the package is being dropped.*

Before going inside, collect any items that are left in the grass.

Display: Making it Clear

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Making our packages pop!
to	You
	11:46 AM

Hi everyone,

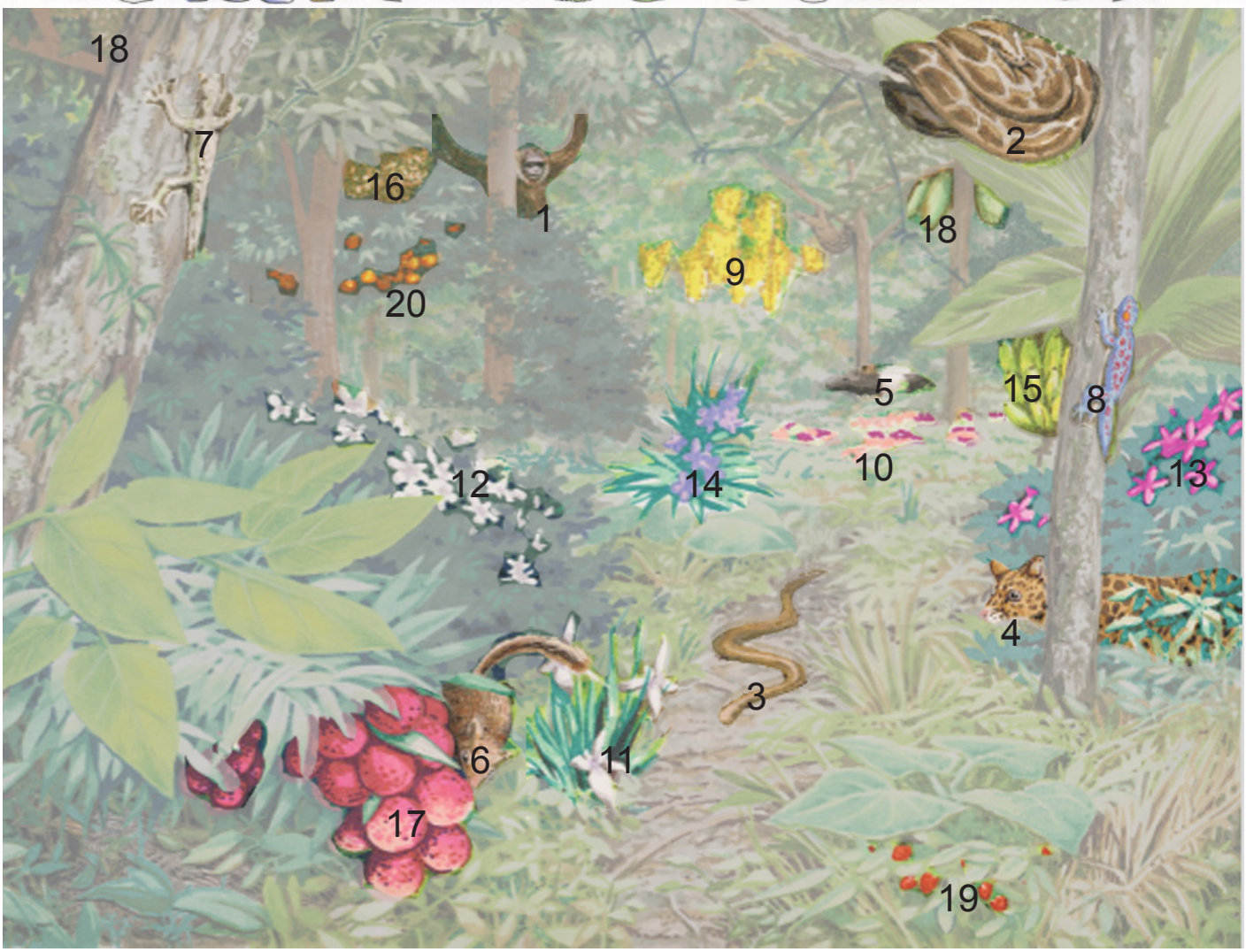
Ratana says we're doing a great job using the Engineering Design Process to help us engineer aid drop packages. She suggested Jacob and I think about what the outside of our aid drop package will look like. Ratana says we should make it easy for people to see the packages once they've landed. Sometimes the packages land in the middle of a forest, or a big field, so it's important that they're easy to spot. When it lands we also want to make sure it is easy to tell what is inside the package. This will help people organize what supplies are dropped. If there is medicine in the package, we want to make sure it quickly goes to the right person!

