TEACHER RESOURCE PACK

PERFORM EDUCATION PRESENTS

LAUNCH TO THE FUTURE

A STEM STORY

perform! education

20 YEARS IN 2020

perform! VIRTUAL INCURSIONS

PERFORM EDUCATION VIRTUAL INCURSIONS

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FACILITATOR GUIDE

Welcome to the **Science/STEM in Schools Virtual Incursion** program ***LAUNCH TO THE FUTURE!*** Educating your students about Space and Lunar Science, the program features features New Zealand's contribution to space science and how STEM helps to drive the future!

Participating in this program is easy and integrates with the New Zealand Curriculum to seamlessly aid your teaching methods both at school and at home.

The Virtual Incursion program includes:

- A 45 minute live-on-film educational theatre performance
- Pre-performance Teacher Preparation video
- Post-performance Q&A videos
- Educational web portal with personalised school login for teachers and students
- Teacher Guide and Resource Pack
- Student digital games
- Student downloadable activities
- Schedule your classrooms for a live-stream 'Meet the Actors & Creatives'

BEFORE THE DAY OF YOUR VIRTUAL INCURSION

1. Go to **PerformEducation.com**
2. On the homepage select the Virtual Incursions **LOGIN** button
3. Use your school password provided to access the educational web portal for ***LAUNCH TO THE FUTURE!***
4. Watch the 'Teacher Preparation' video – and share with all staff that will be assisting students to participate in this program
5. Discuss the program with your students, and the topics covered, and explain to students about the upcoming Virtual Performance.

ON THE DAY OF YOUR VIRTUAL INCURSION

1. Stick to your scheduled performance viewing times for each grade/classroom. This will provide you with a structure for the day and a focused learning environment for your students.
2. Make sure you provide all teachers/classrooms/students that will be logging in with our web portal details and your school password.
3. One hour before your scheduled start time, log yourself into our web portal using your school password to ensure you familiarize yourself with how to access the live-on-film performance.
4. As each individual classroom/group session is ready, the teacher/facilitator or students simply needs to log into our web portal, enter their name and the school password, and then play the performance video.
5. The live-on-film performance will run for approx. 45 minutes. There is no need for the facilitator to pause at any time during the viewing of the performance.
6. However…as your access to the performance video is open for 7 days, you are able to structure your viewing/learning sessions. You may choose to spread the event over a few days. You could watch 25 minutes of the performance per day, and then break into a classroom activity found in this Teacher Pack. Alternatively, you may want to watch the entire performance in one session, and then on another day have students watch again as part of your review and further exploration of the content.
7. At the end of the performance your viewing can continue immediately, or on a separate day/time, with our post-performance Q&A recordings - available all year long to view and discuss.

FACILITATOR GUIDE

How do we view the Virtual Incursion?
The Virtual Incursion is accessed through our website educational portal. All you will need is a screen big enough for everyone to see and an internet connection. You should check in with your school IT department to discuss what will work best.

The live-on-film performance can be watched in individual classrooms, the school hall, theatrette, science lab, library, multipurpose room, or even have students log in and view from home1

You may also want to prepare instructions for any students who may be remote learning and need the portal website and school password in advance to login at home.

If you are viewing at school, you could use:
- Individual classroom interactive whiteboards
- Projector connected to a computer
- A large TV connected to a computer
- Individual students on their laptop**s**

Then for each classroom/group that is viewing you will need a teacher/facilitator to guide your students with very simple-to-follow steps outlined in this Facilitator Guide.

What is the Live-On-Film performance?
LAUNCH TO THE FUTURE is a 45 minute live-on-film educational theatre performance from *Perform Education* and performed by two professional actors.

