

MAKEngineering Kit Facilitation Guide: Friendly Delivery

Task adapted from CoBuild19

ENGINEERING TASK

You want a way to secretly and safely share objects with your friend who lives next door.

You choose to design a prototype that will deliver an object at least 6 feet.



DID YOU KNOW...?

In August 2020, Amazon got a “yes” to deliver packages by a drone. A drone is a flying object with no human pilot, but controlled remotely by a user or computer program.



MATERIALS IN KIT

- ◆ Ziploc bag of pasta
- ◆ 10 pipe cleaners
- ◆ 10 Paper clips
- ◆ 10 rubber bands
- ◆ 10 wooden dowels
- ◆ 10 large popsicle sticks
- ◆ 10 straws
- ◆ ~3 feet of yarn
- ◆ 6 fabric softener sheets
- ◆ 6 sandwich bags
- ◆ Fishing wire
- ◆ Scissors
- ◆ Electrical tape
- ◆ Hot glue gun & 2 sticks

STEP 1—RESEARCH

Let's consider some of the different types of delivery options and how they work.

A zipline? A wind-powered car? A catapult? An airplane? A bird? Superman?

On the next page is a link to information to get you started in your research. What do you notice that might be helpful in designing a solution for your task? Remember to take notes and feel free to explore other delivery options.

STEP 1—RESEARCH

How do ziplines work?

<https://adventure.howstuffworks.com/zip-line.htm>

How does a car run by wind power?

<https://youtu.be/3sxileCaBlc>

What things should be considered when designing an airplane?

<https://www.foldableflight.com/post/how-to-design-your-own-paper-airplane>

How does a trebuchet, a special kind of catapult, work?

<https://youtu.be/W5RFoowvGkw>

STEP 1—SUPPORT

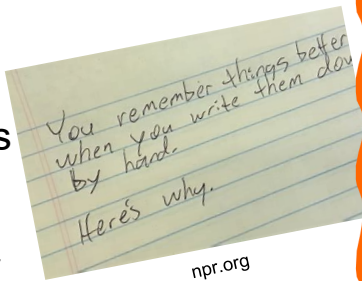
Optional questions to ask:

- ♣ If you had super powers, how would you solve the task? We won't be able to do the same thing, but thinking about it might help us come up with other ideas we can research.
- ♣ What might be the advantage of _____ (e.g., a catapult)? What might be the disadvantage of _____ (e.g., a zipline)?
- ♣ What do you think _____ (name of friend) would suggest for the delivery system? Why do you think this?
- ♣ What are the important characteristics of _____ (e.g., an airplane) that we should consider for this engineering task?

STEP 2—PLAN

What will you deliver?
How will you deliver it?

Draw two detailed designs or sketches for your delivery system. How did your research inform your designs? Keep in mind the size, weight, and shape of your object to deliver.



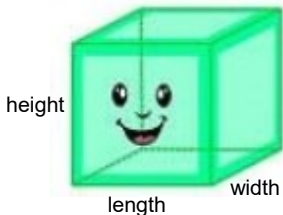
STEP 2—SUPPORT

Optional questions to ask:

- ♣ What type of delivery system works best for the object you want to deliver?
- ♣ Do we need a container? Let's think about the object you plan on delivering, what shape should we make the container? What height, length, and width should we make the container? (See next page for additional information.)
- ♣ What are the key, "I must have this," features that you noticed in your research that you would want to include here?
- ♣ What material will be best to use based on the weight of the object?
- ♣ I really like _____ (i.e., part of sketch). It is a unique feature. What made you think of that idea?
- ♣ Can I make a suggestion? (ask for permission)

STEP 2—DID YOU KNOW...

the surface area of a three-dimensional object or a container can be found by adding up the area (e.g., length x width) of all sides. How is surface area different from volume? Consider this question within packaging of tea bags.



<https://youtu.be/SJGpKnl-784>

MATERIALS IN HOME—BINGO STYLE

Now that you have two designs, let's find materials around your home to make it happen. As a family, work together to find items to complete the bingo card on the next page. As you search for objects, think what kind of parts do _____ (e.g., cars) have?