We think the Engineering Design Process can help us with this, just like it helped us think about how to protect what's inside the package.

First, Jacob and I thought of a fun way to Ask some questions about what colors and patterns stand out in a certain place, and why. We sent it to you, so you can try it out! Then we can create our own label. Don't forget to communicate what's inside the package!

India

Display: Making it Clear



Animals

1. Agile Gibbon
2. Burmese Python
3. King Cobra
4. Leopard Cat
5. Tapir
6. Tree Shrew
7. Tree Dragon
8. Tokay Gecko

Flowers

9. Cassia Fistula
10. Cosmos
11. Orchids
12. Gardenia
13. Plumeria
14. Vanda

Fruits

15. Banana
16. Durian
17. Lychee
18. Papaya
19. Strawberry
20. Tangerine

Environment Page: Forest

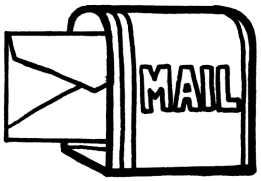
Adventure 4
Creating an Aid Drop Package

Educator Page: Preview

Overview: Kids will use what they have learned about package engineering to engineer an aid drop package that protects its supplies, communicates to the user what's inside, and is easily seen in its environment.

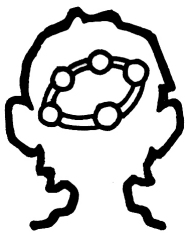
Note to Educator: Your role during this adventure is to encourage group communication, and push kids to be as creative as possible in engineering their packages. Remind them of the three functions of their packages: to protect the aid supplies, communicate what is inside, and be visible to the users.
Be sure to save the packages kids engineer in this activity for Adventures 5 and 6!

Duo Update (5 min)



Activity (30 min)

Reflect (10 min)



Materials

For the entire group:
- ☐ *Message from the Duo*, track 7 or Engineering Journal p. 16
- ☐ EDP poster
- ☐ *Environment Pages*, this guide, pp. 75-79

Materials Store
- ☐ 1 roll of string
- ☐ ruler or tape measure
- ☐ 16 small cardboard boxes
- ☐ 20 sheets of felt
- ☐ 20 cups, 3-5 oz. size
- ☐ 30 foam sheets
- ☐ 30 plastic grocery bags
- ☐ 50 construction paper sheets
- ☐ 50 paper plates
- ☐ 50 coffee stirrers
- ☐ 100 pipe cleaners
- ☐ 100 craft sticks
- ☐ 250 pom-poms

For each group of 3-5 kids:
- ☐ 1 sandwich bag
- ☐ scissors
- ☐ tape
- ☐ 1 twist tie
- ☐ 2 flat marbles
- ☐ 10+ pieces of farfalle pasta
- ☐ Optional: Aid Package sheets from 2a

For each kid:
- ☐ Engineering Journal

Preparation

Time Required: 10 minutes

1. Have the *Message from the Duo* ready to share.
2. Set up a Materials Store with all of the materials kids will have available for engineering their packages.
3. Place a tape mark at the 5 foot drop height for testing (note you could use a higher drop height if you think your kids would enjoy the additional challenge).
4. If your kids completed Adventure 2a, be sure to have the Aid Package pamphlets they created available.

Journal Pages for Adventure 4

Message From the Duo, p. 16

Adventure 4 **Message from the Duo**

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Creating an aid drop package
to	You 10:39 AM

Hi everyone,

Congratulations! You've done a great job Asking questions and Imagining the best ways to engineer packages for an aid drop. Now it's time to put it all together using the Engineering Design Process. Let's use the Plan, Create, and Improve steps to engineer a technology that will protect supplies dropped from an airplane.

Remember that these packages will be dropped from high above the ground. The package has to protect the supplies inside so they won't get damaged when the package lands.

It's also really important that the package is easy to see and lets people know what is inside! If the package is hard to see, people might not be able to find it. And once they do find it, you want them to be able to understand what's inside.

