On this Journey, Cadettes learn how engineers solve problems. They use the Design Thinking Process to complete three hands-on design challenges, including designing prototypes of a life vest to help a corgi swim, a camp cabin inspired by nature, and a leg prosthetic for an elephant. Cadettes also use the Design Thinking Process to Take Action. They’ll look at what defines a community, brainstorm community problems, and dig deeper to explore the root causes of each. They’ll decide on one problem to address as a group before they plan, create, and present their sustainable Take Action project.

**Girl Leaders:** At this point, your girls might be ready to lead the meetings, and that’s fantastic! To help, you might decide as a troop on girl leaders for each of the Journey meetings. Share the meeting plan and meeting aids with your girl leaders with plenty of time before the meeting to give them time to prepare. If they have any ideas or ways to improve the activities for their Girl Scout sisters, give them the opportunity to try it out!

**Use the Talking Points (But Make Them Your Own):** In each session, you’ll find suggested talking points under the heading “Things to Know.” Some volunteers, especially new ones, find it helpful to follow the script. Others use the talking points as a guide and deliver the information in their own words. Either way is just fine.

**Be Prepared (It’s What Girl Scouts Do!):** Each meeting includes a “Prepare Ahead” section that includes a materials list and what kind of set-up is required. Read it in advance so you have enough time to gather supplies and enlist help, if needed.

**Use Girl Scouts’ Three Processes:** Girl-led, learning by doing, cooperative learning—these three processes are the key to making sure girls have fun in Girl Scouts and keep coming back. “Learning by doing” and “cooperative learning” are built into this Journey, thanks to the hands-on activities and tips. You can look for ways to keep the Journey “girl-led”, whether it’s helping to prepare or lead a meeting, having girls lead the discussion about the issues they’d like to work on for the Take Action project, or planning the final celebration. They’ll help you create an experience where Cadettes know they can make choices and have their voices heard.

**Fail Fast. Succeed Sooner:** That’s how engineers solve problems. In this Journey, Cadettes will learn about engineering through hands-on activities. They’ll learn to brainstorm ways to solve a problem, design prototypes, test them to see what does and doesn’t work, then improve their designs. To engineers, failure is a good thing because every time a design fails, you learn something and can make it better.

You can help girls think this way. When her prototype doesn’t work, ask questions like, “Why do you think it didn’t work? How can you change your design? Try again—that’s what engineers do!” This approach also
keeps the activity girl-led and fun because Cadettes are free to invent things without feeling the pressure to make them perfect.

**Leave Time for the Closing Ceremony:** If Cadettes are having fun doing a Design Challenge, you may be tempted to skip the Closing Ceremony so they can keep going—but the Closing Ceremony is absolutely key to their learning. Here’s why:

When Cadettes leave a meeting, they’ll remember how much fun it was to build a camp cabin or to make a prosthetic leg for an elephant. However, they may not realize that they just learned how engineers solve problems or that they’re good at engineering—unless you tell them.

That’s why the Closing Ceremony is so important. It’s where you can connect the dots for Cadettes by:

- Pointing out how they acted as engineers. (For example: They did rapid prototyping. When one of their prototypes didn’t work, they saw that “failure” as helpful feedback and tried something else. They worked together to find solutions. They shared their designs and offered suggestions.)
- Reminding Cadettes that they are already engineers—and that it’s fun to solve problems using engineering.
- Letting them know that they have what it takes to continue exploring STEM.

These simple messages can boost Cadettes’ confidence and interest in STEM—and end the meeting on an upbeat note!

**Tell Your Troop Story:** As a Girl Scout leader, you’re designing experiences that Cadettes will remember their whole lives. Try to capture those memories with photos or videos. Cadettes love remembering all they did—and it’s a great way for parents to see how Girl Scouting helps their Cadettes! And please do share your photos and videos with GSUSA by emailing them to STEM@girlscouts.org (with photo releases if at all possible!).

**To Prepare for the Meetings:** Before each meeting, you’ll find an Overview, notes to help you Prepare Ahead, and a Materials List, all specific to that meeting.

**Go over new words Cadettes can learn.** In the Prepare Ahead section for each meeting, you’ll see a list of words Cadettes may or may not know and how to define them. These words appear in context throughout the Meeting Plan and Meeting Aids, but if you need a reminder, refer back to this list. You can find a full list of vocabulary for the Journey in the meeting aid “Cadette Think Like an Engineer Journey—Glossary”.

**Read through the Meeting Plan and its Meeting Aids.** This will help you become familiar with the flow of the meeting. As you prepare, it’s important to understand the activity steps and Things to Know, but feel free to adapt the activities to fit your troop, meeting time allotment, and available materials.

Before starting, read the referenced handouts located in the Appendix:

- **Cadette Think Like an Engineer Journey - Materials List:** Each meeting has its own materials list. However, if you like to do all of your supply shopping at one time, use this handout. It includes the materials needed for the entire Journey.
- **Cadette Think Like an Engineer Journey - Glossary:** This is a list of words introduced in this Journey with definitions.
- **Design Thinking Process Poster:** This poster describes the steps of the process engineers use to solve problems. This meeting, use it to introduce Cadettes to the Design Thinking Process and have it available for them to look at as they take on their first Design Challenge. It will continue to be used throughout the Journey.
• **Take Action Guide:** Need some sample project ideas to jumpstart your Take Action brainstorming? This handout includes Take Action project ideas to use as inspiration, tips on making a sustainable project, and information on the difference between Take Action and Community Service.

• **Think, Pair, Share:** These facilitation tips will help you to make sure that every girl’s voice is heard during brainstorming activities.

Cadettes earn two awards - Think Like an Engineer award and the Take Action award following the completion of the Take Action project and Journey in **Think Like an Engineer Part 6**.

---

**Cadette Think Like an Engineer Journey Part 1**

**Overview:** *In this meeting, Cadettes discover how engineers use the Design Thinking Process to solve problems. They take on a hands-on Design Challenge to engineer a model life vest that gives a model dog the ability to float. Cadettes also find out about the Take Action™ project.*

**Prepare Ahead**

These words are used in Think Like an Engineer Pt. 1:

- **Constraints** - ways that you or your design are limited. For example, you might only have a certain amount of time or materials for your prototype.

- **Criteria** - things you or your design needs to accomplish. For example, if your Design Challenge is "You must create a tower 4 feet tall" or "You must build a structure that can withstand wind for 30 seconds," those are your criteria.

- **Design Thinking Process** - the steps engineers use to design technologies to solve problems. Engineers begin by identifying a problem that needs to be solved and investigating what has already been done. Next, engineers imagine different solutions and plan their designs. Then, they create and test their designs and make improvements based on the test results. Finally, engineers communicate their findings to others.

- **Engineers** - people who use their creativity and knowledge of math and science to design technologies that solve problems. They create infrastructure like bridges, build clean water solutions like wells, design energy solutions like solar and wind power, build rockets that take aeronauts into space, and so much more.

- **Prototype** - a quick way to show your idea to others or to try it out. It can be as simple as a drawing or it can be made with everyday materials, such as cardboard, paper, string, rubber bands, etc.

- **Technology** - anything created by people to help solve a problem or meet a need. Engineers design and improve technologies when faced with new problems. Technology can be things that require electricity, such as computers and phones, as well as everyday (and non-electric) items, such as pencils, paper, and water bottles.

You will need the following Journey Meeting Aids found in the Appendix:

- **Engineering Notes: Corgi Life Vest (Activity Material):** This handout guides Cadettes through the Design Challenge. It includes details like criteria and constraints as well as space for groups to brainstorm solutions and plan their design.
• **Dog Model Template (Activity Material):** Groups will use this handout to build a model of a corgi or other animal in As Everyone Arrives: Build an Animal Model. It contains a template with shapes that groups can use to draw and cut out foam shapes to attach to their animal’s body (can).

**Other Things You Could Do to Prepare Ahead for this Meeting:**

- Create a sample model dog to show as an example in As Everyone Arrives: Build an Animal Model.
- Cut the foam pieces for As Everyone Arrives: Build an Animal Model ahead of time, putting each set of pieces into a bag or envelope for groups to easily assemble.
- Find and print/bookmark picture(s) of corgis and life vests to show during the Design Challenge: Corgi Life Vest.
- Try it out! Challenge yourself to complete the Design Challenge. This will give you a hands-on chance to troubleshoot issues and solutions for the challenge before you do the activity with your troop. For example, while testing, you might find out that the cans you have are too heavy for the dog's body or that the plastic bags you have continue to rip so you'll need something sturdier.

**Activity 1: As Everyone Arrives: Build an Animal Model**

**Materials**

Each pair or group of 3 will need:

- Dog Model Template
- 1 sheet of foam (roughly 9 x 12 in.)
- 1 unopened can (12 oz.)
- Scissors
- Duct tape
- **Optional:** Extra foam and markers to design and build animals other than a dog.

**Steps**

Welcome everyone, and have them organize into pairs or groups of 3 to build a model of a corgi or other animal for today’s Design Challenge. Groups use the Dog Model Template to cut a corgi design from foam, attaching the foam pieces to the can with duct tape. They will use the models for testing in Design Challenge: Corgi Life Vest.

**THINGS TO KNOW:**

- Today, you’ll do a hands-on activity to learn how engineers think.
- The first step is creating a model of a corgi dog from foam, duct tape and a can.
- You may want to design and build an animal that isn't a dog, and that's great! Feel free to repurpose the foam sheets and create your own unique animal designs.

**Activity 2: Opening Ceremony: Engineering Everywhere**

**Materials**

- Design Thinking Process poster
Steps

Begin the Journey by introducing everyone to engineering. Talk briefly about what engineers do, and ask the group how they would describe engineers' work. Share some of these examples, which connect engineering with helping others (a good way to get everyone interested in the topic!)

- **Everyday Solutions**: Engineers solve everyday problems by inventing and building things that can be used in the real world, like bridges, buildings, planes. They create new and improved ways to make life easier and more efficient for everyone.
- **Agricultural Solutions**: Engineers work with farmers to design new machines, like improved irrigation (watering) systems, that help them to grow and harvest crops faster and more efficiently.
- **Water Solutions**: Engineers work around the world to build wells and other water systems, providing communities with access to clean water.
- **Manufacturing Solutions**: Engineers create machines that speed up the production process.
- **Energy Solutions**: Engineers create energy and light systems, like solar and wind power, to bring electricity to communities.
- **Solutions in Times of Disaster**: Engineers design structures with disaster in mind. For example, following Hurricane Sandy in New York City, engineers evaluated their current systems and designed stronger infrastructure for cities like New York to better weather against any future natural disasters.
- **Technological Solutions**: Aerospace engineers design spaceships and satellites, giving astronauts and scientists the ability to learn more about our solar system and universe.

After, show everyone the Design Thinking Process poster, and tell them about the awards for this Journey, using the Things to Know.

