National Engineering and Geoscience Week

Activity Planning Guide

February 27 – March 8, 2009

Professional Engineers
and Geoscientists of BC

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National Engineering and Geoscience Week: A Valuable Outreach Opportunity

Engineering and geoscience are important to BC's future, and we want to encourage students to consider careers in engineering and geoscience in order to ensure that the professions continue to thrive in the years to come. Showcasing engineering and geoscience as exciting, rewarding, and challenging careers also raises the profile of the professions by exposing parents through their children to the contributions of engineers and geoscientists to society.

APEGBC aims to raise the profile of the professions through the Career Awareness Program. By engaging elementary and high school students in activities that promote curiosity about science, technology, and engineering, we can encourage children to think about the world they live in. Engaging them in science promotes a thirst for knowledge and develops critical thinking and problem-solving skills that benefit them later in life.

National Engineering and Geoscience Week (February 27 – March 8, 2009) is a valuable outreach opportunity that celebrates engineering and geoscience achievements and encourages students to learn more about the many exciting careers available in engineering and geoscience.

Many APEGBC Branches host events and activities for elementary, junior and senior high school students that foster a healthy curiosity about what engineers and geoscientists do. We are extremely proud of the vital outreach work our Branches undertake, making NEGW celebrations more dynamic and exciting every year.

NEGW is filled with opportunities to promote math and science among BC's youth and general public. We hope this guide will provide you with all the information and inspiration you need to plan some exciting NEGW activities in your area.

National Engineering and Geoscience Week
February 27 – March 8, 2009

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SECTION 1: PLANNING AN OUTREACH EVENT

GETTING STARTED: EVENT BASICS

What is an Outreach Event?

Any event that actively engages the public in learning about engineering and geoscience concepts and ideas – for example, a Popsicle stick bridge building competition or a visit to your local elementary school classroom.

Outreach events encourage and nurture an understanding and appreciation of the professions by introducing engineering and geoscience concepts in a fun and interactive way. NEGW is the perfect opportunity to raise the profile of the professions by reaching out to children in your community and encouraging them to think about engineering and geoscience as fun and exciting career choices.

What makes for a good outreach event

It should be fun, interactive, and engaging! Visually appealing events that are applicable to real life will encourage your participants to think outside the box. And a WOW factor doesn't hurt, either – kids of all ages will delight in seeing a carefully crafted Popsicle stick bridge crumble spectacularly under pressure!

Generally, schools are very receptive to outreach programs and are always looking for new opportunities that can add something different to the traditional curriculum. Well-organized and well-run events that relate to the BC curriculum will be a draw for teachers.

Take a look at the current curriculum to see where your NEGW event might fit in:

http://www.bced.gov.bc.ca/irp/irp.htm

Here are some ideas to consider for your NEGW events:

- Visit a classroom and demonstrate how engineering and geoscience touch our lives
- Organize a Popsicle stick or spaghetti bridge building competition (hint: grade 3 classes study structures as part of their curriculum!)
- Set up a walking tour of a major engineering feat in your community
- Organize a teacher workshop to show them how the math, science, and technology are used in the real world, and introduce some fun activities they can use with their students

Step By Step: Planning Elements to Consider

1. Vision

What is the purpose of your event, and what do you hope to accomplish? What will define "success"?

Envision your event when you start your planning – this will give you an idea of the look and feel of the final product and will give you a strong framework for your planning. Begin with the end in mind by defining your 5 W's:

WHY do we want to hold this event?
WHO will be attending?
WHAT kind of event will it be? (Presentation? Active learning? Contest? Tradeshow?)
WHERE is the ideal location? (Are you flexible?)
WHEN should the event take place? (Are you flexible?)

2. Goals and Objectives

What do you want participants to take away with them, and what do you want them to learn? Your goal is the general purpose for your event, and your objective is your target, or measure of success. Use your vision to guide you. For example:

Goal: to educate students about engineering and geoscience disciplines

Objective: Host a classroom visit with grade 10 students and have them try the Chocolate Chip Cookie Mining exercise.

3. Location

Decide where you want to hold your event. When choosing your venue, there are several things to consider, including:

- The number of people participating
- A central location for all participants
- Amount of foot traffic and visibility

A hotel or shopping centre might be the perfect place for your event, but you can also consider less traditional locations, such as museums, art galleries, sports facilities, community centres, and libraries.

Do you need insurance?