India and I are leaving Thailand soon, but we really want to show Ratana the technologies you engineered before we go.

Jacob

Engineering Adventures: Engineering Journal 16 © Museum of Science

Score Page, p. 17

Adventure 4 **Score Page**

Remember!
Take out any broken pieces of pasta and make sure there are 10 unbroken pieces before retesting!

Protect Score: Circle how much damage you saw after dropping your aid drop package.

No Damage +6 points	Some Damage +3 points	A Lot of Damage +0 points

Display Score
Place your package in front of the Environment Page you chose.

Is your package easy to see?

No — Yes

0 points 1 2 3 4 points

Communicate Score
Does your package communicate what is inside?

No — Yes

0 points 1 2 3 4 points

_____ + _____ + _____ = _____

Protect + Display + Communicate = Total Score

Engineering Adventures: Engineering Journal 17 © Museum of Science

Improve Page, p. 18

Adventure 4 **Improve Page**

Your package needs to **protect** *the supplies,* **communicate** *what is inside, and be* **easy to see.**

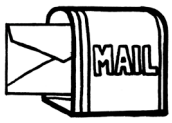
Draw your design here. Circle the parts you would like to improve.

What materials will you need to make these improvements?

Engineering Adventures: Engineering Journal 18 © Museum of Science

Adventure 4 Educator Page: Adventure Guide
Creating an Aid Drop Package

Kids will learn:
- the Engineering Design Process can help guide them to a successful solution.
- designs don't always work the first time; kids can learn from their failures.



Present the Message From the Duo (5 min)

1. Tell kids that they Asked great questions about package design and have already started Imagining what type of aid drop package they might engineer. Now they're ready to Plan and Create!
2. Have them turn to p. 16 of their Engineering Journals. Tell them Jacob has sent them a message with more details. Play track 7.
3. To check for understanding, ask:
   - **Which steps of the Engineering Design Process will help us engineer a technology to protect supplies?** *All of them! Especially Plan, Create, and Improve.*
   - **What three things does our aid drop package need to do?** *Protect the supplies inside from getting damaged, be easy to see, and communicate what's inside.*
4. Post the three goals for the aid drop packages so groups can refer back to them throughout the adventure.

See It!: For links to online video resources about aid drops, visit: www.mos.org/eie/engineeringadventures/packages

Plan Your Package (10 min)

1. Remind kids the pasta and marbles in the bag are a model for the supplies they're sending.
2. Hold up the *Environment Pages*. Each group needs to engineer their package so that it is easy to see while in front of an *Environment Page* of their choice.
3. Show kids the materials at the Materials Store. Point out the new materials in the store that kids have not tested yet. Tell kids that they may want to take a few minutes to test with these materials to figure out how they might be useful in their aid drop package designs.
4. Once each group has spent a few minutes discussing a plan, they can collect their materials.

Tip: If your kids completed Adv. 2a, have them put the pamphlet they made showing the 5 items they would pack inside their aid pacakges.

Tip: Make multiple testing stations with marks on the wall so all groups can test at the same time. Consider making the drop height higher than 5 feet for a bigger challenge.

Create! (20 min)

1. Remind kids that they will test to see if their supplies are damaged after a drop by taking the pasta out of the bag after each drop and assessing pieces. They will evaluate the damage using the Damage Meter on their *Score Page,* p. 17. Make sure kids remember to have 10 full pieces of pasta in their bags before each drop.
2. As groups create, encourage them to test their designs by holding them at the 5 foot mark and dropping them. Make sure kids pull out any broken pieces of pasta, and start with 10 complete pieces before they retest. Groups will also test for display by seeing how well their package stands out from the *Environment Page* they chose, and communicate by noting whether the package tells people what is inside.
3. Groups should record results of their group's best test on their *Score Page.*
4. While groups create and test, ask questions like:
   - **How will your package protect the aid inside?**
   - **What makes your package easy to see?**
   - **What parts of your design are working well?**
   - **How will you improve your design?**
5. As groups work, use the Engineering Design Process Poster to guide conversations and encourage students to use the names for the steps to describe what they are doing.

Tip: Remind kids to make sure they have 10 unbroken pieces of pasta before testing!

