06

The Smallpeice Trust

ENGINEERING @SCHOOL

The Rocket Launcher Challenge

Subject: STEM/Engineering

Year group: 2-6

smallpeice
Dare to imagine

#EngineeringAtSchool

ROCKET LAUNCHER TEACHER GUIDANCE

This activity can be used as one of eight towards students obtaining the CREST SuperStar Award.

What Is CREST?

CREST is a nationally recognised scheme for student-led project work in the STEM subjects (science, technology, engineering and maths).

CREST gives young people aged 5–19 the chance to choose their own subject and methodology when completing their hands-on investigation.

CREST provides activities and project ideas for a range of ages, group size and abilities. From off-the-shelf, one-hour long challenges through to large-scale, student-led projects of over 70 hours work or more, CREST can be done by anyone.

What is CREST SuperStar?

SuperStar level is designed to be easy-to-run and low-cost for children typically aged 7-11 years. Children gain an Award by completing eight challenges.

You can download a CREST SuperStar passport template for your students to track their progress once you create an account via

www.crestawards.org/crest-superstar

ENTRY FEE per child: £1 UK / £4 International*

Within four weeks of payment, you will receive certificates and fabric badges to give out to your class.

LENGTH OF LESSON: 1-2 HOURS

How to make your Rocket Launcher:

https://bit.ly/2ZLohk3

LESSON OVERVIEW

Students work in teams of "engineers" to design and build their own Rocket Launcher out of everyday items. They test their rocket launcher, evaluate their results, and present to the class.

Learning Objectives

During this lesson, students will:

- Design and construct a rocket launcher
- Test and refine their designs
- Communicate their design process and results

Learning Outcomes

- To develop an understanding of aerospace engineering
- To develop an understanding of space flight
- To use "metres per second" (m/s) as the unit of speed
- To design and build models by using different materials and to test selected functional characteristic of the model built with the chosen materials

Key Vocabulary: ROCKETS, SPACE, FORCES, TIME, AEROSPACE, ENGINEERING

Curriculum links

SCIENCE KEY STAGE 2

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces
- Working scientifically: asking relevant questions and using different types of scientific enquiries to answer them
- Working scientifically: setting up simple practical enquiries, comparative and fair tests
- Working scientifically: making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers
- Working scientifically: gathering, recording, classifying and presenting data in a variety of ways to help in answering questions
- Working scientifically: recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables
- Working scientifically: using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions

DESIGN & TECHNOLOGY KEY STAGE 2

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at individuals or groups
- Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design
- Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately
- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures

INTRODUCTION

What is space exploration?

Explain to students that: Space exploration is sending people or machines into space to visit other planets. Since the first person walked on the Moon in 1969, hundreds of people have been into space on lots of different types of rockets. Getting rockets into space requires the work of aerospace engineers.

What is an aerospace engineer?

Explain to students that: Aerospace engineers evaluate designs to see that the products meet engineering principles. Aerospace engineers design primarily aircraft, spacecraft and satellites to send into space.

How does a rocket get into space?

Explain to students that: If they have ever blown up a balloon and let it go, they would have noticed that air goes one way and the balloon moves in the opposite direction. Rockets work in much the same way. Exhaust gases coming out of the engine nozzle at high speed push the rocket forward.

What forces are acting on the rocket (taught at key stage 3)

Explain to students that: When a rocket is sitting on the launch pad and not moving, there are forces acting on it, but these forces are balanced. This means that the force pulling it downwards (gravity) is equal to the force pushing it upwards (support force of the ground). These forces are balanced.

For a rocket to start moving, there needs to be an unbalanced force. This means that the forces pushing an object in one direction are greater than the forces pushing it in the opposite direction. There are two forces acting on a rocket at the moment of lift-off:

- **Thrust pushes the rocket upwards by pushing gases downwards in the opposite direction**
- **Weight is the force due to gravity pulling the rocket downwards towards the centre of the Earth**

As the rocket increases speed, there is a third force of drag that begins to increase, slowing the rocket down.