An important consideration that many people overlook is the need for insurance. Depending on the nature of your event, the venue you've booked may request you obtain liability insurance. In this case, contact APEGBC ***no less than 10 days in advance*** to secure a rider on our insurance policy.

4. Promotion

Don't let all your hard work meet with little reward – start early and promote often! You can begin advertising your event as soon as you have all your major details confirmed. Think about your target audience, and how you want to grab their attention. There are usually local online event listings that will post events free of charge – try your local Chamber of Commerce, and community newspapers.

For larger scale events, you may want to draft a news release to alert local media. Refer to the media release template included at the back of this guide, or contact APEGBC for assistance.

5. Participants

Who is the event for? What is your target age group? You may also have a secondary group of participants. If you're organizing a classroom presentation, for example, the teacher and parents of students will also be learning about your event. If you're in a public venue, passers-by will stop to see what's going on.

6. Agenda

An outline of activities and related times will keep you on track and focused. It will also alert you to any "dead space" you might have during your event (i.e., a break for judges to deliberate on a winner). Try to fill this space with secondary activities that will keep your participants active and engaged.

If your event is large, you might want to draft a planner's agenda (your timeline) and a participant's agenda so you can make sure you have enough resources at your disposal.

7. Budget

Budget carefully – even for non-profit events, a budget helps you set guidelines and measure results. Invest creativity rather than money!

Keep in mind that some costs may be unavoidable. For example, schools are not often able to cover major costs for a school trip or tour, such as transportation, materials, or lunch.

If you are able to provide some food and beverages at your event (if appropriate), it's always a nice touch, especially if your event is long. Be sure to take common allergies such as nuts into consideration. If you aren't able to provide refreshments, are the participants able to purchase food nearby? You may also request that students bring their own lunches.

8. Transportation

How will your participants get to you? If your event targets a particular school, you want to make sure you can host the event nearby. If it will draw participants from throughout your area, make your location as central as possible to minimize transportation difficulties.

If your event requires organized transportation, plan this well in advance. You may be able to arrange for parent drivers, but don't rely on this as your only transportation option. You can book school buses for large events for about $40 an hour, between the hours of 9:00 am and 2:00 pm.

If your event occurs outside these hours or on a weekend, you can arrange for bus transportation through First Student Canada (www.firstbuscanada.com).

9. Your Team

You have a great idea – now you need some help to make it happen. Securing a team of volunteers will make your event run smoothly. Assign tasks to everyone involved, and assign early! Be realistic in your efforts – don't plan an event that will attract hundreds of people if you can only rely on a few volunteers.

If yours is a repeat event, you may want to assign extra tasks to those who have participated before. You may also want to recruit from outside your branch executive. This is a great way to get members in your area involved in outreach efforts.

General Tips for Success

- Start planning early – try for a minimum of 8 weeks in advance. For large events, you may need even more time.
- Your first step should be a planning meeting with your team.
- Keep your Vision in mind.
- Request APEGBC resourced if you need them, and keep in mind that these resources are limited and book up early.
- Take lots of photos at your event and pass them on to the APEGBC main office

- Have a debrief after the event – what worked well? What needs improvement?
- Expect the unexpected!

Refer to the back of this guide for some ideas and inspiration to get you started, as well as some planning tools that will help you along the way.

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SECTION 2: ORGANIZING A CLASSROOM VISIT

GETTING STARTED: CLASSROOM VISIT BASICS

The objective of a classroom visit is to introduce engineering and geoscience concepts in a fun way, and to promote the value of a future career in engineering or geoscience to elementary or high school groups.

External Resources

Begin by contacting schools in your area to introduce yourself and what you can offer. The following resources may assist you:

BC School Districts Listing: Check this page to see what school districts and schools are in your area, and to obtain contact information
http://www.bced.gov.bc.ca/apps/imcl/imclWeb/Home.do

- *Teacher Consultants* work in some districts and can be a great help in distributing information across a number of schools. Check your district page to see if there is a Teacher Consultant in your area.

BC Science Teachers Association: http://www.bcscta.ca

Provincial Specialists Associations: http://bctf.ca/psas/

APEGBC Resources

APEGBC has many resources available to help make a classroom visit more successful. While we will do the best we can to provide resources to everyone who requests them, our supplies are limited. Please request resources and promotional items early.

Some of our resources include:

- *Engineering and Geoscience: Shaping Our World* DVD (running time: approx. 8 mins)
  Can be viewed online at http://www.apeg.bc.ca/students/ShapingOurWorld/index.html
  DVD and downloadable copies are available upon request (marchibald@apeg.bc.ca.)