**THINGS TO KNOW:**

- On this Journey, you'll learn how to think like an engineer to solve problems.
- Engineers go through certain steps to solve problems. Those steps are called the Design Thinking Process. First, engineers identify a problem that needs to be solved and investigate what has already been done. Next, they come up with different ideas for solutions. They pick one or more possible solutions and create their designs. Then, they test their designs and make improvements based on what they learned. Finally, engineers let other people know what they learned.
- You will earn two awards on this Journey. The first one is called the "Think Like an Engineer" award. You earn that for solving problems like an engineer.
- The second one is called the "Take Action" award. You earn that for creating a Take Action project that solves a problem in your community and uses what you've learned about engineering and technology. Your Take Action project will make a sustainable difference in the world.
- For this Journey, you'll use the Design Thinking Process to Take Action. You'll work as one team identify a problem, investigate why it happens and who it impacts, brainstorm lots of possible solutions for the problem, then choose one solution to plan out in more detail and bring it to life! After you create your Take Action Project, you'll share it with others, just like engineers!
Activity 3: Design Challenge: Corgi Life Vest

Materials

- **Prepare ahead:** Large plastic tub filled with water and placed in an area of the room that can get wet. This will be the testing station.
- Towels for testing clean-up
- **Design Thinking Process poster**
- **Engineering Notes: Corgi Life Vest**, one for each girl
- Stopwatch
- **Optional Prepare Ahead:** Find and print, save or bookmark picture(s) of corgis and life vests

Each pair or group of 3 will need:

- Model dog created in As Everyone Arrives: Build an Animal Model
- 2 sheets of foam (roughly 9 x 12 in. each)
- 2 plastic bags (strong sandwich bags)
- 3 large rubber bands
- Measuring tape
- Scissors
- Duct tape
- Extra blank paper (for planning)
- Pens or pencils

Steps

**Note to Volunteers:** Give 10- and 5-minute warnings to wrap up, leaving time for the Closing Ceremony.

Identify the Problem

Handout **Engineering Notes: Corgi Life Vest**, and explain today's Design Challenge:

**Today's Design Challenge:**

- Throughout this Journey, you'll be challenged to design things that make the lives of animals and humans better. Today, you've been hired by a family who has a corgi named Champ. Corgis have a hard time swimming because of their short legs. In preparation for an upcoming trip, the family would like a life vest made for Champ that would allow him to play with the children in the lake.
- If you made an animal model other than a dog, use your imagination to create a reason why your animal might need to be able to float.
- When everyone arrived, you worked in groups to create models of Champ (or other animals). You'll use your group's model to test the prototype of your life vests.
- A **prototype** is a quick way to show an idea to others or to try it out. It can be as simple as a drawing or it can be made with everyday materials like cardboard, paper, string, rubber bands, etc.

As a group, identify the problem you're trying to solve.
DISCUSS:

- What’s the problem we’re trying to solve? **(Answer: Engineer a life vest that will allow Champ to swim in the water.)**
- Do you think this is a problem you can help solve?
- What's our goal for this Design Challenge? **(Answer: The life vest must keep the model dog's head above water.)**

**Investigate the Problem**

Before they begin to design or build anything, engineers start by asking questions to gather information about the problem they are trying to solve. This helps them to brainstorm different ways to solve the problem(s). Form pairs or groups of 3 for the Design Challenge. In the smaller groups, investigate the problem by discussing what questions the group has, what do they need to know before you start?

**For example:** Are we limited by time or materials? How long does the dog need to float? Is there anything we already know about life vests that might help us?

After, discuss the criteria and constraints for the Design Challenge.

- **Criteria** are things you or your design needs to accomplish. These are specific goals for you or your prototype.
- **Constraints** are ways that you or your design are limited. For example, you might only have a certain amount of time or a limited amount of materials for your prototype.

**Criteria and Constraints for the Design Challenge:**

- Life vests must allow the dog to float with its head above the water for 10 seconds. The life vest must attach and detach from Champ as quickly as possible.
- Each group can use up to two plastic bags, two sheets of foam, three rubber bands, one measuring tape, and one pair of scissors. The scissors and measuring tape cannot be used as a part of the life vest.
- Groups have 20 minutes to engineer their design. Groups cannot test the life vest on Champ until the designated testing time.
- After, groups will have 20 minutes to test, iterate, and improve their life vests.

**Note to Volunteers:** Some groups may worry that this is a competition they need to "win." Remind everyone that professional engineers learn a lot from failure. Failure can help them improve the designs of future technologies. They can also learn from each other's failures and successes.

**Brainstorm Solutions, Plan and Build a Prototype**

Work in the small groups to design and build the life vest prototypes. Each group will need a set of supplies and a model dog or animal (created in As Everyone Arrives: Build a Model Corgi). Make sure each group has the space to brainstorm and create their own unique design.

Spend about 5 minutes brainstorming the design and features of their life vests. Encourage ideas both possible and impossible before deciding on one of their designs to turn into a prototype.
Optional: If groups have trouble brainstorming solutions, show the pictures you brought of pet life vests and corgis. Explain that often engineers think about who will be using the product and look at what’s already been invented. After they have an idea of what’s already been created, they think of ways to improve the design. As groups plan and build, encourage them to think above and beyond a normal life vest!

After groups have planned, set a timer for 15 minutes to build the life vest prototypes. Encourage each other to try lots of different solutions to see what works and doesn't work. Remember, the goal is to practice thinking like an engineer, NOT to make a perfect life vest!

Test, Evaluate, and Redesign

Gather around the plastic tub of water for groups to take turns presenting their prototypes.

Each group can:

1. Explain their prototype.
2. Predict what they think will happen to their prototype during testing.
3. Test the prototype by attaching their life vest to their model dog as quickly as possible and seeing whether or not their life vest can keep the model dog's head afloat for at least 10 seconds.

DISCUSS: How could you improve your prototype with more time? Why do you think that idea will improve your prototype?

For the remaining activity time and as materials allow, improve the life vest prototypes using results from testing (what worked, what didn’t). Retest as needed!

If you run out of materials, groups can go back to the drawing board and refine their designs. Are there ways they could change their design to focus on the most important features? Challenge groups to engineer a design that still fits within the material constraints for the Design Challenge.

Courtesy of the Museum of Science, Boston. Adapted from the Engineering is Elementary, Go Fish: Engineering Prosthetic Tails. ©2014, 2016 Museum of Science.

Activity 4: Closing Ceremony: Reflect on Our Results

Materials

- Design Thinking Process poster

Steps

Sharing your design decisions is an important part of the Design Thinking Process. Gather together to talk about the Design Challenge and how everyone used the Design Thinking Process to build a prototype.

QUESTIONS ABOUT THE DESIGN CHALLENGE:

- What problem did you solve today?
- What were some possible solutions you came up with?
- What was challenging about engineering the life vest? Possible Answers: Not enough materials, not enough time, etc.
- Why do you think your design did/did not work?
QUESTIONS ABOUT THE DESIGN THINKING PROCESS:

- What are some action words to describe what you did today? **Possible Answers:** Brainstorm, build, cut, collaborate, discuss, team up, etc.
- Do these steps sound like something engineers use? **(Answer: Yes, the Design Thinking Process!)**
- Which steps of the Design Thinking Process did you use to engineer your life vest?
- Did you do the steps in a particular order?
- Did you return to any of the steps more than once?

Explain that because everyone in the room just engineered a life vest, everyone used the Design Thinking Process to solve a problem!

**Optional:** Talk about any to-do's for the next meeting. This might include assigning a Girl Leader for the next meeting or deciding on materials to bring in for the next Design Challenge.

---

**Cadette Think Like an Engineer Journey Part 2**

_Cadettes learn about bioinspiration as they work together to engineer a model camp cabin inspired by nature. They also talk about what defines a community before brainstorming community problems that could lead to a sustainable Take Action project._

**Prepare Ahead**

These words are used in Think Like an Engineer Pt. 2.

- **Bioinspiration** - the process of being inspired by living things. Bioinspired engineering is a new and growing field. It combines knowledge of engineering and natural sciences to develop technologies that are often more sustainable than those not inspired by nature. Many technologies are bioinspired, such as Velcro strips inspired by plant burrs or aerodynamic cars shaped like boxfish.

- **Materials engineering** - the field of engineering focused on designing materials with desired properties. Materials engineers use their understanding of the properties of different materials (such as metals, plastics, or woods) to design and improve technologies. In particular, materials engineers explore the properties of different materials to help them choose which material will work best to solve the problem.

You will need the following Journey Meeting Aids found in the Appendix:

- **Engineering Notes: Camp Cabin:** This handout guides girls through the Design Challenge. It includes details like criteria and constraints as well as space for groups to brainstorm solutions and plan their design.
- **Animal Shelter Examples:** This handout provides examples of animal shelters to use as inspiration for the Design Challenge. While the handout includes several different examples, encourage the group to think above and beyond what shelters are there for their design!
Other Things You Could Do to Prepare Ahead for This Meeting:

- Find and print out (or bookmark!) pictures of other animal shelters to show during the Design Challenge.
- Try it out! Challenge yourself to complete the Design Challenge. This will give you a hands-on chance to troubleshoot issues and solutions for the challenge before you do the activity with your troop.

Activity 1: As Everyone Arrives: What's a Community?

Materials

- **Prepare Ahead:** Before the meeting, create 2 large chart papers. Label them with "Community is..." and "Types of Communities"
- Tape to hold posters on walls (Alternatively, place papers on different floor/table areas around the meeting space.)
- Markers
- Star stickers (Alternatively, girls can draw stars.)

Steps

**Note to Volunteers:** This quick activity is meant to help girls to start thinking about the communities they belong to and the issues that affect each community. This activity will give girls ideas for community problems they may want to address with a Take Action project. Girl will continue their Take Action brainstorm later in the meeting.

Welcome everyone as they arrive. Have them gather around the papers and work as a team to write down 1) what community means to them and 2) all of the communities they can think of. Remind everyone to think about both big and small problems!

THINGS TO KNOW:

- Something engineers do is spot problems in the world and design technology and solutions that help others in their community.
- In today's world, your community might be something small, like your school or neighborhood, or something much bigger, like the global community!
- Before we get started with the today's activities, let's think about what it means to be a community or what makes a community.
- Then, create a list of all the communities you can think of, starring the ones that you think you are a part of. No idea is too big or too small!

Activity 2: Opening Ceremony: Brainstorm Problems in Our Community

Materials

- Community lists from As Everyone Arrives: What's a Community?
- Take Action Guide
- Design Thinking Process poster
Steps

Share the **Design Thinking Process poster**, and remind everyone that the Design Thinking Process is similar to the steps of Take Action. To Take Action, the troop will team up to: Identify a problem in their community, come up with a sustainable solution, develop a plan, put the plan into action, reflect on what they've learned, and share the project with others.

Discuss the first activity, As Everyone Arrives: What's a Community?, to zero in on a community to impact with the group’s Take Action project. First, look at what the group wrote under "A community is..." Reflect on what's there, forming a loose definition of what your group considers a community. Then, look at the list of communities, reflecting on whether they fit into the group’s definition of a community.

**DISCUSS:**

- Do the communities we listed fit into our definition of a community?
- Which of these communities are you a part of? Are there any we are all a part of?
- What other communities (not listed) are you a part of?
- What role(s) do you play in each of these communities?

Have the group choose one of the communities to focus on with their Take Action project. Once the group has decided, congratulate everyone on choosing the community to impact, or the user(s), for their Take Action project! After, begin to brainstorm problems that affect the chosen community ("our community").

**DISCUSS:**

- What are some issues or problems that impact our community?
- Who else is in our community? What are some of their problems?
- Which of the problems could have an engineering or technological solution?
- Which of these issues are you most interested in? Which do you most care about?

For more examples of Take Action projects, use the **Take Action Guide**. Girls can use the examples as thought starters that will help them develop their own ideas.

---

**Silver Award Connection:** The group may come up with many Take Action ideas, but they only need to choose one for this Journey. Remind girls that the list they developed can be a great starting point for a Silver Award project! This Journey's Take Action project helps girls build' skills, like such as critical thinking, project management and communication, that will help them to develop an excellent Silver Award project. Throughout the discussion, take notes on the group's growing list of community problems. Save these for the next meeting.

---

**Activity 3: Design Challenge: Camp Cabin Inspired by Nature**

**Materials**

- **Design Thinking Process poster**
- **Engineering Notes: Camp Cabin**, one for each girl
- 1 ball of string
- 1 electric fan, approximately 9 inches
- 1 roll of aluminum foil
- 1 spray bottle with water

*Cadette Think Like an Engineer Journey UNOFFICIAL Rewrite – Page 11*
• Construction paper, each group will need a quarter sheet of construction paper for testing
• Stopwatch
• **Optional Prepare Ahead:** Find and print, save or bookmark pictures of other animal shelters.