Materials

1. 2 CARDBOARD TUBES
2. CARD/CARDBOARD
3. STRAW
4. ELASTIC BAND
5. PAPER
6. SCISSORS
7. TAPE

MAIN ACTIVITY

1. Students can work alone or in pairs for this activity.

2. Explain that students must develop a rocket launcher from everyday items.

3. Ask students to develop a plan for their rocket launcher. They will need to decide and agree on the materials they will use, write/draw their plan, and present their plan to the class.

4. Show students the student activity sheet and explain that they will need to follow the instructions to make their rocket launcher.

5. Student groups next execute their plans and build their rocket launcher using the materials they have chosen. They may need to rethink their plan, request other materials, or start again if the materials chosen are not working.

6. Next, teams will test their rocket launcher.

7. Teams complete an evaluation / reflection worksheet, and present to the class.

PLENARY (QUESTIONS TO ASK STUDENTS)

1. **Did you succeed in creating a rocket launcher?**
2. **Which materials did you use for your rocket launcher?**
3. **How far did your rocket go?**
4. **Did you decide to revise your original design or request additional materials while in the construction phase? Why?**
5. **If you could have had access to materials that were different than those provided, what would your team have requested? Why?**
6. **Do you think engineers have to adapt their original plans during the construction of systems or products? Why might they?**
7. **If you had to do it all over again, how would your planned design change? Why?**
8. **What designs or methods did you see other teams try that you thought worked well?**
9. **Do you think you would have been able to complete this project easier if you were working alone? Explain…**

STEM Day Risk Assessment

smallpeice
Dare to imagine

Risk Assessment for	**Engineering at School Projects**
Assessment undertaken on	31/03/2020
Assessment undertaken by	Jessica Lee
Signed	

No.	Activity/area being assessed	Associated risk	Who is at risk?	Existing control measures in place?	Level of risk (low, medium, high)	Responsibility
1	General Activity and Workspace	**Slips, trips and falls:** Injury due to tripping over items	Students and adults	Activity supervised by adult supervisor. Deliverer reminds students about safety in video introduction.	M	Students and adults
2	Use of Materials: paper/card, plastic containers	**Injuries:** Injury due to paper cuts, cuts from sharp edges **Injuries:** Injury due to misuse	Students and adults	Activity supervised by adult supervisor.	L	Students and adults
3	Use of materials: elastic bands, sellotape, glue stick, blu-tack, small toys, paper fasteners, LEGO pieces, nuts & bolts or equivalent.	**Injuries:** Injury due to use as a missile **Slips, trips and falls:** Injury due to slipping on dropped items **Injuries:** Ingestion risk of choking.	Students and adults Students and adults Students and adults	Activity supervised by adult supervisor. Activity supervised by adult supervisor. Activity supervised by adult supervisor.	L	Students and adults
4	Use of materials: plastic, corrugated carboard	**Injuries:** Cuts from sharp edges	Students and adults	Activity supervised by adult supervisor.	L	Students and adults

No.	Activity/area being assessed	Associated risk	Who is at risk?	Existing control measures in place?	Level of risk (low, medium, high)	Responsibility
5	Use of sharp tools: Scissors, craft knives	**Injuries:** Cut to self	Students	Activity supervised by adult supervisor.	M	Students and adults
		Behaviour: Cut to others	Students and adults	Activity supervised by adult supervisor.	L	Students and adults
		Behaviour: Vandalism of property	School or home	Activity supervised by adult supervisor.	L	Students and adults
6	Testing of projects: bathtub, drop from height, items on floor	**Spillage of water on floor**: damage and injury due to slip	Students and adults	Activity supervised by adult supervisor.	L	Students and adults
		Slip, trip or fall: Injury due to falling from testing area, tripping over items in testing space	Students and adults	Activity supervised by adult supervisor.	L	Students and adults