- *Engineering and Geoscience: Shaping Our World* brochure for students
  Available in February 2009

- *What is APEGBC?* brochure for parents and general public

- *Explore the World of Engineering and Geoscience!* brochure for teachers

- Powerpoint presentations for elementary and high school visits
- Activity guides for engineering and geoscience exercises
- APEGBC pop-up banners
- Promotional Items and Prize Giveaways
    - "Robot" pens
    - Foam boomerangs
    - Backpack prize pack – includes one APEGBC backpack, *Engineering Feats and Failures* book, APEGBC highlighters, Robot Pen, and Boomerang

To request any of these items, please contact APEGBC at least two weeks in advance.

A school visit introduces children to engineering and geoscience and illustrates that the professions are fun, involve problem-solving, and involve the application of physical principles and experimental techniques.

LEARNING CHARACTERISTICS

It is important to know the target audience in order to tailor the presentation to the group's learning characteristics. Talk to the teacher before your visit to see if the presentation would be age-appropriate and also suitable for any special characteristics of the class. Hands-on activities are effective at all ages, but are especially useful for younger students (the back of this guide contains some suggestions and inspiration). Here are the typical learning characteristics of age groups you may be targeting:

Kindergarten to Grade 2

- Learn by using their senses and manipulating objects
- Respond well to adult authority
- Have short attention spans
- Like surprises and the unexpected
- Respond well to the highly visual
- Presentations for this age group should incorporate a variety of activities and involve frequent changes of pace. Group work and hands-on activities are popular.

Grades 3 to 4

- Thinking tends to be concrete; need to have an example of something in order to understand it

- Beginning to conceptualize previously experienced objects
- Understand rules and can follow them
- Ask questions that encourage students to discover answers for themselves. Provide an activity before introducing the scientific concept.

Grades 5 to 8

- Respond well to hands-on activities
- Still need concrete examples since they have not yet learned to understand concepts
- This is a critical period in determining students' continuing participation in science and engineering. Get the students involved in the presentation as soon as possible.

Grades 9 to 12

- Exhibit more complex thinking skills
- Can formulate hypotheses
- Able to apply previous knowledge
- Can adapt well to new ideas and technologies
- Lecture presentations can be effective if varied media is used: slides, pictures, models, video, etc. Use language that the students can understand. Allow enough time for discussion.

LEADING A DISCUSSION

Good teachers invest a lot of energy in creating a safe environment where children can express and explore their ideas. Lecturing has its merits, but chances are that children will lose interest after a few minutes. You may want to start by showing the class the *Engineering and Geoscience: Shaping Our World DVD*, and by leading them in some activities.

Help children get excited about learning. Let them get their hands on something and experiment with it. After some hands-on work, bring them together to talk about what they have been doing and learning.

Encourage them to think by asking appropriate questions:

- Use attention-focusing questions such as "What do you notice?" "What can you see?" to help students take notice of details.

- Use paraphrasing and questions that ask for more information to help children articulate and clarify their ideas. "You say you think your bridge needs two arches. Why do you think so?"

- Use comparison questions to help children organize their data. “Which is stronger, heavier?” “In what ways are they alike?”
- Use action questions to encourage experimentation and investigation or relationships. “What might happen if….?”
- Ask open-ended questions and allow students adequate time to think and respond.
- Listen carefully to the students’ responses in order to frame further questions to encourage continued thoughtful examination of ideas. Remember that it takes practice to become a good questioner and discussion leader. Don’t be discouraged.

Telling Your Own Story

Sharing your personal story will help students relate to you as a “real” engineer or geoscientist. Tell them what inspired you to choose the career you have, and describe the process you followed to your current position. Share anecdotes and stories about some of the more interesting, exciting, and challenging things you have experienced.

Describe a typical day, whether that includes spending time in the office or at a site; lab work, work with customers, or overseeing other technical personnel.

- What are the best features about a job in engineering or geoscience?
- What are the most exciting projects? Discuss these in terms that students can understand, such as how it helped people or how it was the first of its kind.
- Use stories and visuals liberally!

Conclude by summarizing for students that:

- Engineering and geoscience are all around us every day.
- Professional engineers and geoscientists are a diverse group but they share a love of math, science, and problem-solving.
- They identify, analyze, design, refine and solve problems.
- They are team players.

