



# Developing Engineering Mindset in Youth

Christine M. Cunningham

Youth Engineering Solutions  
Museum of Science, Boston



# Today

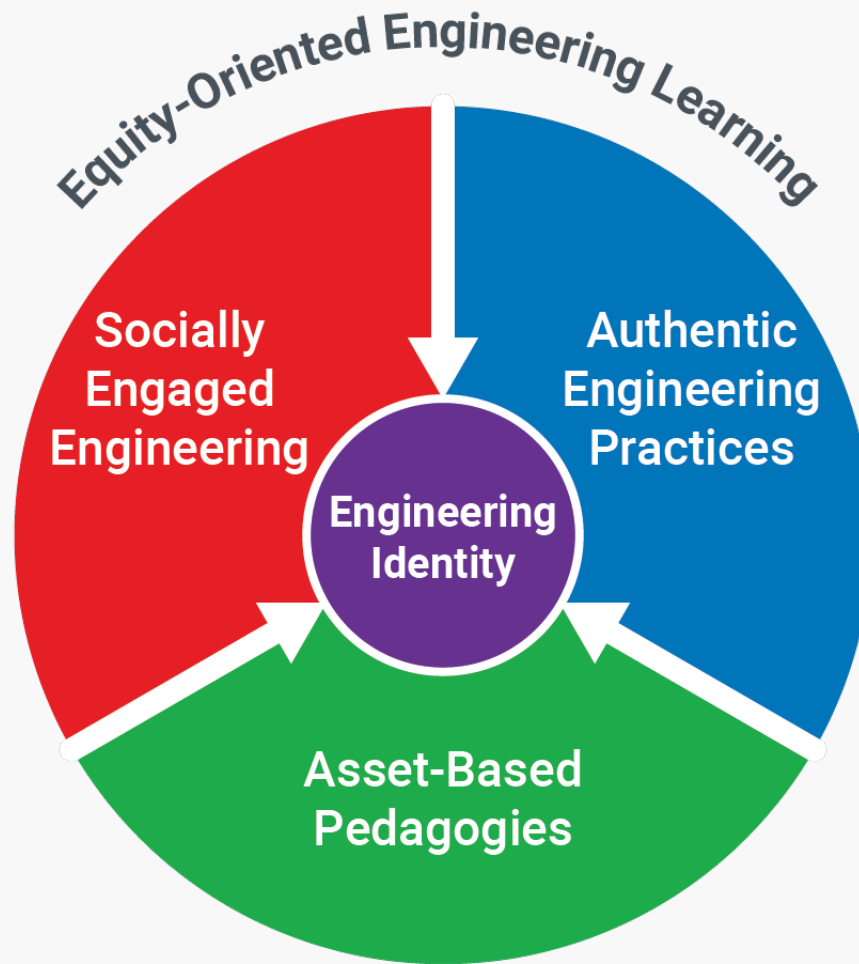
Introduce engineering practices and mindset

Engage in YES Rescue Shuttle challenge

- Variable testing
- Engineer a shuttle

Reflect on engineering practices







Engineering practices – patterned behaviors that create knowledge and products

Engagement in practices → engineering mindset

# Engineering practices

## 10 Practices for an Engineering Mindset

Use a systematic engineering design process

Balance criteria and constraints

Consider real-world problems

Identify as engineers

Explore materials

Work in teams

Envision multiple solutions

Apply math and science

Evaluate and iterate

Persist and learn from failure

Reference

Cunningham, C.M (2018). Engineering in elementary STEM education: Curriculum design, instruction, learning and assessment. New York, NY: Teacher College Press  
Cunningham, C. M., & Kelly, G. K. (2017). Epistemic practices of engineering in education. Science Education, 101, 486-505

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# Engineering Rescue Shuttles



EDUCATOR GUIDE | Upper Elementary

09.2023



### Activity 1







How do shuttle features affect flight distance?

# Which result in longer or shorter flight distances?

Material

Body length

Fins

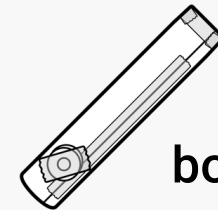
Weight Location

construction paper

short



no fins



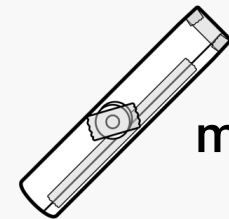
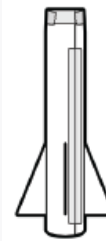
bottom

craft foam

medium



2 fins



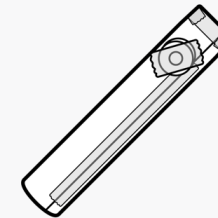
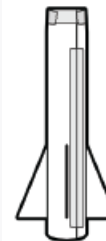
middle