The Smallpeice Trust

ENGINEERING @SCHOOL

06

The Rocket Launcher Challenge

#EngineeringAtSchool

Suitable for ages: **6+**

Time needed: **1hr+**

smallpeice

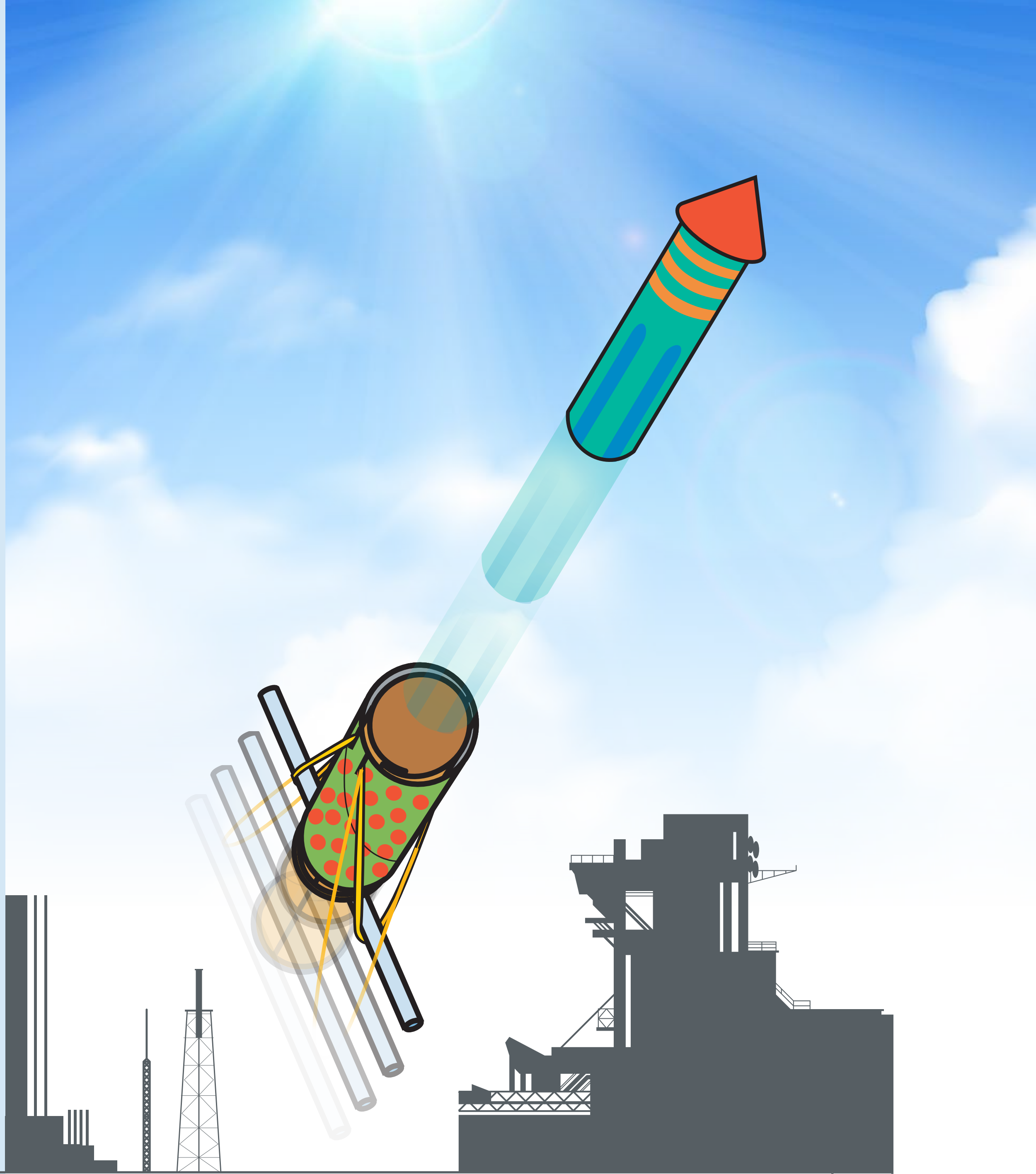
Dare to imagine

DESIGN A ROCKET LAUNCHER

You are a team of engineers who have been given the challenge to design your own rocket launcher out of everyday items. The rocket needs to be able to travel as far as possible