Reflect (10 min)

1. Collect each group's package design to save for Adventures 5 and 6.
2. Ask the group:
   - **What materials are working the best for your package design? Why do you think so?**
3. Review the Engineering Design Process poster. Ask:
   - **What steps of the Engineering Design Process are you using to help you engineer?** *Accept all responses, but guide kids to focus on Imagine, Plan, and Create.*
   - **What about your design would you like to Improve next time?**
4. Give kids time to record thoughts in their Engineering Journals on *Improve Page*, p. 18. Having kids record their their improvement ideas will help them be ready to redesign and implement these ideas in the next adventure.

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Creating an aid drop package
to	You
	10:39 AM

Hi everyone,

Congratulations! You've done a great job Asking questions and Imagining the best ways to engineer packages for an aid drop. Now it's time to put it all together using the Engineering Design Process. Let's use the Plan, Create, and Improve steps to engineer a technology that will protect supplies dropped from an airplane.

Remember that these packages will be dropped from high above the ground. The package has to protect the supplies inside so they won't get damaged when the package lands.

It's also really important that the package is easy to see and lets people know what is inside! If the package is hard to see, people might not be able to find it. And once they do find it, you want them to be able to understand what's inside.

India and I are leaving Thailand soon, but we really want to show Ratana the technologies you engineered before we go.

Jacob

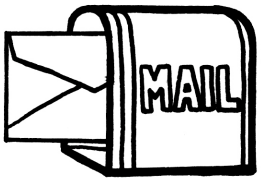
Adventure 5 Improving an Aid Drop Package

Educator Page: Preview

Overview: Kids will improve their aid drop packages and decide if they want to test with a water balloon in their final aid package in the Engineering Showcase. Kids will also write a letter to the Duo outlining their final aid drop package designs.

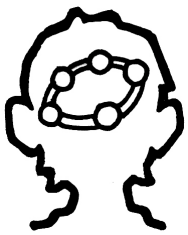
Note to Educator: Your role during this adventure is to help groups finalize their package designs. As mentioned above, groups will have the chance to test with a water balloon during the next Adventure. They will have to account for the added space. Have kids ball up a piece of paper or use a small stuffed toy to account for the water balloon size. **Be sure to save the packages kids engineer for Adventure 6!**

Duo Update (5 min)



Activity (30 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 8 or Engineering Journal p. 19
- ☐ EDP poster
- ☐ *Environment Pages*, this guide, pp. 75-79

Materials Store (remaining materials from Adv. 4):

- ☐ 1 roll of string
- ☐ ruler or tape measure
- ☐ 16 small cardboard boxes
- ☐ 20 sheets of felt
- ☐ 20 cups, 3-5 oz. size
- ☐ 30 foam sheets
- ☐ 30 plastic grocery bags
- ☐ 50 construction paper sheets
- ☐ 50 paper plates
- ☐ 50 coffee stirrers
- ☐ 100 pipe cleaners
- ☐ 100 craft sticks
- ☐ 250 pom-poms

For each group of 3-5 kids:

- ☐ 1 sandwich bag
- ☐ scissors
- ☐ tape
- ☐ 1 twist tie
- ☐ 2 flat marbles
- ☐ 10+ pieces of farfalle pasta
- ☐ Optional: Aid Package sheets from 2a

For each kid:

- ☐ Engineering Journal

Preparation

Time Required: 15 minutes

1. Have the *Message from the Duo* ready to share.
2. Gather the packages groups engineered in Adventure 4.
3. Set up a Materials Store with all of the materials kids will have available for improving their packages.
4. Place a tape mark at the 5 foot drop height for testing (note you could use a higher drop height if you think your kids would enjoy the additional challenge).

Journal Pages for Adventure 5

Message From the Duo, p. 19

Adventure 5 **Message from the Duo**

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Take what's good and make it better!
to	You 8:07 AM

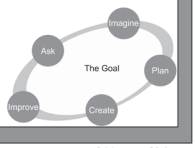
Hey everyone,

Jacob and I really like your package designs so far. Ratana told us that she and her package engineering team have to test, retest, and Improve their designs many times before they consider them ready to be used. They try to think of anything that could happen to the package, just like you are trying to think of where the package might land, and how to make sure people will be able to see it!

