



ENGINEER



RATIONALE FOR ADVENTURE

This adventure will provide a fun way to learn about science and mathematics technologies and introduce Scouts to career options in engineering.

TAKEAWAYS FOR CUB SCOUTS

- A basic understanding of the engineering world: what an engineer does and the impact of engineering on our daily lives
- Learning about career choices in engineering and schoolwork that can help prepare them
- Awareness of the Engineering merit badge for Boy Scouts, which offers more advanced learning and projects than this adventure

ADVENTURE REQUIREMENTS

Webelos Handbook, page 360

Do all of these:

1. Pick one type of engineer. With the help of the Internet, your local library, or a local engineer you may know or locate, discover and record in your book three things that describe what that engineer does. (Be sure to have your Webelos den leader, parent, or guardian's permission to use the Internet.) Share your findings with your Webelos den.
2. Learn to follow engineering design principles by doing the following:
 - a. Examine a set of blueprints. Using these as a model, construct your own set of blueprints or plans to design a project.
 - b. Using the blueprints or plans from your own design, construct your project. Your project may be something useful or something fun.
 - c. Share your project with your Webelos den and your pack by displaying the project at a pack meeting.
3. Explore other fields of engineering and how they have helped form our past, present, and future.
4. Pick and do two projects using the engineering skills you have learned. Share your projects with your den, and also exhibit them at a pack meeting.

NOTES TO DEN LEADER

Meeting 3 will be a den outing to visit a city or county engineer, to tour a college of engineering or a U.S. Army Corps of Engineers project—or any trip that would enhance the Scouts' learning experience. In advance of the outing, the leader will need to make arrangements with the outing location and confirm the outing plan with families, including transportation and any additional items they need to bring. Make sure a tour and activity plan has been submitted, if required, and activity consent forms are distributed, signed, and collected.

You may also invite local engineers to assist at Meetings 1 and 2. Share the adventure requirements with each guest so he or she can be prepared. Engineers may be found through government offices, acquaintances, phone directories, Internet searches, construction firms, or local colleges or universities. Other potential guests include electricians, plumbers, surveyors, architects, and heavy equipment operators.

See the Appendix for optional den meeting activities, including openings, gatherings, and closings.

MEETING 1 PLAN

PREPARATION AND MATERIALS NEEDED

- U.S. and den flags
- Sample set of blueprints or plans (Guests may be able to provide these, or you might borrow them from a building contractor or find them in a local library.)
- Have Scouts prepare for Meeting 1 by starting or completing requirement 1—to research one type of engineer and record some basic information in the *Webelos Handbook*. Then they can share what they learned at the meeting.
- Items for Tower Game (Gathering): wooden dowels, empty thread spools, paper cups, blocks of wood
- Items for the Block and Tackle Challenge (Activity 1): rope and two lengths of broomstick or large dowels
- Items for creating blueprints or plans (Activity 2): graph paper or large regular paper, pencils, erasers, rulers
- Prepare thank-you notes that Scouts can sign for their guest(s).

GATHERING

- Have Scouts work as a team, creating the tallest structure they can by stacking the items you collected.
- To increase the challenge, include items of different sizes. A Scout could try stacking with his eyes closed or with the opposite hand from the one he naturally prefers.

OPENING

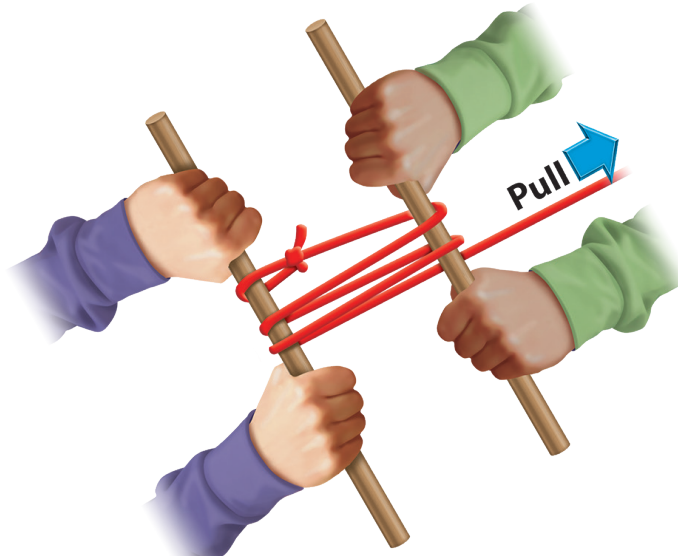
- Conduct a flag ceremony of your choosing that includes the Pledge of Allegiance and, as appropriate, the Scout Oath and Scout Law.
- If you have access to a flagpole with a rope and pulley system, point it out.