Paper-based item	Something that is round or a cylinder but as many of this item as you want.	Something that is flat and sturdy
Random items from a "junk" drawer or recycle bin	FREE SPACE (anything that will help you innovate)	Food container of any kind
Something that will help keep things together	Something that clips	Something that adds personality



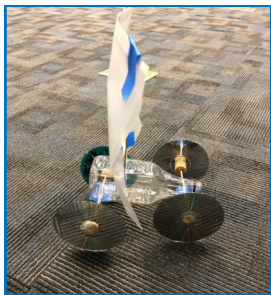
COMMUNICATE

Have a conversation about what you have so far as an engineer. The camera can be focused on your notes and/or design sketches.

1. What did you learn from your research?
2. What will you deliver? How will you deliver it? Explain why you selected this delivery system.
3. Showcase some of the materials you gathered in the Bingo board. How do you plan on using the materials in your prototype?

STEP 3—CREATE

Pick one of your designs from Step 2 and build a prototype using material from the kit or collected from Bingo.



What are the wheels on this car?



What could that paper airplane deliver?

STEP 3—SUPPORT

Optional questions to ask:

- ♣ How can I help? (position child as lead engineer)
- ♣ Which part of the prototype is informed by your research?
- ♣ How close does our prototype align with our initial sketch/idea/solution? Why did you make that change to the prototype?
- ♣ Where do you think we might experience a failure? Why? Can we make a change to the prototype to address this before testing?

STEP 4—TEST

Now that you have built your prototype, it's time to test.

(Psst. Some wise person, William Whewell said, “Every failure is a step to success.”)

Document or write down your failures...



and celebrate your successes.



STEP 4—SUPPORT

Optional questions to ask:

- ♣ How can we be sure that the prototype travels at least 6 feet? (Did you know an average foot is about 12 inches?)
- ♣ I noticed _____ when testing the prototype. Why do you think this happened? How might we change the prototype to address this?
- ♣ What do you think about the quote, “Every failure is a step to success”? Do you think this is true for our prototype?
- ♣ Let’s show the prototype to _____ and get their feedback.

STEP 5—IMPROVE

“Changes call for innovation,
and innovation leads to
progress.” ~Li Keqiang

As a family of engineers,
discuss the following:

What are three ways you
can improve upon your
prototype? How are these
based on the results from
your testing step?



DID YOU KNOW...?

Bubble wrap was created in 1960 in an attempt to create a trendy new textured wallpaper. Oops! IBM was the first to use bubble wrap to package and transport a computer.

Some adults use Legos as a prototyping resource. You know, those toys that kids play with?

It took 36 prototypes to create Wheaties, a popular breakfast cereal. Yes, development of a new food item is prototyped just like your prototype of a friendly delivery system.



COMMUNICATE

Have a conversation. The camera can be focused on the prototype.

1. Showcase your prototype. Describe what it is (maybe give it a name), the types of items it can deliver, and how it works.
2. Provide a specific example of a change made to your prototype and why?
3. How many prototypes did it take until you were happy with the end product? How does this compare to Wheaties?

EXTENSION

“Don’t limit your challenges. Challenge your limits” (Anonymous). Are you up for a challenge?

- ◆ Deliver an object further than 6 feet. 10 feet? 12 feet? 20 feet?
- ◆ Complete a delivery with an obstacle in the way (e.g., chair)
- ◆ Deliver additional objects. How much weight can your prototype hold?
- ◆ Build a different container. What shape of the container can hold the most weight?
- ◆ Complete a delivery in a time faster than your first prototype.

DID YOU KNOW...?

Mechanical engineers research, design, develop, build, and test mechanical devices, including tools, engines, and machines.

Jobs for mechanical engineers are projected to grow 4% from 2019 to 2029 and considered to be one of the most popular engineering fields. But in the year 2018, only about 15% of Bachelor degrees in mechanical engineering were awarded to women.

WHAT TYPE OF ENGINEER ARE YOU?

Add a sticker to your Engineering Passport that identifies the type of engineer you were most like in the design of a friendly delivery system. Don't forget to write why you chose the type of engineer.



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