Use the Improve step of the Engineering Design Process to make sure your packages can protect the supplies, be easy to see once they land, and communicate what is inside. You can use everything you've learned so far to help you get ideas. This way we will know whether our package designs will protect lots of aid supplies!

Jacob and I also sent along one more exciting item you might test in your packages. You can decide if you want to take on this added challenge. Once you're done, can you send your ideas? We can't wait to see what you engineer!

India



Score Page, p. 20

Adventure 5 **Score Page**

Remember!
Take out any broken pieces of pasta and make sure there are 10 unbroken pieces before retesting!

Protect Score: Circle how much damage you saw after dropping your aid drop package.

No Damage **+6 points**	Some Damage **+3 points**	A Lot of Damage **+0 points**

Display Score
Place your package in front of the Environment Page you chose.

Is your package easy to see?

No — Yes

0 points 1 2 3 4 points

Communicate Score
Does your package communicate what is inside?

No — Yes

0 points 1 2 3 4 points

_____ + _____ + _____ = _____

Protect + Display + Communicate = Total Score

Letter to the Duo, p. 21

Adventure 5 **Letter to the Duo**

India and Jacob, the Duo
c/o Museum of Science, EiE
1 Science Park
Boston, MA 02114

Dear India and Jacob:

We finished engineering our aid drop packages. My group and I engineered our package to land in the:


Forest


Beach


Field

To make sure people would be able to see it we _____

_____.

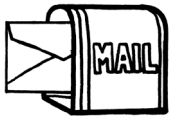
Here is a picture of our final design:

Sincerely,

_____

Adventure 5 Educator Page: Adventure Guide
Improving an Aid Drop Package

Kids will learn:
- the Engineering Design Process can help guide them to a successful solution.
- designs don't always work the first time; they can learn from their failures.



Present the Message From the Duo (5 min)

1. Tell kids that they have received a message from India about some new improvements they'll need to make.
2. Have kids turn to Engineering Journal p. 19 to follow along. Play track 8.
3. To check for understanding, ask:
   - **What technology are we improving?** *Our aid drop package.*
   - **What steps of the Engineering Design Process will help us?** *Improve, Plan, Create.*
   - **Does anyone remember the three goals of our packages?** *Protect the supplies inside from getting damaged, be easy to see, and communicate what's inside. Post the goals so groups can refer back to them.*

Make a Plan (10 min)

1. Show the kids a sandwich bag of 10 pasta pieces and 2 flat marbles. Remind them that this will help them see whether their supplies are damaged.
2. Have each group look back to *Improve*, p. 18, of their Engineering Journals, that they filled out last time to remind them of improvements they need to make.
3. Tell kids that for the showcase they'll have the option of adding the additional supply India mentioned to their package. It will be represented by adding a water balloon to their aid package bag. They won't get the water balloons to test with today, but they'll have to make sure there is enough room for it in their package!
4. Give groups a few minutes to settle on their improvement ideas, then they can visit the Materials Store to pick up additional materials.

Tip: Kids can use a balled up piece of paper or felt to represent the size of the water balloon.

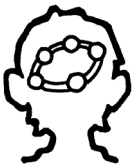
Improve! (20 min)

1. Remind groups they will test the protect function of their package by using the same process they used in Adventure 4. They'll test for display and communicate by seeing how well their package stands out against the *Environment Page* of their

Tip: Remind kids to make sure they have 10 complete pieces of pasta before testing!

choice and noting whether their package tells people what is inside.

2. As groups improve, encourage them to test their designs and score them using their *Score Page*, p. 20. While groups improve and test, ask:
   - **What parts of your design are working well?**
   - **What are you improving?**
3. As groups work, use the Engineering Design Process Poster to guide conversations and encourage students to use the names for the steps to describe what they are doing.



Reflect (10 min)

1. Collect each group's package design for use in Adventure 6. Ask:
   - **Do you think your improvements make your package better? Why or why not?** *If using water balloons, some groups may have trouble protecting them because of the weight they add to the package. Encourage these groups to discuss their designs and work together to point out things that work well, and things that could be improved.*
2. Show kids the Engineering Design Process poster. Ask:
   - **How did you use the Engineering Design Process to improve your package designs?** *We used the Improve step because we made our designs better. We also used the Plan step to decide what our improvements would be.*
   - **Why do you think engineers need to improve their designs?** *Improving their designs gives engineers a chance to make sure they're meeting the requirements, or criteria, for their design the best way possible.*
3. Tell kids that in their next adventure they will be testing their designs in front of the entire group, and will share how they used the Engineering Design Process to engineer their package.
4. Give kids time to write a *Letter to the Duo*, p. 21 in their Engineering Journals. They can mail these letters or email the duo at engineeringadventures@mos.org. Summarizing the work they've done so far will help prepare kids for the presentations they'll make in the next adventure.