For older students, you may also want to review the education needed to become an engineer or geoscientist.

TIPS FOR PRESENTATION SUCCESS

- Arrive early enough to prepare before the presentation.
- Dress for a day on the job. Students want the total image.
- Determine objectives, have an attention-grabbing opener, a clear plan, interesting activities for students to do and a strong closing.
- Get students involved. Have volunteers help hand out materials, hold models, etc.
- Ask for participation and try to encourage everyone.
- Don't use jargon and be sure that the information presented is at an appropriate level for the group. If in doubt, consult the teacher.
- Be enthusiastic and make the presentation fun.
- Follow appropriate safety precautions.
- Respect the teacher's and class's time by keeping to the allotted time for your presentation – try not to run overtime.
- Get feedback from the teacher and students on the presentation.
- Continue contact with the class. Encourage students to write with their questions. If appropriate, offer to arrange field trips to a place of work.

Section 3: Ideas and Inspiration

Activity Ideas and Lesson Plans

Popsicle Stick Bridge Building Contest

You may not want to walk across these bridges, but let's see how strong a bridge made using only 100 Popsicle sticks and white glue can be.

Materials

200 Popsicle sticks (whole)
1 sheet of construction paper for the deck of the bridge
White glue such as Bondex or Lepages Bondfast glue
No other materials are permitted

Equipment

To load and test the bridges, use a hydraulic jack and load cell, a screw ram through a wood loading block, or simply suspend a platform from the bridges and add weights.

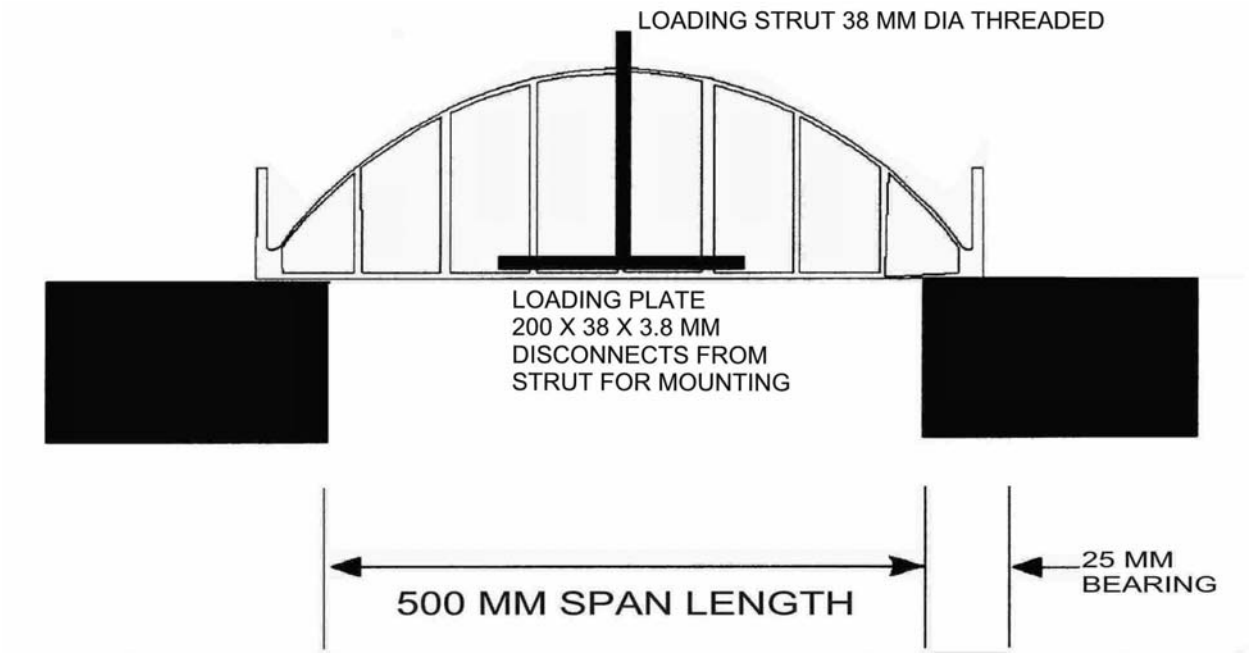
Instructions

There are no step-by-step instructions for this project! The object is to build a bridge, using only Popsicle sticks and glue, strong enough for a matchbox car to be able to traverse.