In a series of sketches, professional actor/educators use audience suggestions to create uniquely hilarious scenes that educate on the moon and space science.
Students will learn:
- How science helps to solve the unsolvable (SCIENCE)
- Innovation drives technology (TECHNOLOGY)
- Space engineering helps design new solutions (ENGINEERING)
- How maths helps to drive the future (MATHS)

AFTER YOUR VIRTUAL INCURSION

1. Have all teachers, staff and facilitators go to **PerformTeachers.com**, click on the name of this program, and evaluate the program – they will then go in a draw to **WIN $200** for their classroom!
2. Then jump back onto **PerformEducation.com**
3. Log into this Virtual Incursion program using the same password you used to view the performance
4. Utilise the year-round educational resources including digital games, activities and videos for your students
5. Take the opportunity to schedule a live-stream 'Meet the Actors & Creatives' session and have students chat directly with our team.
6. Now schedule a date for 2021 – with options once again for ***LIVE*** and ***VIRTUAL*** incursions!

MANY THANKS FOR YOUR ASSISTANCE AND SUPPORT!

ABOUT THE COMPANY

Perform! Education is a multi award-winning educational production company and part of the largest educational producers operating across New Zealand, Australia, and the USA.

The company specialises in touring curriculum aligned, educational musicals, theatre and sketch comedy into schools and has been operating in New Zealand for fifteen years. Every year we tour to over 250,000 students and in all, the company and its writers have toured our specialty educational programs to **over three million students** across the world.

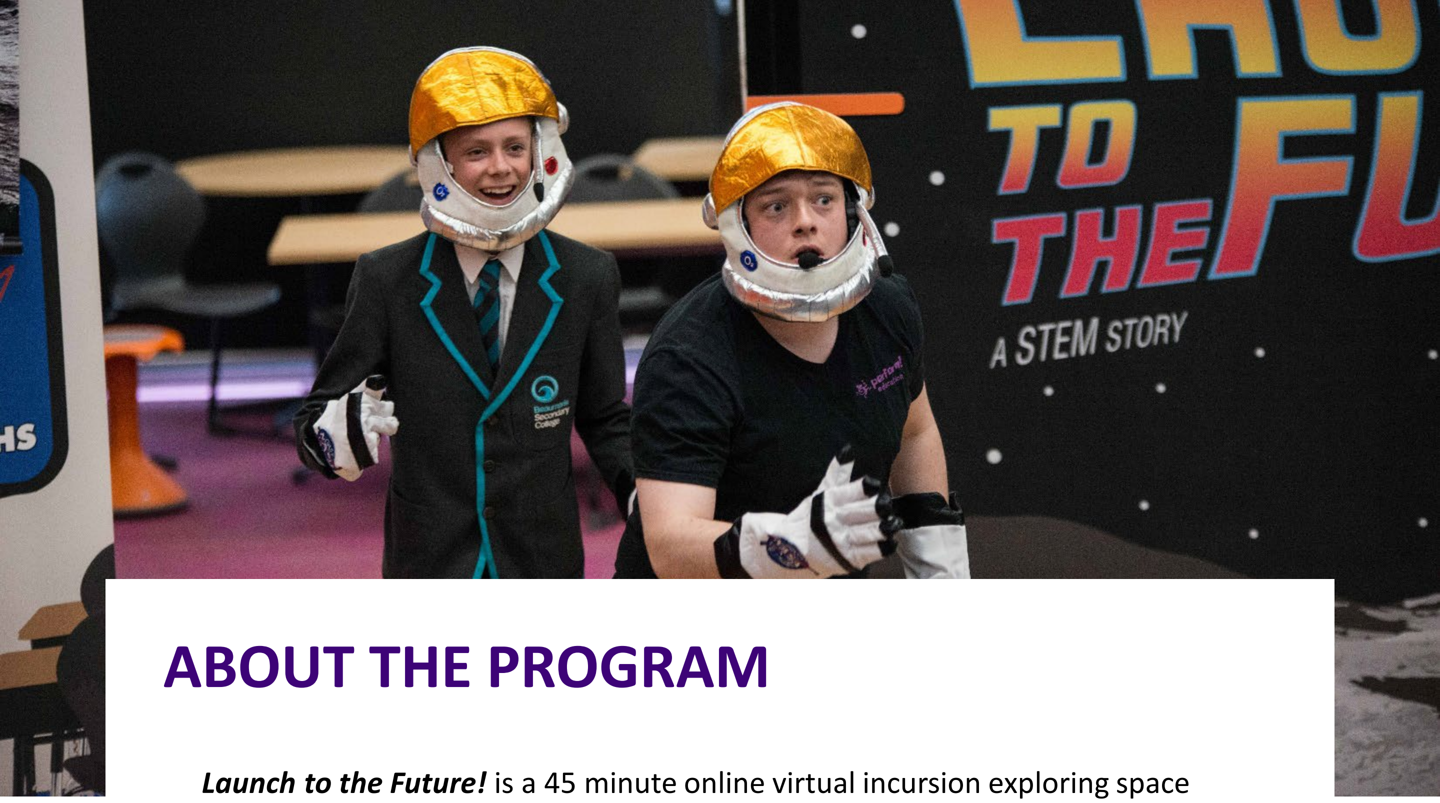
In New Zealand, we tour an annual **Science/STEM** educational sketch comedy program as well as a **Book Week** literacy program. The **Science/STEM** program inspires students with the limitless fun and possibilities offered by Science, Technology, Engineering & Maths – while promoting how science impacts our everyday lives and future careers.