Each pair or group of 3 will need:

• 1 piece of masking tape, 12 inches long
• 1 piece of packaging tape, 12 inches long
• 1 sheet of cardboard, 8"x 8"
• 2 plastic cups, 1-2 oz.
• 2 sheets of construction paper
• Measuring tape
• Scissors
• **Animal Shelter Examples**
• Extra paper (for planning)
• Pens or pencils

**Steps**

**Note to Volunteers:** Give 10- and 5-minute warnings to wrap up, leaving time for the Closing Ceremony.

**Identify and Investigate the Problem**

Hand out **Engineering Notes: Camp Cabin**, and explain today's Design Challenge.

**Today's Design Challenge:**

• You’ve been contacted by a local engineering firm. The firm has a client who owns a local summer camp and would like you to design their new cabins. She would like the cabins to be based upon, or inspired by, shelters created by animals.
• "Animal shelters" refer to the natural homes animals create and live in. For this challenge, animal shelters does not mean the place where stray animals are housed.
• **Goal for the Design Challenge:** Engineer a model camp cabin inspired by a shelter created by an animal.

First, identify the problem as one large group.

**DISCUSS:**

• What problem are we being asked to solve? (Answer: **We need to design a model of camp cabin that is inspired by the shelters built by animals.**)
• What are some examples of animal shelters? **Possible Answers:** Birds' nests, beehives, beaver lodge, den, burrow, etc.
• What are some features people look for in a shelter? **Possible Answers:** Warm, dry, comfortable, spacious, safe, accessible, etc.
• How can we use shelters created by animals to inspire cabins for people? **Possible Answers:** We can find inspiration from the materials, shapes, and ways that the materials are put together.

Then, investigate the problem for the Design Challenge. Form small groups of 2-3 to talk about what questions the group has about the problem. **For example:** How are we limited by time or materials? Is there anything we already know that might help us?

Criteria and Constraints for the Design Challenge:

- Groups must work together to engineer a model of a camp cabin that is inspired by at least one animal shelter.
- The model cabins must be water and wind resistant.
- The model cabins must have at least one entrance that allows for a quarter sheet of construction paper to be easily placed inside and taken out.
- The model cabins must be at least 5 inches high and 5 inches wide.
- Groups may use up to one sheet of cardboard, two sheets of construction paper, two plastic cups, 12 inches each of masking and packaging tape, and any amount of aluminum foil and string.
- The measuring tape and scissors may be used as tools.
- Groups will have 10 minutes to brainstorm and plan before they have 20 minutes to engineer their model cabins.

Testing Process: Groups will place their prototype in front of a fan for 15 seconds and observe whether it is impacted by wind. To find out if the cabins are water-resistant, spray the structure with water 15 times and observe whether a piece of paper inside gets wet.

Brainstorm Solutions and Plan

First, hand out the Animal Shelter Examples and discuss as one large group. If you brought other photos of animal shelters, share them with the group. Ask everyone to imagine what shelter they might like their cabin to be inspired by. Encourage wild ideas. Everyone should feel free to find additional inspiration from shelters not listed on the handout.

Then, work in the same groups of 2-3 to design and build the model camp cabins. Groups can talk about their ideas and write down which animal shelter, or shelters, they will draw inspiration from for their design. They may also want to discuss other specifics related to their cabins, such as whether the door(s) should open and close, whether there should be windows, etc. Give everyone the opportunity to look at the available materials and spend a few minutes sketching out a plan for their model camp cabin.

Build a Prototype

Set a timer for 20 minutes for groups to gather their materials and build their cabin. Encourage each other to try lots of different solutions to see what works and doesn't work. Remember, the goal is to practice thinking like an engineer, NOT to make a perfect cabin!

Let everyone know when there are 15, 10 and 5 minutes left. If you run out of materials, groups can go back to the drawing board and refine their designs. Are there ways they could change their design to focus on the most important features? Challenge groups to engineer a design that still fits within the material constraints for the Design Challenge.

Test, Evaluate, and Redesign

When time is up, gather together to present and test their model camp cabins. Each group can share the design of their cabin, acting as if they are presenting to the firm's client.

Groups can answer the questions:

- What part of your design was inspired by a shelter created by animals?
- How do the different features of your cabin meet the criteria of the challenge?
- Why will your design work well during testing?
After each group presents, they can test their structure:

- **Is the cabin wind resistant?** Place it in front of the fan for 15 seconds. Start the fan on the lowest setting. If the model cabins aren't moved by the wind, turn the fan to a higher setting.
- **Is the cabin water resistant?** Put a quarter sheet of construction paper to place inside of their design. Spray the top of their model cabin with water 15 times, and check the construction paper for water.

For the remaining activity time, groups can improve their cabins using their results (what worked, what didn't). If you have the materials available, give each group 1 additional sheet of cardboard, 1 sheet of construction paper, and 1 plastic cup to improve their designs.

*Courtesy of the Museum of Science, Boston. Adapted from the Engineering is Elementary, It's in the Bag: Engineering Bioinspired Gear. ©2014, 2016 Museum of Science.*

**Activity 4: Closing Ceremony: Evaluate Our Results from Testing**

**Materials**

- Design Thinking Process poster

**Steps**

Evaluating your results from testing and brainstorming how you could improve your design are important parts of being an engineer. Gather together to reflect on your design decisions, the testing results, and how groups used the Design Thinking Process to design their model camp cabins.

**QUESTIONS TO GET STARTED:**

- Would the cabin you designed keep campers dry?
- How was your model impacted by wind?
- What part of the challenge did you find the most difficult?
- How could you improve your model? Why do you think that idea will improve your design?
- What steps of the Design Thinking Process did you use today?

If there's any extra time, continue to brainstorm community problems that the group would like to address with the Take Action project. In the next meeting, girls will choose one issue to focus on.

**Optional:** Talk as a group about any to-do's for the next meeting. This might include assigning a Girl Leader for the next meeting or deciding who can help bring in materials for the next Design Challenge.

**Cadette Think Like an Engineer Journey Part 3**

**Overview:** Cadettes explore biomechanical engineering as they design, build, and test a prototype of a prosthetic elephant leg. They also review their Take Action ideas and choose one problem to address with their Take Action project.
Prepare Ahead

Watch one video: *Engineering Everywhere: Special Report* video (8:21): [eie.org/engineering-everywhere/curriculum-units/prosthetics](eie.org/engineering-everywhere/curriculum-units/prosthetics) This video is about an engineer who designed a prosthetic device for a dog. You can bookmark and show this to your troop to demonstrate how biomechanical engineers create prosthetics. This is optional. You may not have the equipment, Wi-Fi connection, or time to show the video.

Listen for the main points you want to make. For example:

- Are Derby's prosthetic legs an example of a technology? Why? (Answer: Yes, because they were designed by Tara and they solve the problem of Derby not being able to move around.)
- What factors did Tara account for while designing Derby's prosthetic? (Answer: Tara needed to make sure the device was able to function like two legs, was able to stay attached, and was comfortable and durable.)
- How did Tara solve the problem? (Answer: She tried many different shapes and materials, found different ways to attach the device, etc.)

Links to third-party websites are provided for convenience only. GSUSA does not endorse nor support the content of third-party links and is not responsible for the content or accuracy, availability, or privacy/security practices of other websites, and/or services or goods that may be linked to or advertised on such third-party websites. By clicking on a third-party link, you will leave the current GSUSA site whereby policies of such third-party link may differ from those of GSUSA.

These words are used in Think Like an Engineer Pt. 3:

- **Biomechanical engineers** - people who use what they know about biology and mechanical engineering to solve problems related to health and safety. Biomechanical engineers work on projects such as designing artificial limbs, joint replacements, and safety equipment, like helmets and life jackets.
- **Form and Function** - the concept that the form (shape and size) of an object determines how well that object functions (does its job). For example, adding a rudder to a boat helps it to move in specific directions.
- **Prosthesis** - an artificial device that takes the place of a missing body part.
- **Prosthetic** - a replacement body part (e.g. A prosthetic device such as an artificial leg).
- **Technology** - anything created by people to help solve a problem or meet a need. Technology can be things that require electricity, such as computers and phones, or non-electric products, such as pencils, paper, and water bottles.
- **Sustainability** - coming up with a solution that lasts and continues to address the problem over time.

You will need the following Journey Meeting Aids found in the Appendix:

- **Engineering Notes: Elephant Prosthetic**: This handout guides girls through the Design Challenge. It includes details like criteria and constraints, a short story on how engineers solved a similar problem, space for groups to brainstorm solutions and plan their design, and instructions for testing.

**Other Things You Could Do to Prepare Ahead for this Meeting:**

- Send girls the link to watch the *Engineering Everywhere: Special Report* video before the meeting. This will save meeting time, give girls a better understanding of the Design Challenge,
and is a great option if Wi-Fi and equipment won't be available to show the video during your meeting.

- Bring in prosthetic devices to show to girls.
- Try it out! Challenge yourself to complete the Design Challenge. This will give you a hands-on chance to troubleshoot issues and solutions for the challenge before you do the activity with your troop.

**Activity 1: As Everyone Arrives: But Why?**

**Materials**

- **Prepare Ahead:** Write the group's list of community problems from the Journey meetings on index cards, one problem per card.
- Pens, pencils or markers
- For more examples of problems for Take Action projects, use the **Take Action Guide**. Girls can use the examples as thought starters that will help them develop their own ideas.

**Steps**

**Note to Volunteers:** This opening activity is meant to help the group examine the community problems they've identified as issues to address with a Take Action project. It can help the group to narrow down or broaden their focus before they choose one problem for their project in Opening Ceremony: Identify the Problem for Our Take Action Project.

Welcome everyone, and have them pair up or work in groups of 3. Divide the problem cards you created between the groups. Each group should spend time looking at their card(s), asking each other, "But Why?", and taking notes on the answers on the back of the card. Groups should drill down each problem to at least one root cause before moving on to the next card.

**THINGS TO KNOW:**

- Before engineers begin a new project, they investigate the problem and brainstorm many different ways they could design a solution.
- Over the past few meetings, you've brainstormed different community problems that you might like to work on for the Take Action project.
- Now, it's time to dig deeper into each of these problems. Ask yourself, "But why?" to explore why each of these problems happens.
- Think: What causes it? What conditions or contexts led to the problem?

**For example:** If the issue is polluted oceans, the "But Why..." questioning might go

1. The oceans are polluted.
2. But why? There is trash in the ocean.
4. But why? Humans don't use trash cans at the beach.
5. But why? There aren't enough trash cans for the amount of people at the beach.
6. But why? The local government doesn't have funding for additional trash cans or people to dispose of the trash.

*Cadette Think Like an Engineer Journey UNOFFICIAL Rewrite – Page 16*
Activity 2: Opening Ceremony: Identify the Problem for Our Take Action Project

Materials

- Take Action Guide, one for each girl
- Index cards with problems and root causes from As Everyone Arrives: But Why?

Steps

Ask girls to tell the group what they talked about during "As Everyone Arrives: But Why?" What problem did they discuss? What root cause(s) did they identify? Each group can share their problem topic as well as the causes they came up with for the issue.

As you talk about the problems and their root causes, reflect on what level of the problem the group might be able to address with a Take Action project. For example, the group may find that they need to scale down their original idea, based on the time and resources available.

Next, decide on one problem to address as a group for the Take Action project. Ask girls to look at all problems they've listed. Discuss which ideas are most interesting to the group, as well as which ones are the best candidates for a Take Action project.

To Help Narrow Down Your Problem List:

- Which of these problems happens the most in our community?
- Which of these problems impacts the most people in our community?
- Which of these problems most interests us?
- Which of these problems do we know the most about?
- Which of these problems are we in the best position to address?
- For which of these problems do you think we could create a sustainable solution?
- Which of these problems do you think could be solved with an engineering and/or technological solution?

