Cuyahoga County Public Library
Strongsville Branch
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Strongsville, OH 44136
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May 30, 2025

Mr. Tim Protiva (Host)
Children's Services Supervisor

Subject: Engineering Program at CCPL Strongsville Branch (NSPE Pilot Program for 2025)

Summer Fun, For Everyone 2025 Procedures!

Dear Students and Volunteers:

The following is our procedures for the first two exercises we will be performing on Thursday, June 5, 2025 for the CCPL Strongsville Branch celebration of **Summer Fun for Everyone!** The procedures we will be applying are from the National Society of Professional Engineers (NSPE) and the Ohio Society of Professional Engineers (OSPE) National Engineer's Week (NEW) Discover E Program.

NEW is celebrated in February around Presidents Day. This date was selected since our first president, George Washington (birthday celebrated with Abraham Lincoln on Presidents Day) was a Military Engineer.

Our plan is to help develop interest and skills in engineering for students in elementary school grades 2 through 6. The specific focus of the exercises will be detailed later in the writeup.

We are very thankful to the students, their parents, and our table volunteers for participating in this event hosted by Tim Protiva and the CCPL Strongsville Branch. We hope you will enjoy your time discovering skills in engineering. Our program will have two parts. The first part is Thursday, June 5 and the second part is Thursday, July 3rd.

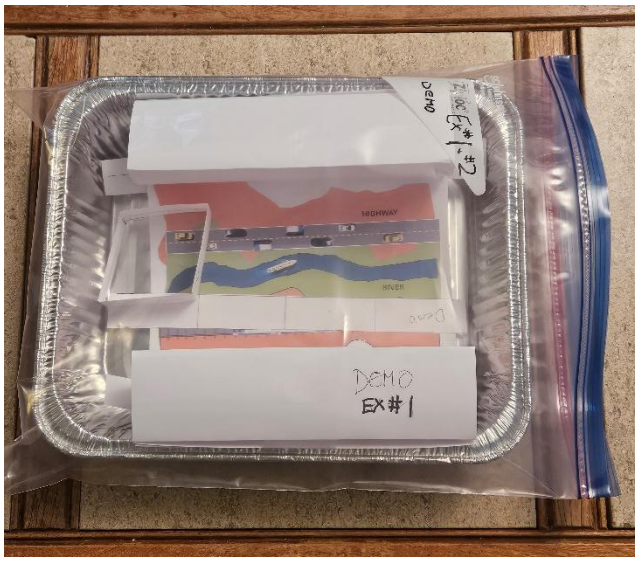
Note that the most important part of these exercises is to have FUN!

Best regards,

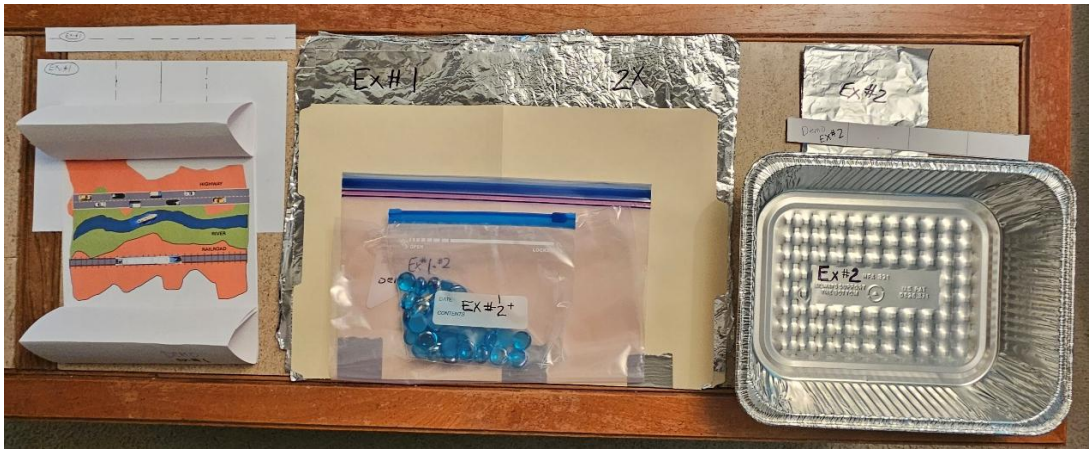
Joseph Yurko, PE
NSPE NEW Facilitator
yurkojoe5@gmail.com