The performances, which take place within schools, are **highly interactive** and feature highly comedic sketches, appealing and identifiable characters, loads of **comedy**, fun scientific facts and student interaction that captivates and engages all audiences from ages 10 to 15 years old (as well as their teachers!).

Question/Discussion time at the conclusion of the performance reinforces the learning outcomes, and this specially designed **Teacher Resource Pack** sent prior to the performance offers a comprehensive selection of classroom exercises for both before and after the performance.

To find out more about ***Perform! Education*** or to contact the company, please log onto our website at www.performeducation.com

If you or any of your students would like to find out more details about our company please visit our website: **www.performeducation.com**



ABOUT THE PROGRAM

Launch to the Future! is a 45 minute online virtual incursion exploring space science and the ways in which it's propelling us into the future using **STEM!**

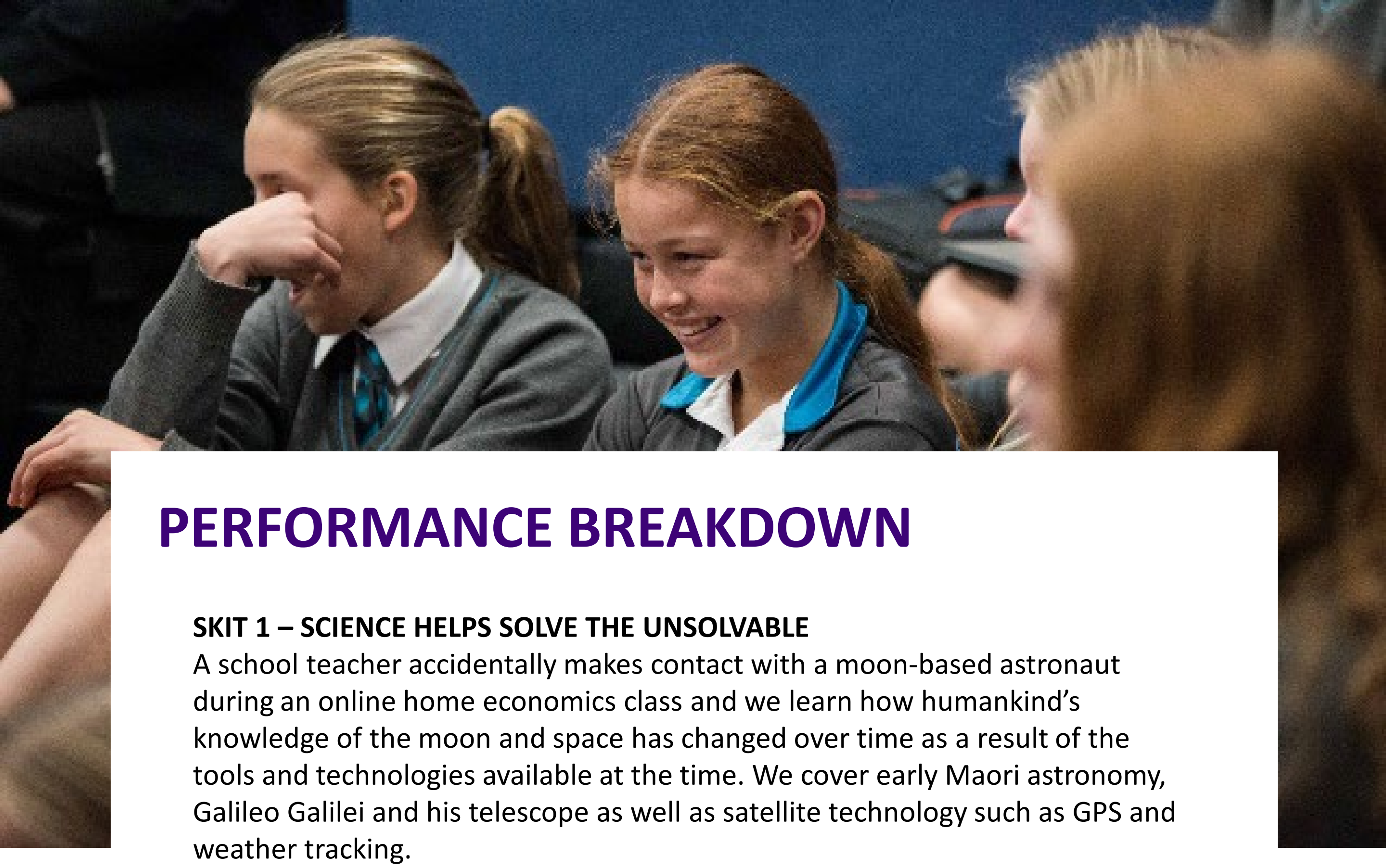
In a series of comedic sketches set in the fictional vlog of a young performer, professional actor/educators explore how:

- **Science helps solves the unsolvable (SCIENCE)**
- **Innovation drives technology (TECHNOLOGY)**
- **Space engineering helps design new solutions (ENGINEERING)**
- **Maths helps drive the future (MATHS)**

LEARNING AREAS: Science, Mathematics & Statistics, Technology, Social Sciences, English, The Arts (Drama)

THEMES:

- 50th Anniversary of the Apollo 11 moon landing