Contest Rules

- The bridge must span a 500 mm gap, with maximum 25mm long bearing pads.
- Total length of the assembled bridge is not to exceed 550 mm.
- A minimum length overall of 520 mm is advised. Bridges spanning less than the 500 mm gap, are disqualified.
- Design the bridge to support the highest load possible along a longitudinal loading plate, as described above. Span this plate over multiple transverse supports on the deck of the bridge.
- Design the roadway portion of the bridge to support a 38 mm x 3.8mm x 300 mm long loading plate.

- Design the uppermost portion of the bridge to accommodate a 38 mm diameter-loading strut, vertically positioned at the centre of the bridge, from the loading plate to above the bridge superstructure. Loading strut must pass through any cross bracing and be able to fasten onto the loading plate.



Testing the Bridges

Weigh all bridges before they are loaded. The lightest bridge earns extra points.

Load the bridge using a hydraulic jack and a load cell, or proceed with your testing equipment of choice. If using a hydraulic jack, deliver the test force to a loading plate placed on the deck via a vertical strut projecting above the bridge.

The jacks will be manually actuated to produce as rapid and uniform an application of force as possible, given the test equipment. Testing will proceed rapidly and as uniformly as the equipment will allow.

Ratings

The maximum capacity of the bridge will be based on the highest of either: the maximum load accepted by the bridge as measured on the load cell during the loading cycle; or the load supported by the bridge at a deformation of 50 mm at the centre of the bridge.

Suggested Directions to Organizers

Sign up: Specify several locations where people can sign up, pay, and pick up materials.

Contest Fee: $10

Schedule: Welcome, Contests for under13 years, 13-18 years, over18 years, Awards ceremony. Prepare participation certificates for all, providing prizes as available to each category winner. You may wish to look for sponsors for prizes.

Chocolate Chip Cookie Mining (courtesy of UBC Faculty of Applied Science)

This exercise allows students to understand mining and the impact it has on our environment, as well as the tradeoff between protecting the environment and extracting resources. It introduces mining engineering and the careful planning that goes into protecting the environment to obtain the necessary resources.

Materials

- White paper to work on
- Chocolate chip cookies (Chunky chocolate chip cookies work best for this exercise, such as "Chunks Ahoy". Check with the teacher in advance for any allergy concerns)
- An assortment of digging tools, such as straws, paper clips, kabob skewers

Procedure

1. Have students wash their hands

2. Place a cookie on a sheet of white paper. Once the cookie has been placed, you may not move or rotate the cookie.

3. The goal is to extract as much chocolate as possible without destroying the cookie environment using only the tools provided. One technique is to model a mine shaft by creating a "core drill" by placing a finger on the end of the straw and pushing it into the cookie. Use the skewer to push the collected chocolate and cookie crumbs out.

4. How much chocolate did you extract from the cookie? How much damage was done to the cookie?

5. The small crumbs of the cookie represent waste rock and tailings, which create acid rock drainage. How much damage will they do?

6. There was probably a lot of chocolate near the surface of the cookie. In our resource-dependent world, these minerals have already been depleted, and we have to mine deeper. How much more damage is done to the cookie when you mine deeper?

Foil Boat Competition (courtesy of UBC Faculty of Applied Science)

Build a boat from the piece of aluminum foil supplied that can withstand the weight of the most pennies before sinking.

Materials

- 20 cm square of aluminum foil
- Pennies or washers
- Tank or pan of water

Procedure

Students are allowed 10 minutes to design and build a boat out of the foil supplied. They do not have an opportunity to test their designs. Once the 10 minutes are up, students will take turns placing their boats in the water and start adding the pennies.

Record the total number of pennies each boat can hold before sinking. The boat that holds the most pennies wins!

Straw Towers

Students discover some of the basic rules of structures, including the "triangle trick" – triangles are strong because each side stops the others from moving in other directions. Each finished tower must be able to support the weight of a cup of water or juice box. You can also use toothpicks and shaving cream for a small-scale exercise.

Materials

- 30 straws and 3 metres of masking tape per group
- 1 cup with 200 mL of water (messy!) or a 200 mL juice box per class

Procedure

Challenge the students to build the highest tower possible using the straws and tape provided. No other items can be used, not may they use tools (scissors, etc.). The finished tower must be able to support the weight of the cup of water or juice box. The final height is measured from the lowest point on the weight.

After completing the activity once and observing the structures of their classmates, let students discuss how to improve their final height. If possible, allow them to repeat the activity to see how they do the second time.