transparency

long



4 fins

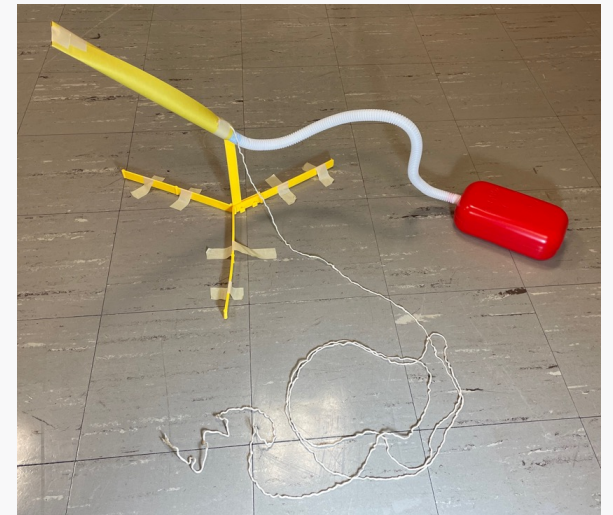


top

YES

# Launch process

- Make sure launcher is set to 30 degrees
- Place shuttle on launcher
- Make sure rescue area is clear
- Yell “Ready” and jump on the balloon



## Shuttle Flight Distance



A1

What changes to the shuttle body result in a **shorter** flight distance?



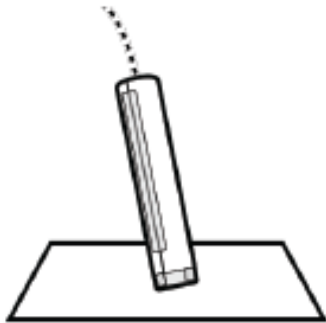
What changes to the shuttle body result in a **longer** flight distance?



\_\_\_\_\_ decreases the flight distance.

\_\_\_\_\_ increases the flight distance.

# Today's challenge



## Criterion

Our rescue shuttle must...

land in the target zone in three attempts or fewer.

## Constraints

We can only...|

use provided materials

## Target Rescue Zone Range (circle one)

**Short**

→  
25 ft.–30 ft.

**Medium**

→  
30 ft.–35 ft.

**Long**

→  
35 ft.–40 ft.

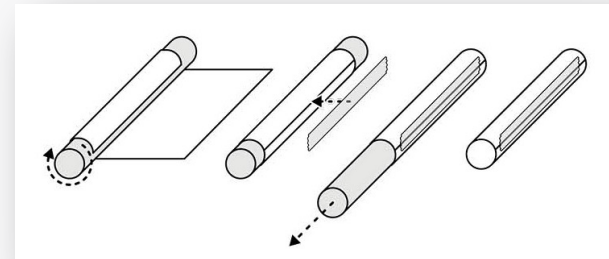
# Making the Shuttle Body

Roll the materials around the tube.

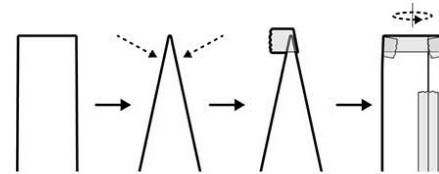
Tape it closed.

Slide it off the tube.

Tape the top closed.



4. Tape the top closed.



Make sure there are **no gaps** at the top.






## Plan Our Rescue Shuttle

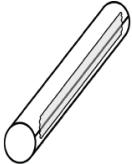


A3

 We could use \_\_\_\_\_ to \_\_\_\_\_.  
 I like that idea because \_\_\_\_\_.  
 What if we tried \_\_\_\_\_ because \_\_\_\_\_?



Draw and label your group's design below.



Length: \_\_\_\_\_

Material: \_\_\_\_\_

Fins: \_\_\_\_\_

Weights: \_\_\_\_\_

Which materials will we use?	How many do we need?



## Test



A4



Launch your rescue shuttle to test if it lands in your target rescue zone. Record results after each attempt.



Rescue Attempt	Flight Distance Mark where your shuttle landed	Score Circle your score:
1	launch site ..... short range ..... medium range ..... long range →	5 (landed in target zone)      0 (missed)
2	launch site ..... short range ..... medium range ..... long range →	5      0
3	launch site ..... short range ..... medium range ..... long range →	5      0
<b>Total Score:</b>		

# Improve



Which parts of your rescue rope shuttle design worked well?

What is something you would like to improve about your rescue rope shuttle?



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# Questions?

YouthEngineeringSolutions.org

yes@mos.org

ccunningham@mos.org



YES Out-of-School

<https://forms.gle/crWU8KKKGD6ZXiF37>



YES Elementary

<https://forms.gle/Pzrho8Gd8EC9aNEa6>

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