TALK TIME (REQUIREMENT 1)

- Carry out business items for the den.
- Allow time for sharing among *Webelos* Scouts.
- Introduce the Engineer adventure to the den. Build interest by describing the goals of the adventure and some of the activities that are planned.
- Have Scouts share the information they researched on a chosen type of engineer. This may be done through discussion, a drawing, a computer presentation, or any appropriate means.
- Show the sample blueprints or plans you collected and allow some time for review.
- Review the project planning process in the *Webelos Handbook*.
- Now introduce any guests you have, and ask them to describe their jobs, field of practice, why they chose that field, and what type of schooling they needed.

ACTIVITIES

◆ Activity 1: Block and Tackle Challenge



This activity will help Webelos Scouts develop their engineering skills:

- Keep the two lengths of broomstick 1 foot apart and wrap the rope loosely around both sticks.
- While two Scouts hold the sticks and pull toward themselves, a third Scout pulls the rope.
Note: The rope should be pulled steadily; do NOT allow the rope to be jerked.
- The boy pulling on the rope should be able to pull the two sticks together, no matter how hard the boys holding the sticks try to hold back.
- Play several rounds as Scouts take turns pulling on the sticks and pulling the rope. Wrap the rope around the sticks more or fewer times with each round. The Scouts should find that having more wraps makes it easier to pull the sticks together.

◆ Activity 2: Designing a Project (Requirement 2a)

- Webelos Scouts will create a plan or drawing for their selected project.
- This activity may be completed at home with assistance from parents or the den may choose to extend or add a meeting.
- The Scouts may use graph paper or regular paper. No special supplies are required, other than paper, pencil, eraser, and a ruler or straight edge.

CLOSING

- Gather the den together and recite the Scout Law. Are any points of the law especially relevant to engineers? Perhaps *helpful*, because an engineer applies scientific principles to practical problems—which helps us in our daily lives.



Do-at-Home Project Reminder:

Each Scout will complete requirement 2b at home, constructing a project—“something useful or something fun”—from the plan he developed at this meeting. The boys may share the projects at Meeting 2, or save them for display at a pack meeting (requirement 2c).

Each Scout should also decide what two projects he wants to do for requirement 4, and bring the materials for at least one of the projects to the next meeting.

Requirement 3—to “explore other fields of engineering”—may be completed on the Internet at home (with permission from the Scout’s parent) or by doing research at a local library. It could also be part of the Meeting 3 den outing if you go to a college of engineering or similar location.

AFTER THE MEETING

- Serve refreshments, if desired.
- Work together to clean up the meeting place.
- Record completion of requirements 1 and 2a.
- Have Scouts sign the thank-you notes for their guests.
- Call each Scout before Meeting 2 and remind them to bring materials for one or both of their requirement 4 projects.

MEETING 2 PLAN

PREPARATION AND MATERIALS NEEDED

- U.S. and den flags
- Thank-you notes that Scouts can sign for anyone who may help with this meeting or the den outing (Meeting 3)
- Items for Gathering activities:
 - Water-Free Water Slide—bucket, several feet of flexible hose material (e.g., dryer venting, plumbing flex hose, old garden hose), round object that will easily fit through the hose (e.g., golf ball, Wiffle ball, marble)
 - Strong Paper—three same-size glasses, one sheet of construction paper
- Materials brought by each Scout for one or both requirement 4 projects. Directions are included in the *WebeLos Handbook* for making a craft stick launcher (defense engineering); paper airplanes and a stomp rocket (aerospace); a block and tackle (architectural); a spaghetti bridge (civil); a telegraph machine (electrical); changing a penny's color (chemical); and a weather vane and pinewood derby experiments (mechanical). See Meeting 2 Resources for two more mechanical engineering options: building a pulley or a belt drive.
- The requirement 4 projects can be voted on by the den or individual Scouts may choose their own, but encourage exposure to more than one engineering field. A boy may pick an activity that isn't listed here, provided it meets the criteria for one of the listed fields.
- An extra meeting may be scheduled for Scouts to complete requirement 4, or they can finish the projects at home.