The Hoopster (courtesy of the Telus World of Science)

This unusual paper airplane works because air moves more quickly in between the hoops, creating a lift force. As the lift force is made on the inside of the plane, it lifts into the air. Air pushes against the motion of the plane with a drag force.

Materials

- Hoopster template (included on next page)
- scissors
- clear plastic tape
- plastic straws (not the kind that bend)

What to Do

1. Cut out the template (one long and one short strip).

2. Curl each strip into a loop and tape the ends together.

3. Place one end of a straw onto the middle of a strip of tape. Put the big hoop on top of the straw and fold the tape up the sides of the hoop.

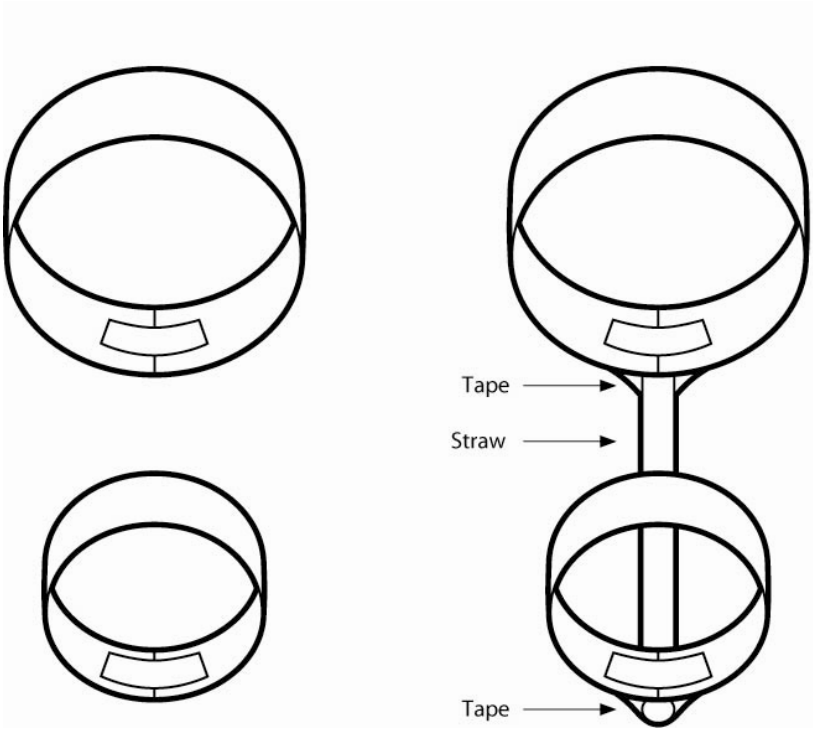
4. Place another strip of tape at the other end of the straw. Press the small hoop very gently onto the tape. Move it around until it lines up with the big hoop, then press the tape down firmly.

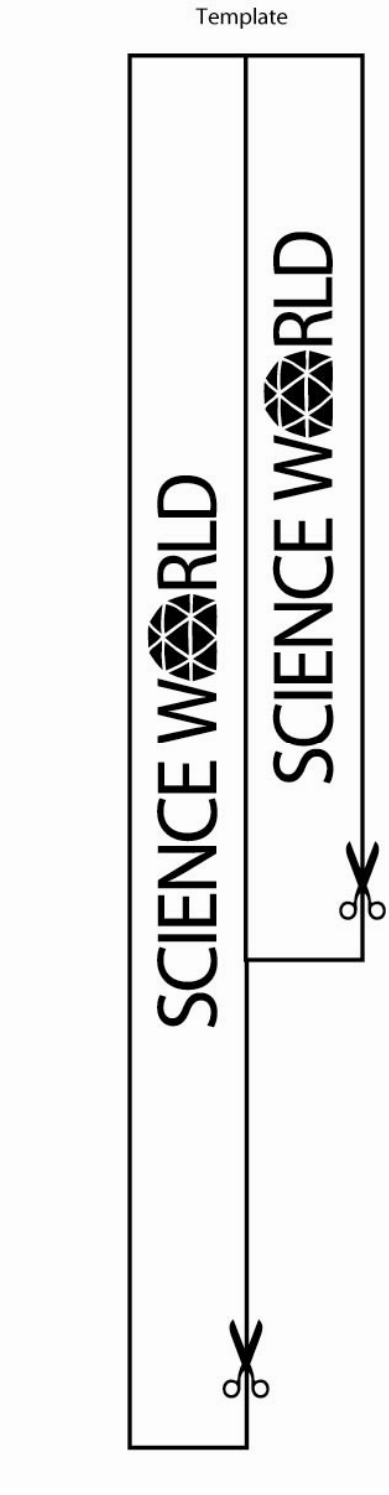
5. Hold the Hoopster in the middle of the straw, with the little hoop in front.