At this stage, do not begin to brainstorm Take Action projects. The group only needs to identify one problem to address with their Take Action project. They should only begin to brainstorm solutions and project ideas if there is time towards the end of this meeting. They'll begin to design and plan their project next meeting.

Silver Award Connection: Remind everyone that all of these problems and issues are great starting points for a Silver Award project. This Journey's Take Action project builds girls' skills, like leadership and experience with project development, that will help as they take on their Silver Award!

If you're divided between a few ideas, choose one topic as a group and keep the others as backups. You can also vote - just make sure that anyone whose idea wasn't chosen knows that it was a good idea. After the group has decided on one problem, congratulate everyone!

Activity 3: Design Challenge: Elephant Prosthetic

Materials

- Design Thinking Process poster
- **Engineering Notes: Elephant Prosthetic**, one for each girl
- **Optional**: Computer, tablet or other device with ability to show the *Engineering Everywhere: Special Report* video (8:21). **This is optional**. You may not have the equipment, Wi-Fi, or time to show the video.

Each pair or group of 3 will need:

- 1 roll of string
- 1 roll of packaging tape
- 1 ruler
- 2 plastic grocery bags
- 2 sheets of felt
- 5 cardboard tubes (9" x 1.5"). Alternatively, you could stack cups or roll tubes using poster board.
- 5 rubber bands
- 1 measuring tape
- 1 pair of scissors
- Duct tape
- Extra blank or notebook paper (for planning)
- Pens or pencils

**Steps**

**Note to Volunteers**: Give 10- and 5-minute warnings to wrap up, leaving time for the Closing Ceremony. Before starting, post the Design Thinking Process poster. Also, prepare a space for groups to test their model prosthetic elephant legs. Ideally, have a flat, open area with a piece of sturdy furniture to hold onto.

**Identify and Investigate the Problem**

Hand out **Engineering Notes: Elephant Prosthetic**, and explain today's Design Challenge.

**Today's Design Challenge:**

- Today, you've been hired as biomechanical engineers to create a prosthetic device for a large land animal - an elephant!
- **Biomechanical engineers** use what they know about biology and mechanical engineering to solve problems related to health and safety.
- A **prosthetic device** is technology that's designed to replace the function of a body part. Prosthetic devices have been made by humans for centuries, and now engineers are beginning to create prosthetic devices for animals, too.

Identify the problem for the Design Challenge. Review the goal, criteria, how engineers use models, and the testing instructions for the Design Challenge.

- **Goal**: Engineer a model prosthetic elephant leg.
- **Criteria**: The model prosthetic elephant leg must:
  1. Support their weight
  2. Attach to the model's actual leg at the knee
  3. Stay together when used
4. Be comfortable to wear

- **Using Models in Engineering:** Biomechanical engineers sometimes use models of their subjects (whoever is using the product) to help them engineer prototypes. You won't have a real elephant to test your prototype today, so you'll be using your own bodies to model the weight of an elephant!

- **How to Test Your Prototype:** Review "Testing the Prosthetic Elephant Leg" in **Engineering Notes: Elephant Prosthetic.** For testing, each group will choose one girl to be the model for testing the prosthetic. She'll have to bend one knee and kneel on the prosthetic leg, shifting her weight to the bent knee.

**Optional:** Show the **Engineering Everywhere: Special Report video (8:21)** to the group. This is optional. You may not have the equipment, Wi-Fi connection, or the time to show the video.

Next, investigate the problem using "Chhouk's Prosthetic Leg" in the **Engineering Notes: Elephant Prosthetic** and see how other engineers have approached the same problem.

**DISCUSS:**

- What factors did the engineers who created Chhouk's prosthetic device have to consider in their design? (Answer: Function, comfort, durability, and attachment.)
- How will we represent the weight of the elephant in our model? Why are we using a model for this Design Challenge? (Answer: We will use the weight of our own bodies as the model. We cannot test on a real elephant because we don't have one; and if we did, it could be uncomfortable for the elephant. With a model, we can test as many times as we need.)
- Based on what you know about elephants, the criteria of the challenge, and the testing procedures, what do you think your design needs to include? **Possible answers:** Sturdy materials that do not bend, a stable base, a system to attach the device to our bodies, cushioning on the top, etc.

**Brainstorm Solutions, Plan and Build a Prototype**

After, form pairs or groups of 3 to gather supplies, plan, and build the prosthetic devices. Groups should spend a couple of minutes sketching at least three different ways they could solve the challenge. Encourage ideas both wild and practical - the best designs are often a combination of each! Groups can then choose one solution to plan and build together. Groups have 20 minutes to design their model prosthetic elephant leg. To help groups with time management, use a timer.

**Note to Volunteers:** If the groups are having trouble building their design, eliminate one of the four criteria to simplify the challenge. For instance, you could eliminate the “attachment” criteria, which would allow groups to hold their devices to their bent knee as they test.

Encourage each other to try lots of different solutions to see what works and doesn't work. Remember, the goal is to practice thinking like an engineer, NOT to make a perfect prosthetic! Let everyone know when there are 15, 10 and 5 minutes left.

**Test, Evaluate, and Redesign**

When time is up, have everyone bring their prototypes to the testing area. If needed, review "Testing the Prosthetic Elephant Leg" before groups begin to test.
Have one tester from each group test their device. The group can record their results on their Engineering Notes: Elephant Prosthetic. For the remaining activity time and as materials allow, groups can improve their prosthetics using their results from testing (what worked, what didn't.)

**Tips for Success: What if...**

- **Your tubes continue to break?** Stuff them with other materials. They will help to create a sturdier tube and even out the weight when used in the prosthetic.
- **Your prosthetic is uncomfortable?** See what materials you could you to soften the force of the model's knee on the prosthetic.
- **You run out of materials?** Go back to the drawing board and refine your prosthetic's design. Are there places you could trim back your design to focus on your prosthetic's most important features? See what improvements you can make to engineer a design that still fits within the material constraints for the Design Challenge.

*Courtesy of the Museum of Science, Boston. Adapted from the Engineering is Elementary, Go Fish: Engineering Prosthetic Tails. ©2014, 2016 Museum of Science.*

### Activity 4: Closing Ceremony: Communicate Our Design Decisions

**Materials**

- Design Thinking Process poster

**Steps**

Communicating your design is an important part of being an engineer. Gather together to reflect on the Design Challenge, and look more at your design decisions and testing results.

**QUESTIONS TO GET STARTED:**

- What are some of the important features of your design? How did they meet the criteria? **Possible answers:** We used felt to make the prosthetic comfortable, we made the leg sturdy and able to hold our model's weight using the cardboard tubes and tape, etc.
- What did you learn from testing? What does the data you collected say about how well you met the criteria of the challenge? (Answer: Testing procedures with a "yes" meet the criteria of the challenge. Testing procedures with a "no" need more improvement in that area.)
- Did your prototype work differently than you planned? What was different?
- Which steps of the Design Thinking Process did you use today? (Answer: We looked at what other engineers designed for the same problem, we planned and created our own designs, and we tested and shared our prototypes with others.)

Congratulate each other on being biomechanical engineers and using the Design Thinking Process! Engineers work together to make the world better for animals, people, and the environment. Remind everyone that they'll be investigating the problem and planning their Take Action project during the next meeting.

**Optional:** Talk as a group about any to-do's for the next meeting. This might include research on the problem (helpful if there's no Wi-Fi at your meeting venue), assigning a Girl Leader for the next meeting, or deciding who can help bring in materials.
If there's extra time, begin to brainstorm what the group might like to plan for the Take Action project. Remind the group that the project must be a sustainable solution that incorporates engineering and/or technology.

### Cadette Think Like an Engineer Journey Part 4

**Overview:** Cadettes use the Design Thinking Process to investigate the problem, brainstorm solutions, and create a plan for their Take Action project.

### Prepare Ahead

These words are used in Think Like an Engineer Pt. 4:

- **Empathy** - the ability to understand how someone else feels.
- **Sustainable solution** - a solution that lasts. Sustainable solutions often address the root causes of an issue. Sustainable solutions create a difference for those impacted by a problem over the long-term.
- **User-centered design** - When engineers practice user-centered design, they involve their users at every stage of the Design Thinking Process. By incorporating the user's needs, concerns, and feedback into their design, engineers are better able to create a product that solves their user's problem and takes into account what's most important to them.

You will need the following Journey Meeting Aids found in the Appendix:

- **Design Thinking Process Poster**
- **Take Action Guide**
- **Think, Pair, Share**

Other Things You Could Do to Prepare Ahead for this Meeting:

- **Research the Problem.** Have girls research the problem ahead of time. This helps if you won't have the ability (equipment, Wi-Fi, etc.) or time during the meeting.
- **Hear from Your Community.** Bring in a community member to talk about their concerns and needs related to the problem. This will give girls a one-on-one opportunity to gather information from their intended user and gain hands-on experience with user-centered design.

### Activity 1: As Everyone Arrives: Investigate with Star Bursts

**Materials**

- **Prepare Ahead:** On a large chart paper (or on a white board), draw a large six-pointed star. On the inside of the star, write the problem your troop has identified for their Take Action project. On the points of the star, write "Who," "What," "When," "Where," "Why," and "How." Depending on the number of girls in your troop, you may want to create multiple stars for groups to work on in pairs or smaller groups.
- Tape to hold poster on the wall (Alternatively, place the paper(s) on the floor or table.)
- Sticky notes
- Pens, pencils or markers
Note to Volunteers: This opening activity will help girls come up with questions they need to investigate before brainstorming possible solutions for their Take Action project later in the meeting.

As everyone arrives, welcome them, and have them generate a list of questions to investigate related to the problem they chose to address with their Take Action project.

**THINGS TO KNOW:**

- Today, you'll be designing your Take Action project. First, you'll investigate the problem you chose, just like engineers.
- Start by thinking about all the different questions that might come up as you plan and build your Take Action project. For example, who are you trying to help - what ideas do they have about solving the problem? What causes the problem? What materials will you need? How will you include engineering and technology?
- Fill in the star by writing your questions on sticky notes. Think big and small, both about the project and problem. The more questions you look at and are able to solve for in your initial project design, the less you will have to troubleshoot later.
- If you see that someone else has written a question you have, add your initials for us to easily see what questions the group agrees are most important for the project.

**Activity 2: Opening Ceremony: Plan to Take Action**

**Materials**

- Design Thinking Process poster

**Steps**

Introduce the meeting, sharing the Things to Know.

**THINGS TO KNOW:**

- Over the last few meetings, you've looked at different problems and issues your community faces. Last time, you looked at their root causes before you identified one problem to address with a Take Action project.
- Today, you'll plan the details of your Take Action project. Your project must 1) be a sustainable solution that addresses the root causes of an issue and 2) incorporate what you've learned throughout the Think Like an Engineer Journey about engineering and technology.
- Even though you might already have an idea of what you want to do, you'll have a chance to investigate the problem, brainstorm solutions, and plan how you're going to do it.
- By the end of today's meeting, make sure you have a list of supplies you need and action items for the next meeting.

**Activity 3: Design Our Take Action Project**

**Materials**

- Take Action Guide
- Star burst(s) from As Everyone Arrives: Investigate with Star Bursts
Large pieces of paper or poster boards
Blank paper
Markers
Sticky notes
Pens/pencils

Optional Prepare Ahead: Girls may want or need to find out more about their Take Action issue before the meeting. They can do an online search to learn more about the issue. They may also be able to talk to people in the community to find out more and get possible solutions. For example, if girls want to address a problem at their school, they could talk to other students or create a quick online survey to get ideas and feedback.

Optional: Bring laptops, tablets, or smartphones to research the Take Action project during the meeting. You may need to organize time at a computer lab or library. Girls could invite a guest speaker to the meeting or visit the organization they want to help (for example, a local animal shelter, food pantry, city park department, etc.) This will take additional meeting time.