- Everyday technologies invented by space science eg camera phones, baby formula, wireless headphones, laptops, CAT scans, memory foam, Nike Air sports shoes
- Our understanding of the universe is limited to the technologies on hand – Early Maori astronomy, Galileo Galilei, satellite technology.
- New Zealand's contribution to space science: Early Maori astronomy, William Pickering, Peter Beck and Rocket Lab, LeoLabs, NZ Space Agency
- Machine learning, robotics, AI, brain-computer interface
- Future directions in space science: sustainable human presences on the moon and Mars, recyclable rockets, space junk strategies, solar energy harvesting in space, mining asteroids



PERFORMANCE BREAKDOWN

SKIT 1 – SCIENCE HELPS SOLVE THE UNSOLVABLE
A school teacher accidentally makes contact with a moon-based astronaut during an online home economics class and we learn how humankind's knowledge of the moon and space has changed over time as a result of the tools and technologies available at the time. We cover early Maori astronomy, Galileo Galilei and his telescope as well as satellite technology such as GPS and weather tracking.

SKIT 2 – INNOVATION DRIVES TECHNOLOGY & SPACE ENGINEERING HELPS DESIGN NEW SOLUTIONS
2 television game shows - *Are You Smarter Than a Game Show Host?* and *Who Wants to be a Millionaire?* zero in on the astonishing array of objects we use every day that come from space engineering and technology. Nike Air sports shoes, wireless headphones, laptop computers, baby formula, memory foam and CAT scans to name a few.