GATHERING

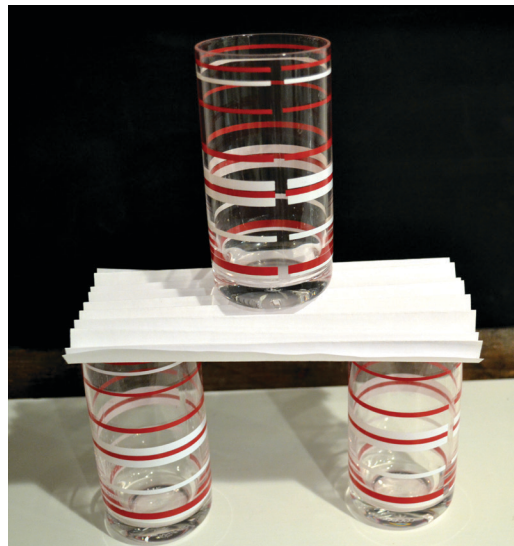
Water-Free Water Slide

- Lay the hose out straight on the ground or floor. Space the Scouts out along the hose. Have them pick up the hose and hold it at waist height with one end over the “pool” (bucket). The den chief or another Scout will start rolling the ball at the opposite end to see if they can get it to the bucket.
- Have Scouts work together to decide the best way of holding the hose (higher at one end than the other?), the best order to have everyone stand in, and whether the Scouts nearest the bucket should kneel so gravity can help.
- To pose an extra challenge have them raise the hose overhead, or put some crooks and turns in it by repositioning the Scouts.

Strong Paper

(from *Cub Scout Leader How-To Book, No. 33832*)

- Ask whether anyone has seen “the new strong paper” that will support a glass.
- Show an ordinary piece of paper and lay it as a bridge between two glasses. Naturally, it won’t support a glass.
- Then make ½-inch pleats in the paper and lay it on the two glasses again. Now it will support another glass.



OPENING

- Conduct a flag ceremony of your choosing that includes the Pledge of Allegiance and, as appropriate, the Scout Oath and Scout Law.

TALK TIME (REQUIREMENTS 2B AND 2C)

- Carry out business items for the den.
- Allow time for sharing among Webelos Scouts.
- If the boys brought their do-at-home projects for requirement 2b, allow some time for showing their work. Have each Scout share one thing he especially liked about the project. The projects may also be displayed at the upcoming pack meeting along with those for requirement 4.

ACTIVITIES

◆ Activity 1: Engineering Projects, Part 1 (Requirement 4)

- Give each Scout room to set out the materials for his first project.
- Have Scouts build the projects according to directions in the *Webelos Handbook*—with assistance, if needed, from invited guests.

◆ Activity 2: Engineering Projects, Part 2 (Requirement 4)

- If time allows, Scouts can also work on their second projects.

CLOSING

- Recite the Scout Law or offer a closing thought.
- Review details for the upcoming outing in Meeting 3. Make sure all Scouts and their families know the plans.



Do-at-Home Project Reminder:

If necessary, Scouts may finish their second project for requirement 4 at home, or you can schedule a fourth meeting to do this before or after the den outing.

Scouts should also complete requirement 3 before the last meeting of the adventure, unless the den outing will be at a college or similar location where the boys can explore various engineering fields.

AFTER THE MEETING

- Serve refreshments, if desired.
- Work together to clean up the meeting place.
- Record completion of requirements 2b and 2c.
- Have Scouts sign their thank-you notes for guests at this meeting or those who will help with the outing.

MEETING 2 RESOURCES

ACTIVITIES

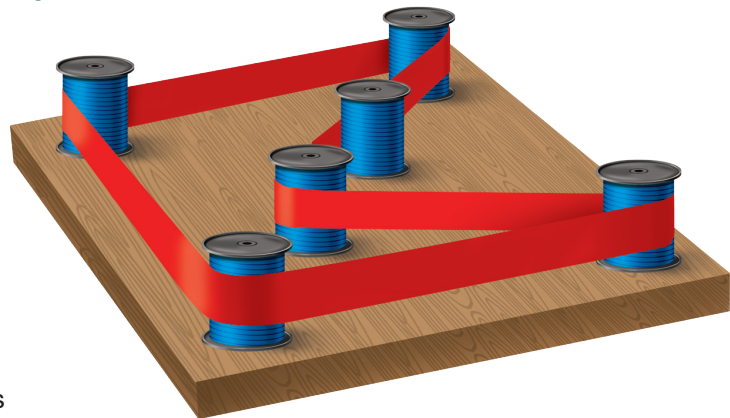
Engineering Project: Build Your Own Pulley

Materials: Heavy wire (such as a wire hanger), spool(s), light cord or rope, and a weight

Instructions: Center the spool on 8–10 inches of wire and bend the wire ends into a triangle. Hang the wire from a suitable place. Then tie one end of the cord to the weight and pull the other end over the spool. Pull the cord to lift the weight.