Steps

Identify & Investigate the Problem

Take a few minutes to review the problem the group has identified for their Take Action project.

DISCUSS:

- What's the first step of the Design Thinking Process? (Answer: Define a problem or need.)
- What problem are we trying to solve?
- What are the next steps for our Take Action project? (Answer: Investigate the problem, brainstorm solutions, and design.)

Now, investigate the problem for the Take Action project. Look at the star burst of questions from As Everyone Arrives: Investigate with Star Bursts and use them as a starting point. At this point, don't worry about answering the questions.

DISCUSS:

- Are there any questions that we all think are important?
- Are there any questions that we already know the answers to?
- Which of the questions are most important? Least important?
- How will we answer these questions? Do we need to answer all of them?
- How can we categorize the questions to help us with planning?

Through the discussion, the question categories to emphasize are:

- Understanding the Problem: These are questions related to "Why" the problem happens and its impact on people, animals, and the environment. The questions build on the discussion of root causes in Think Like an Engineer Pt. 3. For example, why does the problem continue to happen? What other reasons are there for it happening that we haven't thought of yet? What is the impact of the problem?
- User-Centered Design: These are questions about those affected by the problem. Through discussion, girls can begin to define the user(s) for their Take Action project. The user is the community audience the group intends to help. For example, who is impacted by the problem?
Who do we want to help with the project? How can we make sure we address their needs and concerns?

- **Community Strengths, Weaknesses & Resources:** Why does the problem continue to happen in the community? Who in the community can help us solve this problem? Who has resources we may be able to use for our project?

- **Take Action Project Details:** These are questions related to the nuts and bolts of the Take Action project. For example, what is the project? How does the project incorporate engineering and technology? When and where will it happen? What materials will we need? Who do we need permission from to do our project?

Then, organize the sticky notes with the major questions for the group's Take Action project into these four categories. If there are questions that fit into multiple categories, the group can rewrite the question on another sticky note to have one in each category.

Discuss what the group already knows about the problem - what questions do you already know the answer to? If anyone has done research or has experience with the community, let them share what they know with the group.

After, make a plan for how you'll find answers to the other questions. Remember, research may need to be done outside of the meeting and could include reading articles, talking to community members, gathering data, and anything else that will help to inform the design of the Take Action project.

Optional: Research the Problem. If you have the time and/or equipment, investigate the problem during the meeting by having groups look at stories, data and anything else that helps to answer the questions. After the group has gathered research, have everyone present what they've found, sharing their new knowledge of the subject. This will take additional time.

**Brainstorm Solutions**

Now that the group has a better understanding of their problem, it's time to brainstorm different ways the Take Action project could be designed to solve the problem. If you find that girls need help thinking up ideas for their project, have them look back at some of the examples in the Take Action Guide during this part of the activity.

To experience using user-centered design in their Take Action project, have the group choose two very different people from the community and roleplay how each might solve the problem. Before the group responds, discuss what's important to each person. What would they want? What do they need? What could they do? What do they have the power to impact? Go around the group, and respond to each prompt, one-by-one:

- "(The leader) would solve our problem by..." For example, you might choose "The President," "The Principal," "The Mayor," etc.
- "(Person impacted) would solve our problem by..." For example, you might choose "Students," "Patients," "Refugees," etc.
- "I would solve the problem by..."

Remember - there's no solution too big, small, or wild at this point!

**Reminder:** Think carefully about what might be important to those you want to impact with your Take Action project. The best way to empathize with someone else is to talk to them. Right now, you're only brainstorming potential solutions, which means you most likely make assumptions about their needs and how each group would approach the problem.
As you create your Take Action project, find ways to talk to your community and user groups to create a project that takes into account what's most important to them. After everyone has had a chance to share their ideas for a prompt, discuss them as a group. Which ideas resonate with everyone? Which seem the most possible given the group's resources and abilities? Take note of which ideas the group are focusing on. Then, choose one solution to plan and design in detail for the Take Action project. As the group discusses what they'd like to do, remind everyone to listen and respect one another's ideas.

**TO HELP CHOOSE A SOLUTION, DISCUSS:**

- Would this solution work? Why or why not?
- Will this be a positive solution for our community? What are the benefits? Are there any risks?
- Do we have the time and/or resources to plan and complete this solution?
- If we can’t imagine ourselves doing this, are there parts of it that we can draw from?
- Which of these solutions incorporate engineering and technology?
- Which of these solutions do you think we can be part of?
- Which of these solutions would you like to be a part of?

**Plan Our Take Action Project**

Now that the group has decided on a solution, it's time to plan out the details of the Take Action project. Look back at the question the group had for "Take Action Project Details." Are there any more you can answer now that you've decided on a solution? Next, talk about the most important aspects of the project. Divide into design teams of 3-4 to focus on each aspect, and use the questions to start your project planning. Offer other questions for the group to consider, depending on what they want to do.

**Things to Consider...**

- How will the project help those affected by the problem? What are their needs or concerns?
- How will we make sure the project is sustainable?
- How will our project use what we’ve learned about engineering and technology?
- Who will be responsible for each part of the project?
- What materials will we need?
- What do we need to do outside of the meeting to prepare for the project?

**If we want to make a video...**

- How will we film it?
- What do we want to say?
- Do we want to wear costumes?
- Do we want to use music?
- How will we show it to people - at a school assembly, at a gathering of their families, by having an adult post it (safely) online?

**If we want to create posters...**

- What materials will we need?
- Where will we put the posters?
- Who can we ask for permission to put the posters on the walls?
- How should we ask for permission - what should we say?
- Once we get permission, what should the posters say? What will they look like?
- When do we want to hang up the posters?
Remind everyone that good teamwork is important. Encourage each other to take turns, and make sure everyone has a role or responsibility. The group(s) should keep a list of the "to do" items they are suggesting, for example: materials, people to talk to, etc. Save the plans for the next meeting.

**Note to Volunteers:** You may need to pave the way by calling school or town officials to get permission for what the group wants to do or set up a time for the troop to meet the officials and present their Take Action proposal. Lead the conversation to come up with ideas that allow the troop to have the experience of connecting with others to Take Action.

**Activity 4: Closing Ceremony: Share Our Project Plan**

**Materials**
- Plans and to-do lists created by girls in Design Our Take Action Project

**Steps**

Remind everyone that sharing your work and communicating your ideas are important parts of the Design Thinking Process and the Take Action project. As the troop is completing one project all together, it is important for everyone to understand what each group is responsible for. Gather together to share each group's plan for the Take Action project.

**DISCUSS:**
- What did you plan for the Take Action project? What materials, resources or help will you need?
- How did you include the community's and user's needs in your design?
- How did you use engineering and technology in your design?

After, reflect on the Take Action project and prepare for the next meeting.

**QUESTIONS TO GET STARTED:**
- Think back to the questions from earlier. What questions have been answered? Are there still questions to answer? How will we answer them?
- How does it make you feel to be working on an issue you care about?
- What do you think will be the most difficult part about creating the project next meeting? How can we troubleshoot these problems ahead of time?
- Is there anything we need to do to prepare for the next meeting?
- Who could we share the plan with after this meeting? **Possible Answers:** Our community, users, family, friends, teachers, neighbors, or classmates.

Go over the list of "to dos" to create the Take Action project at the next meeting. This might be making a list of materials, researching the problem more outside of the meeting, finding time to go over your plan with community members, assigning a Girl Leader for the next meeting, gathering names of people to talk to, etc.
Overview: Cadettes use the Design Thinking Process to create their Take Action project and presentation. After, they plan the celebration and awards ceremony for Think Like an Engineer Pt. 6

Prepare Ahead

Gather support for the Take Action Project: If you need more volunteers or adult helpers for the Take Action project, let them know the time and place of the meeting. Brief them on what you’re doing and how they can best support the project. The girls may also need to talk to people who are needed to complete the Take Action project. For example:

- **If girls want to create a maker space their school or local library**, they’ll need to make an appointment with the school/library office to make their proposal in person.
- **If girls want to create an engineering workshop for younger girls**, they’ll need to make arrangements with an administrator at their school or community center.
- **If girls want to advocate for the creation of an engineering club at their school**, they’ll need to talk to their teachers to learn what steps they need to take.

As much as possible, include your girls in all aspects of project planning. Use their Take Action project plan as a guide, and divide up roles and responsibilities to have the group prepare for the meeting.

Other Things You Could Do to Prepare Ahead for this Meeting:

- **Continue to Investigate the Problem.** If there are still questions from Think Like an Engineer Pt. 4 that the group needed to answer or things they needed to do, make sure girls research or complete any tasks in order to create the project this meeting.
- **Hear from Your Community.** Bring in a community member to talk about their concerns and needs related to the problem. Have girls share their plan for the project and ask how to improve their design. This will give girls a one-on-one opportunity to gather feedback from their community and gain hands-on experience with user-centered design.

Activity 1: As Everyone Arrives: Get Ready to Take Action!

Materials

- Paper
- Pens or pencils
- Materials from last meeting for the Take Action project (i.e. to-do list, starburst questions, action plans, etc.)

Steps

Welcome everyone, and have them review their Take Action project plan. The group can look at the list of to-dos', see if they can answer any more questions from the Star Burst activity last meeting, make sure everyone brought materials, look over the plan, etc.
Activity 2: Opening Ceremony: Review Our Plan to Take Action

Materials

- Design Thinking Process poster

Steps

Review the group's plan to Take Action.

DISCUSS:

- What is our Take Action project? What problem or issue are we trying to address?
- Can we answer any more of the questions that we needed to investigate?
- What were some of the solutions we came up with? Why did we choose our plan?
- How will we make sure our project helps the community? What most important to our community?
- Does our project meet the criteria for Take Action? (The project must 1. be sustainable, and 2. use engineering and/or technology.)

Activity 3: Create Our Take Action Project

Materials

- Any materials needed to carry out the Take Action project. For example, you may need: A smartphone or camera if you're creating a video, poster board if you're making signs, a laptop if you're making PowerPoint slides for a presentation to the school principal or city council, or material for costumes if you're putting on a skit.
- For more examples of Take Action projects, use the Take Action Guide. Girls can use the examples as thought starters that will help them develop their own ideas.

Steps

Note to Volunteers: Give 10- and 5-minute warnings to wrap up, leaving time for the Closing Ceremony.

Set Up

Work together to list the "to do" items from the last meeting. Remind the group of any they missed. If anyone did work or research since the last meeting, give them the opportunity to share their update and new knowledge with the group. This might include sharing the plan with people in the community, setting up a meeting with officials, securing permission for the project, etc. Discuss with the group if/how the new information impacts the plan? After, break into teams of 3-4 to create and build the Take Action project. These teams can be the same as those from the last meeting.

Build and Test Our Take Action Project

Groups create what they need (posters, videos, presentations, costumes, and scripts) for the Take Action project.

At the end of the 35 minutes, congratulate the group if they've completed the Take Action project. If there's more to do, remind the group of any "next steps" after the meeting. For example, if they've
decided to hold an event, remind everyone of the time and place of the event and any other important logistics.

Note to Volunteers: It may take more than one meeting for girls to complete their Take Action project, and that's all right! Let girls take the time they need to create a lasting project that makes an impact on the community. They'll have a more valuable experience if they have the time to create and refine a project they care about, instead of rushing to finish within the allotted meeting time.

Create a Presentation about Our Take Action Project

Remind the group that an important part of being an engineer is sharing what you've done with others. Everyone should be prepared to talk at the celebration about their Take Action project. They can tell others how they defined the problem, brainstormed and designed the project, and built it to be sustainable.

DISCUSS:

- How will we present our Take Action project to others?
- What do we want to tell others about it? What do they need to know?
- What do we need to prepare or bring in for the presentation?