SKIT 3 – MATHS HELPS DRIVE THE FUTURE
We see a day in the life of a student in the not too distant future – where life is lived on Mars. We see how maths is at the heart of enabling our lives, both now and in the future with technologies such as artificial intelligence, machine learning, robotics and brain computer-interface technology.

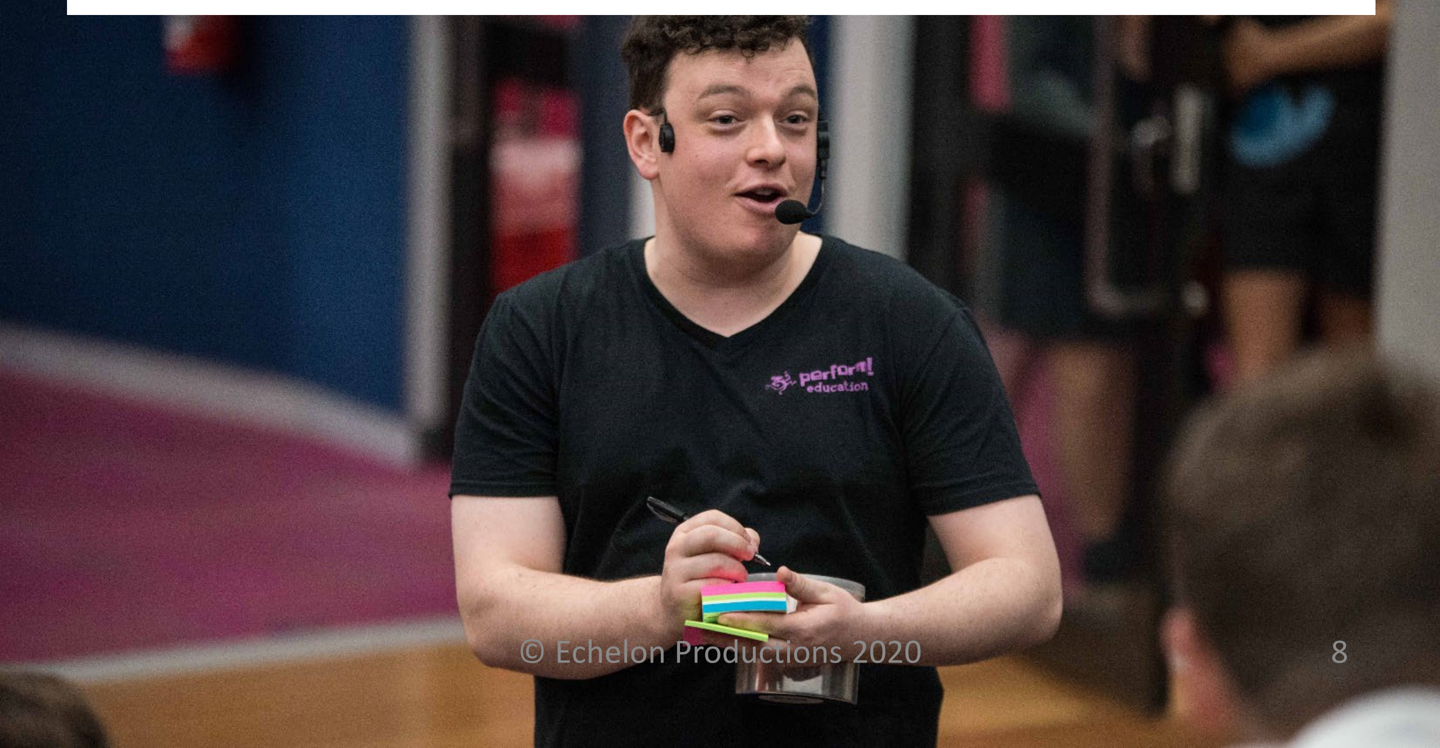
POST SHOW QUESTIONS

A series of questions are posed to our Actors where students can select from separate videos which questions they would like to delve into and watch online, then break into groups for further classroom discussion.
These questions can be viewed straight after watching the live-on-film performance, or on another day/class time to suit your schedule.