Engineering Project: Model Belt Drive

- Many machines have multiple moving parts that turn or rotate. One method of connecting these parts is to use a drive belt. Belts are used in washing machines, sewing machines, and many other appliances. Most modern automobiles use a single belt to drive several parts under the hood, especially the air conditioning compressor and alternator. This is called a serpentine belt, because it “snakes” around several pulleys to turn all of them at the same time.
- A belt drive runs around several pulleys, carrying the turning forces from one to the next. There must be friction between the belt and each pulley so that it doesn’t slip, but if it is too tight, it will break or pull the pulleys out of line.



To build a model belt drive, gather the following materials:

- Sandpaper
- Small board (exact size doesn’t matter)
- Small Velcro strips
- Wide ribbon or cloth (for the belt)
- Several spools (a range of diameters is preferable)
- Wooden dowel (or nails) that will fit the holes in the spools
- Glue a strip of sandpaper around each spool; this will provide friction to keep the belt from slipping.
- Cut the dowel into short lengths, slightly longer than each spool. Drill holes into the board, just big enough so the dowel pins fit snugly.
- Put a dowel into each hole, and put a spool over each dowel pin. Check that the spools turn freely.
- One spool should have a hole between its rim and its center hole. Put a small dowel pin in this hole to serve as a handle for turning the whole contraption.
- Run a length of ribbon around the spools so that it touches each spool. Join the ends of the ribbon with Velcro, which will allow adjustment to ensure that the belt is neither too loose nor too tight.
- Experiment with spools of different diameters. A wide spool will turn more slowly than a narrow spool because the belt has to move farther around the wide one.
- Test the finished model. Do all the spools turn the same direction?

MEETING 3 PLAN (Den Outing)

PREPARATION AND MATERIALS NEEDED

- Contact the outing location at least a month in advance to schedule the visit. Provide a copy of the requirements so they can see what the Scouts are doing in this adventure.
- If Scouts will be meeting a professional engineer at his or her workplace, assist the boys in developing appropriate questions. To avoid forgetting, have them carry the questions on index cards.
- Confirm that a tour and activity plan has been submitted, if required, and that transportation to and from the location is in place. Secure signed activity consent forms.
- Unit den leader should have in possession (if required by local council practices) the tour and activity plan and a copy of the *Guide to Safe Scouting*.
- Scouts who haven't completed requirements 1 or 3 may be able to do so on this outing—depending on where you go. A college of engineering with testing labs would be a good choice. Other options include:
 - Arranging an organized tour of a U.S. Army Corps of Engineers office, if one is in the area.
 - Visiting the city or county engineer or city planner.
 - Visiting a municipal waterworks or waste treatment facility to observe how machines are used to move materials from one area to another.
 - Direct access to a large construction site may not be possible due to safety considerations, but you can probably observe the site from a safe distance. Scouts would see how cranes work along with other equipment that lifts heavy loads.
 - Many large buildings have an “office of the building” with engineering responsibilities such as operation of elevators and safety equipment.
 - Utility companies may offer tours or have someone who could speak about the operation of their facilities.
 - Any location should have several bridges in the vicinity. Take a short tour and look at two or three bridges. Note how the construction varies depending on the width and depth of the area to be crossed.

GATHERING: BADEN-POWELL SAYS

- This game could be played like Simons Says: The leader stands in front of a line of Scouts and gives a command to perform an action (e.g., “Stand on your left foot”). If the leader starts the command with the phrase “Baden-Powell says,” all the Scouts should do it.
- If the phrase isn't used and a Scout still performs the action, he is out. Boys who perform an action different from the one spoken are also out.

OPENING

- Conduct a flag ceremony of your choosing that includes the Pledge of Allegiance and, as appropriate, the Scout Oath and Scout Law. A relatively quiet opening might be best, particularly if meeting in someone's office.

TALK TIME

- Carry out business items for the den.
- Allow time for sharing among Webelos Scouts.

ACTIVITIES

◆ Activity 1: Engineering Visit or Tour

- Introduce the tour guide or host and mention that the Scouts have questions they would like to ask during or after the visit. When the visit ends, be sure the Scouts show appreciation and give their thank-you notes to everyone who helped.

CLOSING

- Recite the Scout Law or offer a closing thought.

AFTER THE MEETING

- Serve refreshments, if desired and appropriate.
- Work together to clean up if needed.
- Record completion of requirements 3 and 4, as applicable.

Upon completion of the Engineer adventure, your Webelos Scouts will have earned the adventure pin shown here. Make sure they are recognized for their completion by presenting the adventure pins, to be worn on their uniforms, as soon as possible according to your pack's tradition.