Summer Fun for Everyone Events for two hours on Thursday, June 5 from 2 to 4 pm:

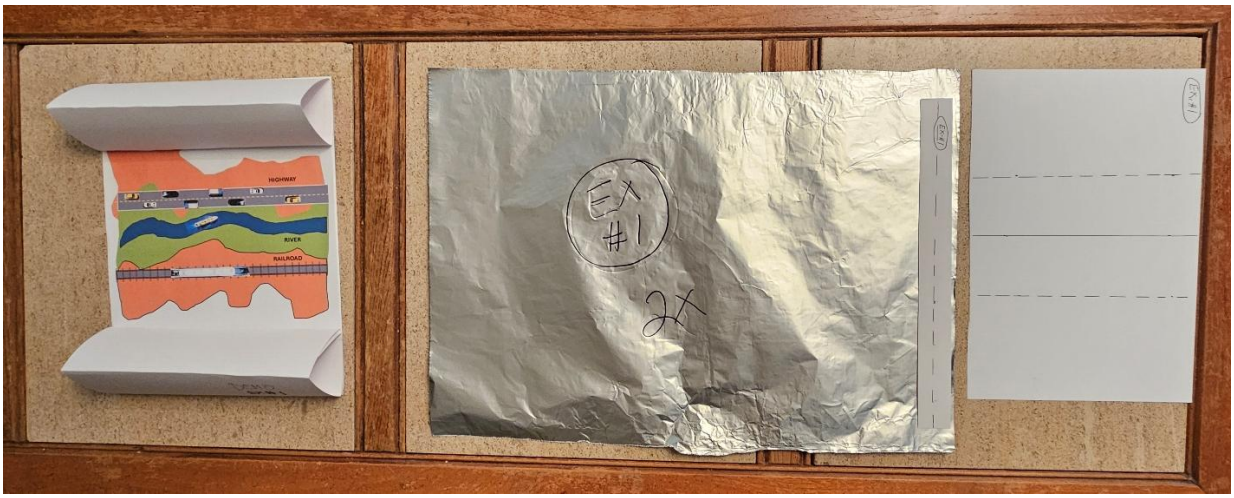
1. **Exercise # 1, Build a Foil Bridge:** To test different Foil Bridge designs, compete between team tables for the heaviest load of weight pellets the bridge can carry.
    a. Time: 45 minute activity (hands-on)
    b. Career: Civil Engineering & Material Science, structural body
    c. Grade: 3 to 6 grades (8 to 11 years old)
    d. Topic: Structures, also Technology and Materials
2. Foil Bridge Narrative (read before beginning the exercise)
   Safe and well constructed bridges have been part of our history from the beginning of Western Civilization. From the transportation of horse carriages over small rivers to the large modern spans of today over highways, rivers, and railroad tracks, we depend on bridges to provide safe and efficient transportation of our family cars during vacation, going to and from work, ambulance and fire emergency services, delivery of mail and packages, as well as the movement of gas tankers refueling gas stations for our vehicles.
   Today we will design and build bridges of foil to compare different weights of foil and different designs to see the most efficient design that will carry the most weight.
   Certificates will be provided for the best foil bridge designs for participants.
3. Foil Bridge Preparation
    a. Obtain the Exercise Bag with both Ex # 1 and Ex # 2 from your table volunteer.



    b. Remove all the parts labeled Ex # 1 from the bag and set the bag aside for Ex # 2. Add two sheets of foil (2X and X) you will receive from your table volunteer.

c. 

d. Organize the Exercise # 1 parts as shown in the photo. Take the white strip of paper and place it on top of the 2X foil edge along the short side.