The rocket that can travel the furthest distance is the winner.

smallpeice
Dare to imagine



PLANNING STAGE

In your team, discuss the problem you need to solve. Then develop and agree on a design for your rocket launcher. You'll need to decide and agree what materials you want to use.

Draw your design in the box and label the different parts and materials you plan to use. Present your design to the class.

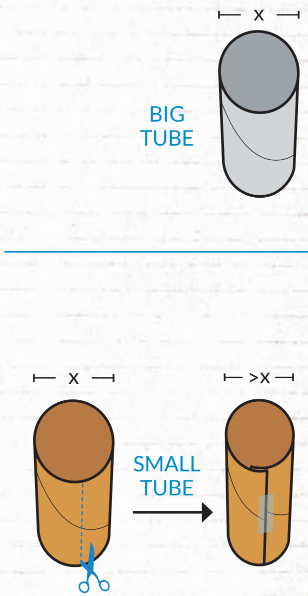
You may choose to revise your team's plan after you receive feedback from class.

ROCKET LAUNCHER DESIGN & MATERIALS

MATERIALS

1. **2 CARDBOARD TUBES**
2. **CARD/CARDBOARD**
3. **STRAW**
4. **ELASTIC BAND**
5. **PAPER**
6. **SCISSORS**
7. **TAPE**

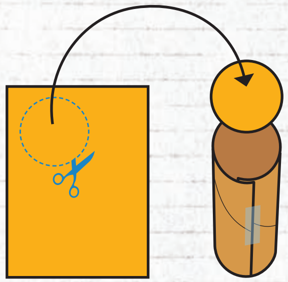
INSTRUCTIONS TO MAKE THE LAUNCHER



1.

You will need one of your tubes to be smaller than the other to fit inside the first one.

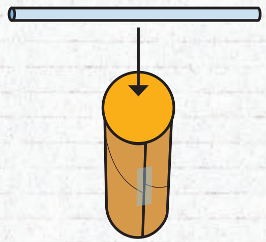
If they are the same size cut one and stick it back with an overlap.



2.

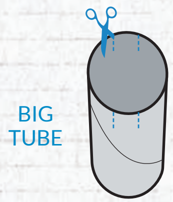
Now block the end of the smaller tube.

Draw round the end onto a cardboard sheet and stick it into the end.



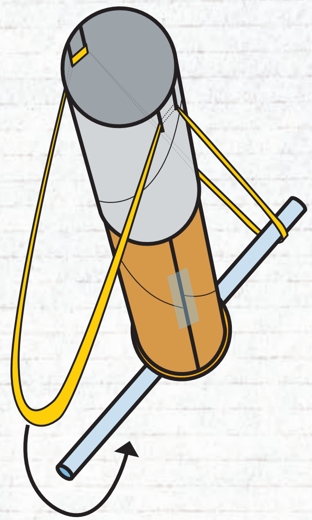
3.

Then stick the straw to the blocked bottom.



4.

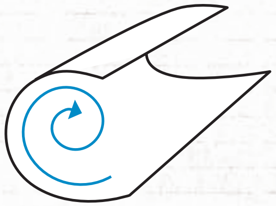
On the bigger tube cut 4 vertical slits, 2 on each side about 1-2 cm apart.



5.