After, brainstorm, in one large group or in smaller groups, and create a short presentation for the troop to give at the celebration in Think Like an Engineer Pt. 6. Older girls may want to try different presentation formats. For example, girls could:

- **Organize a mini "TED Talk,"** with each girl giving a 1-minute speech about their Take Action project. They may also want to film their talks to share with others.
- **Create a "Call to Action" event.** After presenting their Take Action project, they could invite guests to pitch in to help address their issue. Depending on their project, girls could suggest that guests could sign a petition, contact government officials to share their views, donate supplies or time to keep the project going, etc.
- **Launch a Take Action Pledge campaign** at the celebration, asking guests to share what they've learned about the issue with others and giving each guest a sticker or other item to remind them of their pledge.

Some things the group might want to share include:

- What problem or issue did we identify for the Take Action project?
- How did we use the Design Thinking Process in our Take Action project?
- How did we incorporate what's important to our community in our project?
- How does our project benefit the community?
- How is our Take Action project sustainable?
- How does our Take Action project use engineering and technology?
- What are some ways others can get involved to help solve the problem?

Activity 4: Closing Ceremony: Plan to Celebrate!

Materials

- Paper
- Pen or pencil
Steps

Gather together to plan the celebration for Think Like an Engineer Pt. 6.

QUESTIONS TO GET STARTED:

- Is there anything else we have to do for the Take Action project? How will we make sure it happens and the project is complete?
- At our next meeting, we'll celebrate everything we've learned. How do we want to celebrate?
- Who do you want to invite to the celebration? Is there anyone we want to thank?
- Do we want to make a special display of our prototypes from the Design Challenges or photos/videos from the Take Action project?
- What do we want to do for the Closing Ceremony?
- Who can bring in supplies? How else can we prepare for the celebration?

Write down the group's ideas. After, go over the list of "to dos" for the next meeting, and divide up responsibilities. This might include things to complete the Take Action project, a list of party supplies, finding time to share your Take Action project with community members, assigning a Girl Leader for the next meeting, etc. If there's anything others can do to help prepare for the celebration, let them know.

Cadette Think Like an Engineer Journey Part 6

Overview: Cadettes share their Take Action project, celebrate what they've learned, and receive their Think Like an Engineer and Take Action awards.

Prepare Ahead

Note to Volunteers: Depending on your troop, you might choose to save the Awards Ceremony until a later date - that's fine! Use this meeting for girls to present their Take Action project and reflect on what they've learned throughout the Journey.

Complete your Take Action project: Guide girls as they finish their Take Action project and prepare for their presentation before the meeting.

Invite others to the celebration: Ask girls if they'd like to invite guests - such as friends, family or people in the community who help with their Take Action project - to the celebration. Girls can let guests know about the time and place through email or phone calls; they may want to create a special invitation for community leaders, such as the mayor, city council members, school administrators or board members, etc.

Gather support for the celebration: Invite girls to plan the celebration and divide up tasks, such as bringing snacks, a music system, equipment to show photos/videos, etc. If you need more volunteers or adult helpers to organize everything for the celebration, let them know the time and place of the meeting. Tell them what you're doing, what they need to have prepared, and how they can help.

Gather supplies for the celebration: Ask girls what items they need for the celebration, such as snacks, decorations, a music system, materials created for the Journey, photos or videos taken on the Journey, etc. See if there are items you can ask girls to bring to the meeting. Buy the Think Like an Engineer and Take Action awards for each girl at your council shop or on the Girl Scout website.
Depending on the Take Action project, you may also need to prepare or set up specific things for the presentation.

Choose how you’ll give feedback on the program:

1. **Girl Input:** GSUSA wants to know what girls think about this program. We also want to find out how well the program worked in terms of increasing girls' interest, confidence, and competence in STEM. This information will help us to improve our program and talk about how the program has helped girls to learn about STEM. Please encourage your girls to take this survey so that their voices are heard. There are three ways you can help girls do this:

   - **Option 1: Girls take the survey at the last meeting:** You will need technology, i.e. tablets, laptops, Wi-Fi, to use this option. Set aside 10 - 15 minutes for girls to complete the survey. Use this link: [www.tinyurl.com/STEMgirlENGc](http://www.tinyurl.com/STEMgirlENGc)
   - **Option 2: Send survey link to parents:** Email parents and ask them to have their girls complete the girl survey. Here is some suggested text for your email to parents:

     Dear Parent,

     GSUSA wants to know what girls think about this program. We also want to find out how well the program worked in terms of increasing girls' interest, confidence, and competence in STEM. This information will help us improve our program and talk about how it has helped girls to learn about STEM.

     Please encourage your girl to take our survey by clicking on the following link: [www.tinyurl.com/STEMgirlENGc](http://www.tinyurl.com/STEMgirlENGc). It should only take 10 - 15 minutes.

     If you have any questions, please email the Girl Scout Research Institute at [GSresearch@girlscouts.org](mailto:GSresearch@girlscouts.org).

     Sincerely,

   - **Option 3: Print the survey (see appendix), have girls complete it, and send the surveys to GSUSA.** Please print copies of the Girl Survey, which you can find in the Meeting Aids section of this meeting plan

     1. Have each girl complete her own survey.

     2. Either scan the surveys and email them to: [GSresearch@girlscouts.org](mailto:GSresearch@girlscouts.org).

OR

2. Mail the surveys to: **Girl Scout Research Institute, 420 Fifth Avenue, 13th floor, New York, NY 10018**

**Volunteer Input:** At the end of the Journey, complete your own Volunteer Survey to give feedback on the program: [https://girlscoutsusa.ca1.qualtrics.com/jfe/form/SV_eEh5yb0ZJZpDHyB?Q_JFE=qdg&Source=ENGseriesCVol](https://girlscoutsusa.ca1.qualtrics.com/jfe/form/SV_eEh5yb0ZJZpDHyB?Q_JFE=qdg&Source=ENGseriesCVol)
Activity 1: As Everyone Arrives: Prepare for the Celebration

Materials

- **Design Thinking Process poster**
- Any items for the Take Action presentation or to display at the celebration (such as prototypes from the Design Challenges, photos or videos from their Take Action project, posters about their Take Action project problem, etc.)
- Photos and videos from the Journey meetings
- Music system
- Decorations
- Snacks

Steps

Have the troop set up the meeting room for the celebration by putting up posters and decorations. Set up anything for the Take Action project presentation. As guests walk in, have girls give them a warm welcome and offer them a snack.

Activity 2: Opening Ceremony: Welcome!

Steps

Introduce any special guests.

Activity 3: Take Action Project Presentation & Awards Ceremony

Materials

- Anything girls brought or prepared for their presentation
- Think Like an Engineer award, one for each girl
- Take Action award, one for each girl

**Note to Volunteers:** You can buy these awards from your council shop or on the GSUSA website.

Steps

Have the troop present their Take Action project to their guests. Older girls may want to try different presentation formats. For example, girls could:

- **Organize a mini "TED Talk,"** with each girl giving a 1-minute speech about their Take Action project. They may also want to film their talks to share with others.
- **Create a "Call to Action" event.** After presenting their Take Action project, they could invite guests to pitch in to help address their issue. Depending on their project, girls could suggest that guests could sign a petition, contact government officials to share their views, donate supplies or time to keep the project going, etc.
- **Launch a Take Action Pledge campaign** at the celebration, asking guests to share what they've learned about the issue with others and giving each guest a sticker or other item to remind them of their pledge.
Some things the group might want to share include:

- What problem or issue did we identify for the Take Action project?
- How did we use the Design Thinking Process in our Take Action project?
- How did we incorporate what's important to our community in our project?
- How does the project benefit the community?
- How is our Take Action project sustainable?
- How does our Take Action project use engineering and technology?
- What are some ways others can get involved to help solve the problem?

Share "Things to Know" as girls receive their awards.

THINGS TO KNOW:

- You have earned your Think Like an Engineer award, which means you have learned how to see needs in the world and come up with solutions.
- You have earned a Take Action award because you designed and completed a sustainable project to make the world a better place. Your Take Action project solves a problem in your community and uses what you've learned about engineering and technology.

Activity 4: Girl Survey

Materials

- If girls are taking the survey online: Laptop/tablet
- If girls are filling out the survey on paper: Copies of Girl Survey (see appendix) and pen or pencil.

Steps

Have the troop complete the Girl Survey for the Think Like an Engineer Journey.

THINGS TO KNOW:

- The people at the Girl Scouts' national office want to know what you think about it, how you think it could be improved, and what you think of STEM in general. This is a great chance for you to help Girl Scouts create STEM programs that other girls will enjoy!
- It will take about 10 - 15 minutes. You'll take the survey either online or by filling out a printed version.

Note to Volunteers: We hope that all girls will complete the survey; we want every girl's voice to be heard. However, the survey is voluntary, so girls don't have to take the survey if they don't want to.

Activity 5: Closing Ceremony: Think Like an Engineer

Materials

- Anything the girls brought or prepared for the Closing Ceremony

Steps

Gather together for the Closing Ceremony.
Think Like an Engineer Journey Pt. 1
Materials List for Cadettes

ACTIVITY 1: AS EVERYONE ARRIVES: Build an Animal Model
- Each group of 3 will need:
  - Dog Model Template
  - 1 sheet of foam (roughly 9 x 12 in.)
  - 1 unopened can (12 oz.)
  - Scissors
  - Duct tape
- Optional: Extra foam and markers to design and build animals other than a dog.
- Optional Prepare Ahead: Depending on your troop and time available, you may want to cut the foam pieces ahead of time, putting each set of pieces into a bag or envelope for each group to assemble.

ACTIVITY 2: OPENING CEREMONY: Engineering Everywhere
- Flag
- Design Thinking Process poster
- Optional: Poster Board with the Girl Scout Promise and Law

ACTIVITY 3: DESIGN CHALLENGE: Corgi Life Vest
- Prepare Ahead: Fill a large plastic tub with water, and place it in an area of the room that can get wet. This will be the testing station.
- Towels for testing clean-up
- Design Thinking Process poster
- Engineering Notes: Corgi Life Vest, one for each girl
- Stopwatch
- Optional Prepare Ahead: Find and print, save or bookmark picture(s) of corgis and life vests
- Each group of 3 will need:
  - Model dog created in As Everyone Arrives: Build an Animal Model
  - 2 sheets of foam (roughly 9 x 12 in. each)
  - 2 plastic bags (strong sandwich bags)
  - 3 large rubber bands
  - Measuring tape
  - Scissors
  - Duct tape
  - Extra blank paper (for planning)
  - Pens or pencils

ACTIVITY 4: CLOSING CEREMONY: Reflect on Our Results
- Design Thinking Process poster
ACTIVITY 1: What’s a Community?
- Prepare Ahead: Before the meeting, create 2 large chart papers. Label them with “Community is...” and “Types of Communities”
- Tape to hold posters on walls (Alternatively, place papers on different floor/table areas around the meeting space.)
- Markers
- Star stickers (Alternatively, girls can draw stars.)

ACTIVITY 2: OPENING CEREMONY: Brainstorm Problems in Our Community
- Flag
- Community lists from As Everyone Arrives: What’s a Community?
- Take Action Guide
- Design Thinking Process poster
- Optional: Poster Board with the Girl Scout Promise and Law

ACTIVITY 3: DESIGN CHALLENGE: Camp Cabin Inspired by Nature
- Design Thinking Process poster
- Engineering Notes: Camp Cabin, one for each girl
- 1 ball of string
- 1 electric fan, approximately 9 inches
- 1 roll of aluminum foil
- 1 spray bottle with water
- Construction paper, each group will need a quarter sheet of construction paper for testing
- Stopwatch
- Optional Prepare Ahead: Find and print, save or bookmark pictures of other animal shelters.
- Each group of 3 will need:
  - 1 piece of masking tape, 12 inches long
  - 1 piece of packaging tape, 12 inches long
  - 1 sheet of cardboard, 8"x 8"
  - 2 plastic cups, 1–2 oz.
  - 2 sheets of construction paper
  - Measuring tape
  - Scissors
  - Animal Shelter Examples
  - Extra paper (for planning)
  - Pens or pencils
Think Like an Engineer Journey Pt. 3

Materials List for Cadettes

**ACTIVITY 1: AS EVERYONE ARRIVES: But Why?**
- **Prepare Ahead:** Write the group’s list of community problems from the Journey meetings on index cards, one problem per card.
- Pens, pencils or markers
- For more examples of problems for Take Action projects, use the Take Action Guide. Girls can use the examples as thought starters that will help them develop their own ideas.