Extension

Now that groups have engineered their packages, they can take an extra step! Have groups consider how they could turn their final package into a toy or game once the supplies have been removed. This way, even after delivered, the package will have another purpose. Have groups write out directions for how to transform their packages into a toy or game. Kids in the area where the aid is being dropped may have lost their own toys and games. This could offer them something to play with as rebuilding efforts beginning. If kids aren't sure what to do, have them think of their favorite games that don't have batteries or use electricity. They may want to make a board game, arcade game, or a puppet.

Improving an Aid Drop Package

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Take what's good and make it better!
to	You
	8:07 AM

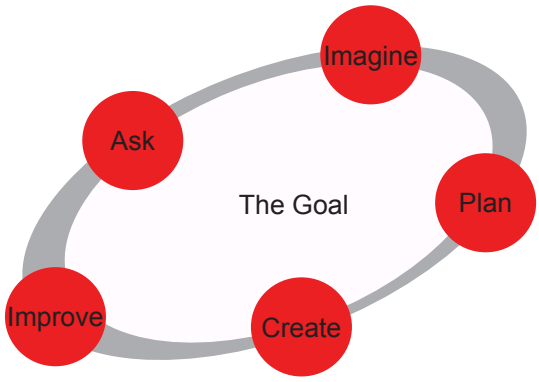
Hey everyone,

Jacob and I really like your package designs so far. Ratana told us that she and her package engineering team have to test, retest, and Improve their designs many times before they consider them ready to be used. They try to think of anything that could happen to the package, just like you are trying to think of where the package might land, and how to make sure people will be able to see it!

Use the Improve step of the Engineering Design Process to make sure your packages can protect the supplies, be easy to see once they land, and communicate what is inside. You can use everything you've learned so far to help you get ideas. This way we will know whether our package designs will protect lots of aid supplies!

Jacob and I also sent along one more exciting item you might test in your packages. You can decide if you want to take on this added challenge. Once you're done, can you send your ideas? We can't wait to see what you engineer!

India



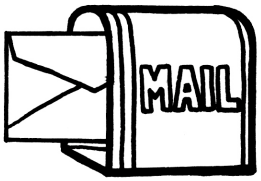
Adventure 6 Educator Page: Preview

Engineering Showcase: That's a Wrap!

Overview: Kids will hold a showcase in which they will evaluate everyone's package design, and make recommendations for Ratana. For groups willing to take the risk, they can choose to add a water balloon to their package for the drop.

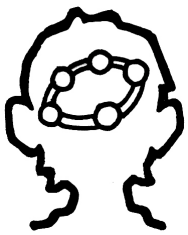
Note to Educator: The showcase is a time for your group to share all of the hard work they've done throughout the unit! Consider inviting guests to the engineering showcase to watch each group present their aid drop package designs.

Duo Update (5 min)



Activity (20 min)

Reflect (20 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 9 or Engineering Journal p. 22
- ☐ EDP poster
- ☐ ruler or tape measure

For each group of 3-5 kids:

- ☐ *Environment Pages*, this guide pp. 75-79
- ☐ final aid-drop packages from Adventure 5
- ☐ 1 sandwich bag
- ☐ 1 twist tie
- ☐ 2 flat marbles
- ☐ 10 pieces of farfalle pasta
- ☐ Optional: 1 water balloon

For each kid:

- ☐ Engineering Journal

Preparation

Time Required: 10 minutes

1. Have the *Message from the Duo* ready to share.
2. Place each group's aid drop package design in a central location.
3. Place a tape mark at the 5 foot drop height for testing.
4. Fill water balloons if groups will be using them to test their final package design.