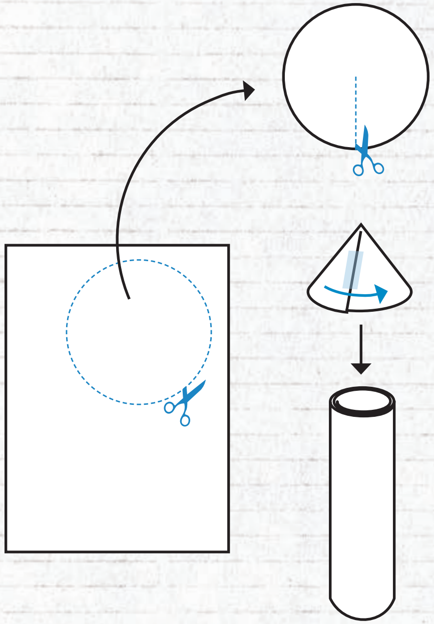
Put the smaller tube inside the bigger one and thread the elastic band through and then loop round the straw.

INSTRUCTIONS TO MAKE THE ROCKET



6.

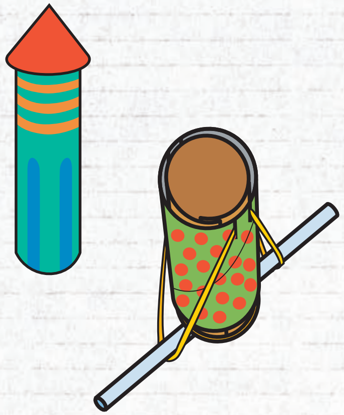
Roll a piece of paper into a tube – this is the body of the rocket.



7.

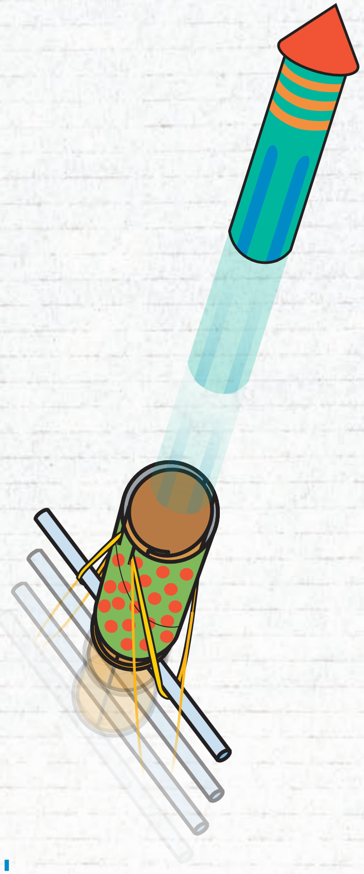
Cut out a circle, cut into the middle and overlap the edges to make a cone. Stick this to the top of your tube.

Think about aerodynamics – how can you make your cone cut through the air efficiently?



8.

Decorate your rocket and launcher.



9.

Place your rocket in the launcher, **pull down and release to launch your rocket.**

TESTING STAGE

Each team will test their rocket launcher. Calculate your rocket speed (distance travelled per unit of time).

Be sure to watch the tests of the other teams and observe how their different designs worked.

ROCKET LAUNCHER DATA

	Distance Travelled	Time Travelled	Speed (m/s)
Test 1			
Test 2			
Test 3			
Average			

EVALUATION STAGE

Evaluate your team's results, complete the evaluation worksheet, and present your findings to the class.

Use this worksheet to evaluate your team's results in the Rocket Launcher Challenge.

1. **Did you succeed in creating a rocket launcher?**
2. **Which materials did you use for your rocket launcher**
3. **How far did your rocket go?**
4. **Did you decide to revise your original design or request additional materials while in the construction phase? Why?**
5. **If you could have had access to materials that were different than those provided, what would your team have requested? Why?**
6. **Do you think engineers have to adapt their original plans during the construction of systems or products? Why might they?**
7. **If you had to do it all over again, how would your planned design change? Why?**
8. **What designs or methods did you see other teams try that you thought worked well?**
9. **Do you think you would have been able to complete this project easier if you were working alone? Explain...**