**ACTIVITY 2: OPENING CEREMONY: Identify the Problem for Our Take Action Project**
- Flag
- Take Action Guide, one for each girl
- Design Thinking Process poster
- Index cards with problems and root causes from As Everyone Arrives: But Why?
- Optional: Poster Board with the Girl Scout Promise and Law

**ACTIVITY 3: DESIGN CHALLENGE: Elephant Prosthetic**
- Design Thinking Process poster
- Engineering Notes: Elephant Prosthetic, one for each girl
- Optional: Computer, tablet or other device with ability to show the Engineering Everywhere: Special Report video (8:21). This is optional. You may not have the equipment, Wi-Fi, or the time to show the video.
- Each group of 3 will need:
  - 1 roll of string
  - 1 roll of packaging tape
  - 1 ruler
  - 2 plastic grocery bags
  - 2 sheets of felt
  - 5 cardboard tubes (9" x 1.5") Alternatively, you could stack cups or roll tubes using poster board.
  - 5 rubber bands
  - 1 measuring tape
  - 1 pair of scissors
  - Duct tape
  - Extra blank or notebook paper (for planning)
  - Pens or pencils

**ACTIVITY 4: CLOSING CEREMONY: Communicate Our Design Decisions**
- Design Thinking Process poster
Think Like an Engineer Journey Pt. 4

Materials List for Cadettes

ACTIVITY 1: AS EVERYONE ARRIVES: Investigate with Star Bursts

- **Prepare Ahead:** On a large chart paper (or on a white board), draw a large six-pointed star. On the inside of the star, write the problem your troop has identified for their Take Action project. On the points of the star, write “Who,” “What,” “When,” “Where,” “Why,” and “How.” Depending on the number of girls in your troop, you may want to create multiple stars for groups to work on in smaller groups.

- Tape to hold poster on the wall (Alternatively, place the paper(s) on the floor or table.)
- Sticky notes
- Pens, pencils or markers

ACTIVITY 2: OPENING CEREMONY: Plan to Take Action

- Flag
- **Design Thinking Process poster**
- **Optional:** Poster Board with the Girl Scout Promise and Law

ACTIVITY 3: Design Our Take Action Project

- **Take Action Guide**
- Star burst(s) from As Everyone Arrives: Investigate with Star Bursts
- Large pieces of paper or poster boards
- Blank paper
- Markers
- Sticky notes
- Pens/pencils

- **Optional Prepare Ahead:** Girls may want or need to find out more about their Take Action issue before the meeting. They can do an online search to learn more about the issue. They may also be able to talk to people in the community to find out more and get possible solutions. For example, if girls want to address a problem at their school, they could talk to other students or create a quick online survey to get ideas and feedback.

- **Optional:** Bring laptops, tablets, or smartphones to research the Take Action project during the meeting. You may need to organize time at a computer lab or library. Girls could invite a guest speaker to the meeting or visit the organization they want to help (for example, a local animal shelter, food pantry, city park department, etc.) This will take additional meeting time.

ACTIVITY 4: CLOSING CEREMONY: Share Our Project Plan

- Plans and to-do lists created by girls in Design Our Take Action Project
ACTIVITY 1: AS EVERYONE ARRIVES: Get Ready to Take Action!
• Paper
• Pens or pencils
• Materials from last meeting for the Take Action project (i.e. to-do list, starburst questions, action plans, etc.)

ACTIVITY 2: OPENING CEREMONY: Review Our Plan to Take Action
• Flag
• Design Thinking Process poster
• Optional: Poster Board with the Girl Scout Promise and Law

ACTIVITY 3: Create Our Take Action Project
• Any materials needed to carry out the Take Action project. For example, you may need: A smartphone or camera if you're creating a video, poster board if you're making signs, a laptop if you're making PowerPoint slides for a presentation to the school principal or city council, or material for costumes if you're putting on a skit.
• For more examples of Take Action projects, use the Take Action Guide. Girls can use the examples as thought starters that will help them develop their own ideas.

ACTIVITY 4: CLOSING CEREMONY: Plan to Celebrate!
• Paper
• Pen or pencil
Think Like an Engineer Journey Pt. 6

Materials List for Cadettes

ACTIVITY 1: AS EVERYONE ARRIVES: Prepare for the Celebration

- Girl Scout Promise and Law poster(s)
- Design Thinking Process poster
- Any items for the Take Action presentation or to display at the celebration (such as prototypes from the Design Challenges, photos or videos from their Take Action project, posters about their Take Action project problem, etc.)
- Photos and videos from the Journey meetings
- Music system
- Decorations
- Snacks

ACTIVITY 2: OPENING CEREMONY: Welcome!

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

ACTIVITY 3: Take Action Project Presentation & Awards Ceremony

- Anything girls brought or prepared for their presentation
- Think Like an Engineer award, one for each girl
- Take Action award, one for each girl
  (Note to Volunteers: You can buy these awards from your council shop or on the GSUSA website.)

ACTIVITY 4: CLOSING CEREMONY: Think Like an Engineer

- Anything girls brought or prepared for the Closing Ceremony
Think Like an Engineer Journey

Glossary for Cadettes

Bioinspiration – the process of being inspired by living things. Bioinspired engineering is a new and growing field. It combines knowledge of engineering and natural sciences to develop technologies that are often more sustainable than those not inspired by nature. Many technologies are bioinspired, such as Velcro strips inspired by plant burrs or aerodynamic cars shaped like boxfish.

Biomechanical engineers – people who use what they know about biology and mechanical engineering to solve problems related to health and safety. Biomechanical engineers work on projects such as designing artificial limbs, joint replacements, and safety equipment, like helmets and life jackets.

Constraints – ways that you or your design are limited. For example, you might only have a certain amount of time or materials for your prototype.

Criteria – things you or your design needs to accomplish. For example, if your Design Challenge is “You must create a tower 4 feet tall” or “You must build a structure that can withstand wind for 30 seconds,” those are your criteria.

Design Thinking Process – the steps engineers use to design technologies to solve problems. Engineers begin with identifying a problem that needs to be solved and investigating what has already been done. Next, engineers imagine different solutions and plan their designs. Then, they create and test their designs and make improvements based on the test results. Finally, engineers communicate their findings to others.

Empathy – the ability to understand how someone else feels.

Engineers – people who use their creativity and knowledge of math and science to design technologies that solve problems. They create infrastructure like bridges, build clean water solutions like wells, design energy solutions like solar and wind power, build rockets that take aeronauts into space, and so much more.

Form and function – the concept that the form (shape and size) of an object determines how well that object functions (does its job). For example, adding a rudder to a boat helps it to move in specific directions.

Materials engineering – the field of engineering focused on designing materials with desired properties. Materials engineers use their understanding of the properties of different materials (such as metals, plastics, or woods) to design and improve technologies. In particular, materials engineers explore the properties of different materials to help them choose which material will work best to solve the problem.

Model – a representation that helps us to understand an object or concept. Biomechanical engineers sometimes use models of their subjects to help them engineer prototypes before they are ready to test their designs in the real world.

Prosthesis – an artificial device that takes the place of a missing body part.
**Prosthetic** – a replacement body part (e.g. A prosthetic device such as an artificial leg).

**Prototype** – a quick way to show your idea to others or to try it out. It can be as simple as a drawing or it can be made with everyday materials like cardboard, paper, string, rubber bands, etc.

**Sustainability** – coming up with a solution that lasts and continues to address the problem over time.

**Sustainable solution** – a solution that lasts. Sustainable solutions often address the root causes of an issue. Sustainable solutions create a difference for those impacted by a problem over the long-term.

**Technology** – anything created by people to help solve a problem or meet a need. Technology can be things that require electricity, such as computers and phones, or non-electric products, such as pencils, paper, and water bottles.

**User-centered design** – When engineers practice user-centered design, they involve their users at every stage of the Design Thinking Process. By incorporating the user’s needs, concerns, and feedback into their design, engineers are better able to create a product that solves their user’s problem and takes into account what’s most important to them.
THE DESIGN PROCESS

Used by engineers, inventors, and other problem solvers, the design process is a series of steps that help people think creatively and come up with solutions.

DEFINE THE NEED

BRAINSTORM

DESIGN

BUILD

REDESIGN

TEST & EVALUATE

SHARE SOLUTIONS
Think Like an Engineer Journey

Brainstorming Tips: Think, Pair, Share

HOW TO RUN A THINK, PAIR, SHARE ACTIVITY:
Tell girls that they’re going to brainstorm answers to your question using “Think, Pair, Share.” Lead girls through the basic steps by telling them they will:

1. **Break into small groups.**
2. **Listen to the question or prompt.**
3. **Think about their answers.**
   - Girls may want to write their answers down.
   - Twenty seconds should be enough time, since girls will need to sit quietly.
4. **Pair with other girls.**
   - Girls talk with one to three other girls (depending on group size), making sure everyone has a chance to share their answers. If there’s time, it’s OK for girls to ask questions about each other’s answers.
   - For pairs, 20 seconds should be enough time. If your troop enjoys discussion, consider extending this to 1 to 2 minutes.
5. **Share with the group.**
   - Girls share their answers with the larger group.
   - This can be completed in 20–30 seconds, but will run longer based on group size and how the group sharing is done.

THERE ARE TWO WAYS TO SET UP GROUP SHARING:

- **Strongly Recommended:** One girl shares the best/most interesting/summary answer for the group. This approach is great if you’re running short on time. It also helps develop conflict resolution and compromise skills.
- **Optional:** Each girl shares her partner’s answer. This helps girls develop active listening skills, but will run longer because all girls are sharing.
Think Like an Engineer Journey Pt. 1

Engineering Notes: Corgi Life Vest

Design Challenge:
You’ve been hired by a family who has a corgi named Champ. Corgis have a hard time swimming because of their short legs. In preparation for an upcoming trip, the family would like a life vest made for Champ that would allow him to play with the children in the lake.

Note: If you made an animal model other than a dog, use your imagination to create a reason why your animal might need to be able to float.

IDENTIFY & INVESTIGATE THE PROBLEM.
Goal: Engineer a life vest that keeps the model dog’s head above water.

<table>
<thead>
<tr>
<th>CRITERIA: Things you or your design need to accomplish.</th>
<th>CONSTRAINTS: Ways that you or your design are limited.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Your life vest must allow the model dog to float with its head above the water for 10 seconds.</td>
<td>• You can use up to two plastic bags, two sheets of foam, three rubber bands, one measuring tape, and one pair of scissors.</td>
</tr>
<tr>
<td>• Your life vest must attach and detach from the model dog as quickly as possible.</td>
<td>• The scissors and measuring tape cannot be used as a part of the life vest.</td>
</tr>
<tr>
<td></td>
<td>• You cannot test the life vest on the model dog until the designated testing time.</td>
</tr>
<tr>
<td></td>
<td>• You have 20 minutes to engineer your life vest prototype.</td>
</tr>
<tr>
<td></td>
<td>• After, you’ll have 20 minutes to test, iterate, and improve the life vest.</td>
</tr>
</tbody>
</table>

Design Thinking Process
- Identify the Problem
- Investigate the Problem
- Brainstorm & Plan
- Build
- Test
- Analyze Results and Improve
- Share Your Solution

(continued)
BRAINSTORM SOLUTIONS, PLAN & BUILD A PROTOTYPE.