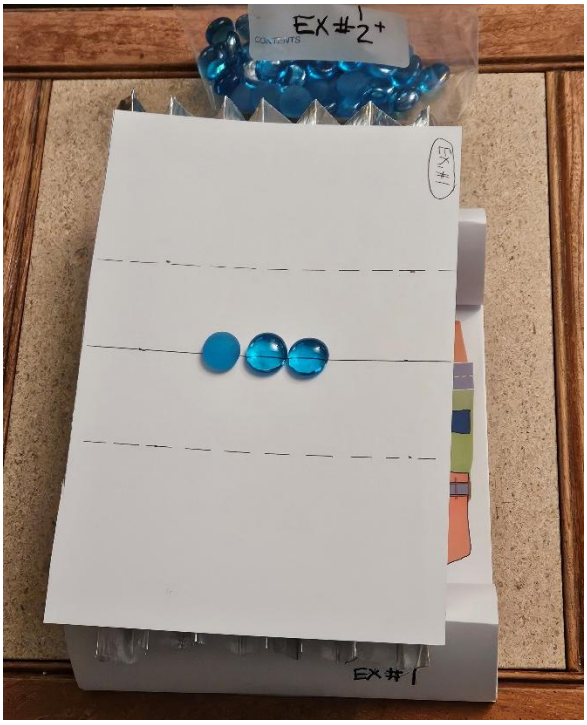


e. Begin folding the 2X foil in 1 inch measures over and under so as to make the foil a zig-zag shape with 1 inch folds.

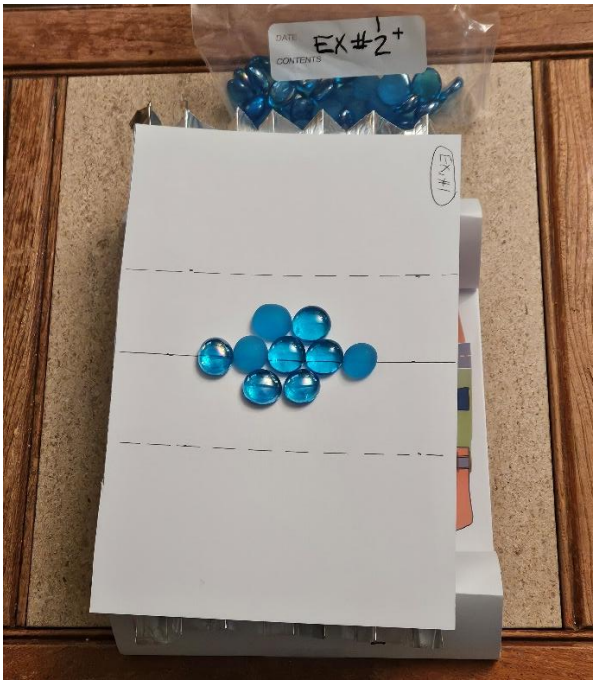
f. Place the Zig-Zag foil on top of the two peaks over the valley to form the bridge.

g. Next place the white paper deck on top of the foil Zig-Zag support structure. This deck will support the load of the weight pellets with the foil structure beneath.

h. Next begin adding the weight pellets very carefully one at a time along the center line of the support deck between the other two dotted lines as shown below.



i. Continue to add weight pellets along the centerline very carefully one at a time between the other two dotted lines as shown below.



j. Continue adding weight pellets until the bridge collapses. Count the number of weight pellets you added to the bridge and tell your table volunteer how many weight pellets your bridge was able to hold for the **2X Heavy Weight Foil Bridge.**

k. **Repeat** the above procedure with a **1X Light Weight Foil Bridge**, and tell your weight pellet count to your table volunteer for the second bridge.

l. **Repeat** the above procedure with the **1X Light Weight Foil Bridge**. Only cut the 1 inch paper strip so it is now only a Half Inch strip, and **make the foil folds a Half inch** in the Zig-Zag support structure.

m. Tell your table volunteer what your weight pellet count was for the third bridge Exercise # 1.

n. The table volunteers from each table will collect all their data for the three bridge designs and the weight pellet count for each design to compare and evaluate the best bridge design with the most weight pellets from all the engineering design teams for awards.

4. **Intermission, Readings by Tim Protiva** to students (15 minutes) between Exercise # 1 and # 2.

5. **Exercise # 2, Build a Foil Boat:** To test Foil Boat designs and compete between teams for the most weight pellets the Foil Boat can hold before sinking. Next level: add propulsion to the boat with a tube filled with baking soda and add vinegar. Generate CO2 as a gas jet propulsion for the foil boats.
   a. Time: 45 minute activity (hands-on)
   b. Career: Chemical Engineering, buoyancy & acid-base reaction making CO2
   c. Grade: 3 to 6 grades (8 to 11 years old)
   d. Topic: Design Challenge (Dream Big), also Forces Motion and Energy