Journal Pages for Adventure 6

Message From the Duo, p. 22

Adventure 6 **Message from the Duo**

reply | forward | archive | delete

from	engineeringadventures@mos.org
subject	Wrapping It Up
to	You 9:18 AM

Hi everyone,

We can't wait to hear about the final aid drop packages you engineered. Today you'll be presenting your package technology designs. We know you must be excited to share them!

As groups present their designs, we want you to think hard about what works well in each one. That way you can put your heads together and come up with final recommendations that we will share with Ratana.

We can't wait to hear about how you used the Engineering Design Process to engineer your aid drop package designs! Engineers are always improving their technologies. By listening to other groups, you might even get more ideas for new packages to engineer!

Until next time,
India and Jacob, the Duo

Recording Page, p. 23

Adventure 6 **Recording Page**

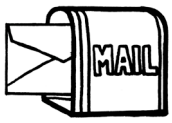
As you look at the packages other groups engineered, write or draw some of the things you like, or things that work really well. We can share these ideas with Ratana so she can engineer a new aid drop package.

Great Protection Ideas:	Great Display Ideas:	Great Communicatoin Ideas:

Ratana, we recommend:

Adventure 6 Educator Page: Adventure Guide
Engineering Showcase: That's a Wrap!

Kids will learn:
- each team used the Engineering Design Process to engineer an aid drop package design.
- discussing designs as a group can lead to new, improved ideas.



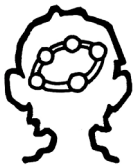
Present the Message From the Duo (5 min)

1. Tell kids that they have received a final message from India and Jacob about presenting the package technologies they engineered.
2. Have kids turn to Engineering Journal p. 22 to follow along. Play track 9.
3. To check for understanding, ask:
   - **What do India and Jacob want you to do?** *Present our packages to the group and come up recommendations to share with Ratana.*

Let the Showcase Begin! (20 min)

1. Tell kids that before they talk as a group, they will do a "gallery walk" to view the packages engineered by other groups.
2. Have each group place their aid drop package on a desk or table around the room with the *Environment Page* they chose.
3. Groups should walk around the room reviewing the packages they see. They should write ideas they like or things that work well in their Engineering Journals on *Recording Page,* p. 23.
4. After everyone has gone on the gallery walk, test each package as a whole group. Have one group member place the package in front of their *Environment Page,* and drop the package from the 5 foot mark. Open the package and see whether the contents were damaged.
5. After each group tests, ask:
   - **Which steps of the Engineering Design Process helped you the most?**
   - **What would you improve if you had more time?**

Tip: You may want to ask one question to each member of the group, to encourage participation.



Reflect (20 min)

1. Gather kids together. Remind kids that India and Jacob want kids to make recommendations to Ratana. Ask the group:
   - **Which packages were engineered to do a good job protecting the supplies?**
   - **Which packages do you think are easiest to see? Why?**
   - **Which packages do you think communicate what is inside well? Why?**

- **Looking at all the great ideas you wrote down, what would you recommend to Ratana to help her engineer an aid drop package?**
- **Do you think engineers combine ideas like we are doing now?** *Yes, engineers often work in teams in order to get lots of good ideas. They put together the best ideas to create their final design.*
- **What's something you'd like to engineer next?**

2. Congratulate kids for being such great engineers!
3. Give kids time to complete their recommendations to Ratana on the *Recording Page,* p. 23. This will help them summarize their thoughts and wrap up their experiences from the unit.

Extension

After pulling out the great ideas from the different packages, make a plan to combine the best of all the designs, and have the kids create one final package that protects the supplies, communicates what's inside, and displays the package in a way thats easy to see. You can email a picture to the Duo at: engineeringadventures@mos.org.

Engineering Showcase: That's a Wrap!

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from	engineeringadventures@mos.org
subject	Wrapping it up!
to	You
	9:18 AM

Hi everyone,

We can't wait to hear about the final aid drop packages you engineered. Today you'll be presenting your package technology designs. We know you must be excited to share them!

As groups present their designs, we want you to think hard about what works well in each one. That way you can put your heads together and come up with final recommendations that we will share with Ratana.

We can't wait to hear about how you used the Engineering Design Process to engineer your aid drop package designs! Engineers are always improving their technologies. By listening to other groups, you might even get more ideas for new packages to engineer!

Until next time,
India and Jacob, the Duo