What’s the design plan for your life vest? Write ideas or draw plans for your design here. Use extra paper if you need to!
TEST, EVALUATE, AND REDESIGN.

What materials or methods worked best for keeping Champ afloat?

What materials or methods worked best for quickly attaching and detaching the life vest to and from Champ?

Courtesy of the Museum of Science, Boston. Adapted from the Engineering is Elementary, Go Fish: Engineering Prosthetic Tails. ©2014, 2016 Museum of Science.
Think Like an Engineer Journey Pt. 1

**Dog Model Template**

Use this handout to trace the shapes on to a piece of foam. Cut out the foam pieces and attach them to the can with duct tape to create your model corgi.

The assembled model will look like this with the head placed on one end of the can.

*Courtesy of the Museum of Science, Boston. Adapted from the Engineering is Elementary, Go Fish: Engineering Prosthetic Tails. ©2014, 2016 Museum of Science.*
Think Like an Engineer Journey Pt. 2

Engineering Notes: Camp Cabin

**Design Challenge:**
You’ve been contacted by a local engineering firm. The firm has a client who owns a local summer camp and would like you to design their new cabins. She would like the cabins to be based upon, or inspired by, shelters created by animals.

**IDENTIFY & INVESTIGATE THE PROBLEM.**

**Goal:** Engineer a model cabin inspired by a shelter created by an animal.

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>CONSTRAINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Your model cabin must be inspired by at least one of the example animal shelters.</td>
<td>● You have 10 minutes to brainstorm and plan. After, you have 20 minutes to engineer.</td>
</tr>
<tr>
<td>● Your model cabin must be water and wind resistant.</td>
<td>● You may use up to one sheet of cardboard, two sheets of construction paper, two plastic cups, 12 inches each of masking and packaging tape, and any amount of aluminum foil and string.</td>
</tr>
<tr>
<td>● Your model cabin must contain an entrance. The entrance should allow for a ¼ sheet of construction paper to easily be placed inside and taken out.</td>
<td>● A measuring tape and scissors may be used as tools.</td>
</tr>
<tr>
<td>● Your model cabin must be at least 5 inches tall and 5 inches wide.</td>
<td></td>
</tr>
</tbody>
</table>

**Design Thinking Process**

- Identify the Problem
- Investigate the Problem
- Brainstorm & Plan
- Build
- Test
- Analyze Results and Improve
- Share Your Solution

(continued)
BRAINSTORM SOLUTIONS, PLAN AND BUILD A PROTOTYPE.

Which animal shelter(s) will you draw inspiration from?

☐ Bird’s Nest
☐ Beaver Lodge
☐ Termite Mound
☐ Wasp Nest
☐ Other: ................................................................................................................

What’s the design plan for your model cabin? Write ideas or draw plans for your design here. Use extra paper if you need to!
TEST, EVALUATE, AND REDISEIGN.

• **Is the cabin wind resistant?** Place your cabin in front of the fan for 15 seconds. Start the fan on the lowest setting. If your cabin isn’t moved by the wind, turn the fan to a higher setting.

• **Is the cabin water resistant?** Put a small sheet of construction paper inside of your cabin. Spray the top of the cabin with water 15 times, and check if the construction paper was able to stay dry.

**What happened during testing?**

In the wind, my cabin:

- [ ] It slid.
- [ ] It tipped or fell.
- [ ] The wind pushed it.
- [ ] No movement.

This much water dripped on the paper in my model cabin:

- [ ] None
- [ ] Spots of < ½ inch
- [ ] Spots of ½ –1 inch
- [ ] Spots >1 inch

Think Like an Engineer Journey Pt. 3
Animal Shelter Examples

**BIRD’S NEST**
A bird’s nest is where a bird keeps its eggs and raises its young. The structure is usually made of intertwined and woven twigs and leave. Often, birds use mud to seal the woven pieces together.

**BEAVER LODGE**
These are structures built by beavers to keep out predators, like coyotes and bears. Beavers make their lodges out of mud, stones, leaves, sticks, and bark to make a large and very strong structure.

**TERMITE MOUND**
Termites live in a nest at the base of a mound that has many chambers and tunnels. Termites create a mixture of earth materials and saliva that makes a concrete-like, water-resistant material that surrounds their mound.

**WASP NEST**
Wasps are able to chew up and soften wood fibers in order to make a paper pulp they can use to construct a nest. The mixture of paper fiber and saliva they use creates a water-resistant building material.

*Courtesy of the Museum of Science, Boston. Adapted from the Engineering is Elementary, It’s in the Bag: Engineering Bioinspired Gear. ©2014, 2016 Museum of Science.*
Think Like an Engineer Journey Pt. 3

Engineering Notes: Elephant Prosthetic

**Design Challenge:** You’ve been hired as a biomechanical engineer to create a prosthetic device for a large land animal—an elephant!

- Biomechanical engineers use what they know about biology and mechanical engineering to solve problems related to health and safety.
- A prosthetic device is a technology that is designed to replace the function of a body part. Prosthetic devices have been made by humans for centuries, and now engineers are beginning to create prosthetic devices for animals, too.

**IDENTIFY THE PROBLEM.**

**Goal:** Engineer a model prosthetic elephant leg.

**CRITERIA:**

- The model prosthetic elephant leg must:
  - Support their weight
  - Attach to the model’s actual leg at the knee
  - Stay together when used
  - Be comfortable to wear

**INVESTIGATE THE PROBLEM: Chhouk’s Prosthetic Leg**

In 2007, a young elephant in need of help was discovered in a remote region of northeastern Cambodia. The elephant was alone and having trouble moving around because the bottom portion of his right front leg had been lost. The injury was likely caused by a hunter’s snare trap.

Human volunteers cared for the elephant and nursed him back to health. They named him “Chhouk,” which means “Lotus Flower,” and arranged for him to be transported to a wildlife rescue center where veterinarians and animal specialists could help him.

It soon became clear that Chhouk needed a prosthetic device to keep him healthy and restore his ability to walk. A team of biomechanical engineers created a prosthetic leg that was designed to function just like his original one. They chose materials that were strong enough to support his massive weight and durable enough to last. They also used soft padding and straps to ensure that the device was comfortable to wear and easy to attach.

The design was a success! Upon receiving his new prosthetic device, Chhouk’s medical issues and spirit improved rapidly. Even so, the engineers have continued to improve upon their original design, creating several new versions of the device that match Chhouk’s growing size and boundless energy!

*Article adapted from: Wildlife Alliance, Chhouk, the Elephant with a Prosthetic Foot*

*Courtesy of the Museum of Science, Boston. Adapted from the Engineering is Elementary, Go Fish: Engineering Prosthetic Tails. ©2014, 2016 Museum of Science.*

(continued)
BRAINSTORM SOLUTIONS, PLAN AND BUILD A PROTOTYPE.

What's the design plan for your prototype of a prosthetic for an elephant? Write ideas or draw plans for your design here. Use extra paper if you need to!
TESTING THE PROSTHETIC LEG

Carefully place your knee onto the top of your model prosthetic elephant leg and secure any attachments you have designed. Hold onto a friend or a steady piece of furniture to prevent yourself from losing your balance. Follow the testing procedures below.

**Function**

Place your weight on the prosthetic leg.

Does the device feel stable?

☐ Yes  ☐ No

**Comfort**

Place your weight on the prosthetic leg.

Does the device feel comfortable?

☐ Yes  ☐ No

**Attachment**

Lift your leg off the ground.

Does the device stay attached to your knee?

☐ Yes  ☐ No

**Durability**

Walk in place for five steps.

Does the device stay together?

☐ Yes  ☐ No

---

Courtesy of the Museum of Science, Boston. Adapted from the Engineering is Elementary, Go Fish: Engineering Prosthetic Tails. ©2014, 2016 Museum of Science.
Congratulations on Completing the Think Like an Engineer Journey!!

We’d love to know what you think about it. Please take a few minutes to tell us about your experience with this program. The survey should take 5-10 minutes to complete. Your answers are private and will be used to improve Girl Scout program. Here are a couple of things to know before you get started:

- **STEM stands for Science, Technology, Engineering and Math.**
- **If you do not want to take the survey, you do not have to.** However, we hope you will so we can learn more about you and what you think about STEM.
- **Please read each question carefully and mark the answer that is most like you.** If you don’t understand a question, please ask an adult for help.
- **This is not a test.** There are no right or wrong answers. We want to know what you really think and feel.

1. **How much did you like the program you just finished?**
   - [ ] A lot
   - [ ] A little
   - [ ] Not very much
   - [ ] Not at all

2. **This program was...**
   - [ ] Way too easy
   - [ ] A little too easy
   - [ ] Just right
   - [ ] A little too hard
   - [ ] Way too hard

3. **Would you recommend this program to your friends?**
   - [ ] Definitely
   - [ ] Probably
   - [ ] Probably not
   - [ ] Definitely not

4. **How true are these statements to you?**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Very true</th>
<th>Kind of true</th>
<th>Not very true</th>
<th>Not true at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>This program makes me want to do more STEM program with Girl Scouts.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I hope that my troop does more STEM programs soon.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I did an activity in this program that I’ve never done before.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I learned something new about science, engineering or technology in this program.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. **Would you like to do more STEM activities through Girl Scouts?**
   - [ ] Yes
   - [ ] Maybe
   - [ ] No

6. **During this program, did you lead or help lead a meeting?**
   - [ ] Yes
   - [ ] No

7. **Did you complete a Take Action project for this Journey?**
   - If YES, please tell us about your Take Action project:

```
```

8. **Do you know the steps of the Design Thinking Process?**
   - [ ] Yes, I learned the steps of the Design Thinking Process in this program.
   - [ ] No, I already knew the steps of the Design Thinking Process.
   - [ ] No, I don’t know the steps of the Design Thinking Process.

9. **Do you know what an Engineer does?**
   - [ ] Yes, I learned what Engineers do in this program.
   - [ ] Yes, I knew some things about Engineers before but I learned more in this program.
   - [ ] Yes, I knew about engineers and didn’t learn anything new.
   - [ ] No, I don’t know what Engineers do.
10. What did you like most about this program? 

11. How could Girl Scouts make this program better? 

12. Describe one thing you learned in this program that you didn’t know before. 

For the following statements, CIRCLE the answer that describes how much the statement is LIKE YOU!

<table>
<thead>
<tr>
<th>How much is this like you?</th>
<th>Exactly</th>
<th>A lot</th>
<th>Kind of</th>
<th>A little</th>
<th>Not at all</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like to figure out how things work.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I love building things.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am excited to learn more about science.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can do most science projects I try.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am very good at solving problems.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am very good at coming up with new ideas when working on projects.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How much do you agree with each statement?</th>
<th>Exactly</th>
<th>A lot</th>
<th>Kind of</th>
<th>A little</th>
<th>Not at all</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking like a scientist will help me do well in my classes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineers make the world a better place to live.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowing science and technology is important for being a good citizen.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How much is this like you? When trying to solve a problem...</th>
<th>Exactly</th>
<th>A lot</th>
<th>Kind of</th>
<th>A little</th>
<th>Not at all</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>I first try to understand what caused it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think about different ways to solve it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I gather or consider information from different places.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think carefully about the information I have obtained.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I try different ways to solve it when I get stuck.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. Which of these is like you?  
○ I usually don’t like doing STEM activities.  ○ I kind of like doing STEM activities.  ○ I love doing STEM activities.

14. What Girl Scout level are you?  
○ Daisy  ○ Brownie  ○ Junior  ○ Cadette  ○ Senior  ○ Ambassador

15. How many years have you been a Girl Scouts (not including this year)?  
○ None, this is my first year  ○ 1 year  ○ 2 years  ○ 3 years  ○ 4 years  ○ More than 4 years

THANK YOU for completing this survey! ☺️

6-12 Think Like an Engineer Journey - Cadette