6. Launch it like you would throw a paper airplane.

Now Try This – Modify your Design

- Explore what happens if the hoops are not “lined up”?
- Attach a paper clip at straw connection/”bottom” of the small hoop.
- Design a really long Hoopster with two straws. Cut a little slit at the end of one straw and pinch it so it fits inside the other straw, then tape them together.
- Design a double Hoopster with two little hoops side by side on one end and two big hoops side by side on the other.
- Imagine your budget has been significantly cut … design a working Hoopster with cheaper materials. Experiment with different types of paper, or a paper only design (no straws).





For more ideas, contact APEGBC or visit the following websites:

Telus World of Science: Try This At Home Activities
http://www.scienceworld.ca/fun_stuff/make_stuff/trythisathome.html

IEEE Lesson Plans
http://www.ieee.org/web/education/preuniversity/tispt/lessons.html

NOVA Online Teacher Activities
http://www.pbs.org/wgbh/nova/teachers/resources/subject.html

Engineers: Everyday Heroes
http://resources.yesican-science.ca/trek/engineers/challenge4.html

SECTION 4: PLANNING TOOLS

OUTREACH EVENT PLANNING CHECKLIST

Event:

_____

Date: _____ Time: _____

Venue: _____

Venue Contact: _____

Venue Address : _____

Venue Tel :_____ Venue Fax : _____

School: _____

School Contact: _____

School Address: _____

School Tel: _____ School Fax: _____

Initial Planning Session (at least 8 weeks in advance)

☐ Vision:

_____

☐ Goals:

_____

☐ Objectives:

_____

☐ Budget: _____

☐ Expected number of attendees: _____

☐ Plan rough outline of event agenda

☐ Assign major tasks

☐ Discuss promotional tools and ideas

☐ Discuss venue options

☐ Items required from APEGBC:

☐ Booth Date Booked: _____

☐ Hanging Banner (name & logo) Date Booked _____

☐ Pop-up Banners "P.Eng,./P.Geo." Date Booked _____

"APEGBC is here" Date Booked _____

"Geoscience" Date Booked _____

"Value of Membership" Date Booked _____

"MAPS" Date Booked _____

☐ AV Equipment Date Booked _____

Initial Conversation with School or Teacher Consultant

☐ Confirm date of event (may need to adjust depending on school schedules)

☐ Do we need to provide transportation? ☐ yes / ☐ no

☐ Do we need to provide food? ☐ yes / ☐ no

☐ Number of attendees _____

At Least 6 Weeks Prior

☐ Book resources from APEGBC, if needed

☐ Book transportation, if needed

☐ Book venue Insurance Required? ☐ yes / ☐ no

Requested from APEGBC: _____

☐ Begin promoting event Media release required? ☐ yes / ☐ no

Requested from APEGBC: _____

At Least 3 Weeks Prior

☐ Finalize event agenda and begin assigning detailed tasks

☐ Request any cheques that are needed

☐ Determine materials required (i.e.: Popsicle sticks, glue, etc.)

☐ Request any promotional items needed from APEGBC (i.e.: boomerangs, pens, brochures, etc.)

At Least 2 Weeks Prior

☐ Get prizes, if needed

☐ Send agenda to school or teacher consultant

Three Business Days Prior

☐ Purchase/print materials

☐ Confirm event set-up with venue

☐ Order catering, if needed ☐ Allergies? _____

Day of Event

Items to bring with you:

☐ Handouts or printed material

☐ Other materials needed

☐ Prizes

☐ Booth/banners/AV equipment

☐ Promotional items

☐ Venue contract

Items to check at event venue:

☐ Is the venue set up as requested?

☐ Is there enough space for AV equipment?

☐ Are cords/cables taped down?

☐ Where are the washrooms, emergency exits?

Post Event

☐ Call teacher/organizer – thank, invite feedback, offer additional materials

☐ Confirm and pay venue invoice, other invoices

☐ Return borrowed items, extra promotional material to APEGBC

☐ Debrief with planning team

What worked?

What needs improvement?

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