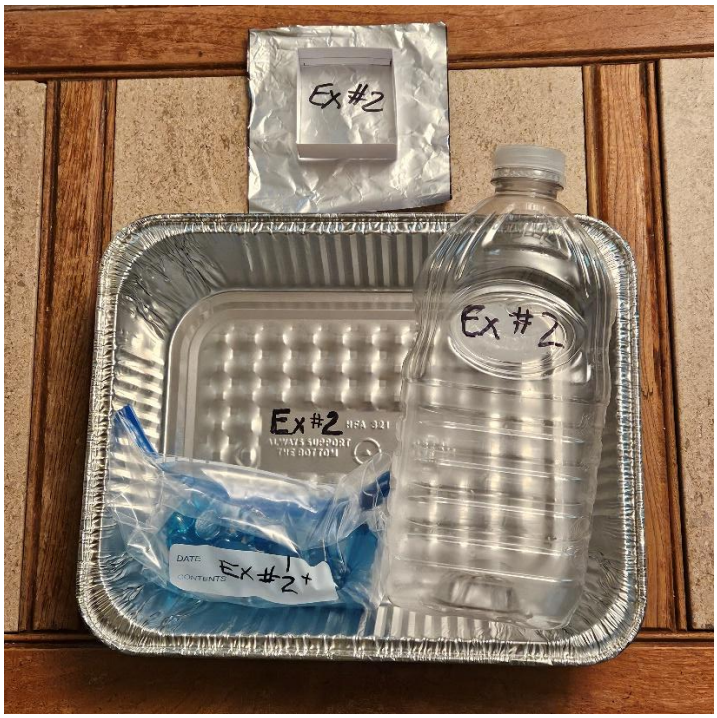
6. Foil Boat Narrative (read before beginning the exercise)
   Safe and well constructed boats have been part of our history from the beginning of Western Civilization. From the transportation of Viking ships across the Atlantic Ocean to the large modern ocean vessels of today we depend on the shipping industry for our goods, services, vacationing, and protection.
   Today we will design and build boats of foil to compare different designs to see the most efficient design that will carry the most weight.

We will also investigate a chemical method of propulsion that can be used to push the boat through the water as a demonstration at the end of our Exercise # 2.
Certificates will be provided for the best foil boat designs for participants.

7. Foil Boat Preparation
    a. Obtain the Exercise Bag with Ex # 2 that was set aside earlier.

    b. Organize the Exercise # 2 parts as shown in the photo.

c. Take the white strip of paper and fold it into a square. Then tape it with tape provided by your table volunteer.



a. Take the 5 inch square of foil and place the paper square in the center of the foil. Begin wrapping the foil around the paper square carefully so as to not tear any of the foil. The foil must not have any holes in it so it can hold off water from leaking into it.

b. Have the table volunteer fill the foil pan with water for the half gallon jug provided, and float the foil boat you just constructed inside the foil pan on top of the water.

c. Begin adding weight pellets very carefully inside the center of the foil boat. Continue adding weight pellets until the foil boat sinks into the water and fails to float.

d. Count all the weight pellets inside the sunken foil boat to get a total count of pellets and report that count to your table volunteer.
e. Repeat the above procedure for the foil boat only use a larger 6 inch square of foil to wrap around a square of paper. This will provide a taller side wall to the foil boat and allow it more water displacement that may provide the ability to carry more weight pellets in theory. Report the number of weight pellets for this Exercise # 2 to your table volunteer.
f. The table volunteers will collect all their data for the two foil boat designs and the weight pellet counts for each design to evaluate the best foil boat designs for certificate awards.
g. Next the Exercise Demonstrator will show how a foil boat may be provided with propulsion from a chemical reaction inside a bulb with a nozzle outlet.
h. The chemical reaction will be with an acid (vinegar, or acetic acid) and a base (baking soda, or sodium bicarbonate). The acid and base react rapidly to form a salt solid, water liquid, and carbon dioxide gas (our propulsion gas)!

8. **This will conclude the Exercise # 1 and # 2** for Thursday, June 5th at the CCPL Strongsville Branch Summer Fun for Everyone Event!

9. We look forward to seeing you at Thursday, July 3rd 2025 Exercise in the CCPL Strongsville Branch Summer Fun for Everyone Event. We will be doing exercises with a basic catapult and an advanced catapult (Trebuchet design)!

10. **Enjoy your safe and fun Summer of 2025!**

Best regards,

Joe Yurko
NSPE NEW Facilitator
yurkojoe5@gmail.com