POST PERFORMANCE

DISCUSSION POINTS

- Name 3 devices that, without its technology, would make your day a little harder and why.
- How many things have you used today that were developed from space science?
- What makes New Zealand so well suited to space technologies?
- Why is space science an important industry for New Zealand to cultivate?
- Name some NZ based companies that use STEM at the core of their business.
- Peter Beck's school career counsellor told his parents that his ambition to build rockets was 'absurdly unachievable'. What does this demonstrate about Peter Beck's character?
- New Zealanders weren't able to see the first moon landing until 5 hours after it happened, because they had to wait for the film to be flown from Australia in order to have it broadcast on NZ television. Bearing this in mind, what are the pros and cons of today's media technology?
- If you were to design and program an autonomous robot, what would its main functions be?
- What additional technologies would you wish to be added to the functions of a car?
- What are some learning pathways to working in the NZ space industry?
- The New Zealand Space Agency was set up as recently as 2016. What are the advantages of having our own Space Agency?



CLASSROOM ACTIVITY #1

MAKE A SODA STRAW ROCKET

by NASA JET PROPULSION LABORATORY EDUCATION

Learning Areas: Science, Mathematics, Engineering **Grade Levels:** 5 – 8

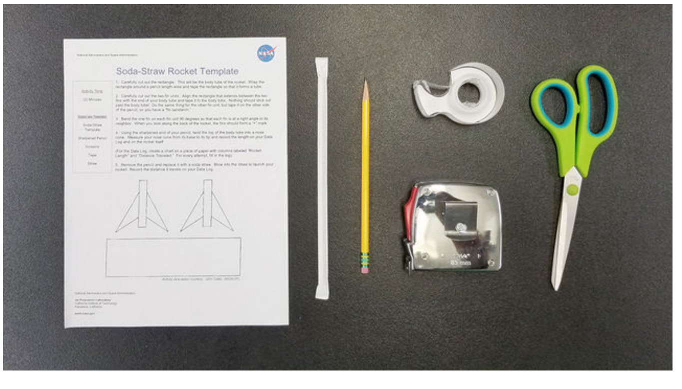
Overview

Soda Straw Rockets is an excellent opportunity for students to practise the engineering design process. This activity provides students with a template that creates a rocket that can be launched from a soda straw. They are then challenged to modify the design to see how the changes impact the rocket performance. Length, fin shape or angle can be changed–one variable at a time–to see how the rocket launch performs, and compares to the control design.

Sources

https://www.jpl.nasa.gov/edu/teach/activity/straw-rocket/

https://www.jpl.nasa.gov/edu/learn/project/make-a-straw-rocket/



Materials

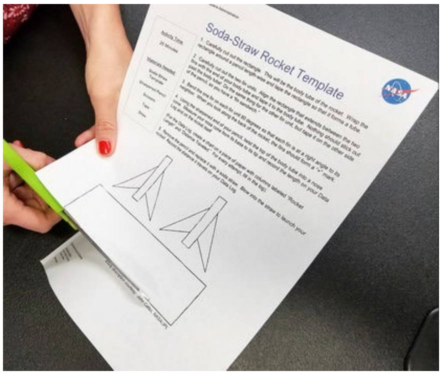
- Pencil
- Scissors
- Tape
- Soda straw (plastic or reusable)
- Metre stick or metre measuring tape
- Rocket template and data log (at bottom of the exercise)

Management

- Move desks or tables out of the way to make room for the rocket launch. Or consider launching rockets outside if that's an option.
- Set out tape-markers for distance if the number of metre sticks or tape is limited. Or, use floor-tile lengths to calculate distance.
- Each student should construct their own rocket even while working in a group.

CLASSROOM ACTIVITY #1

MAKE A SODA STRAW ROCKET



Background

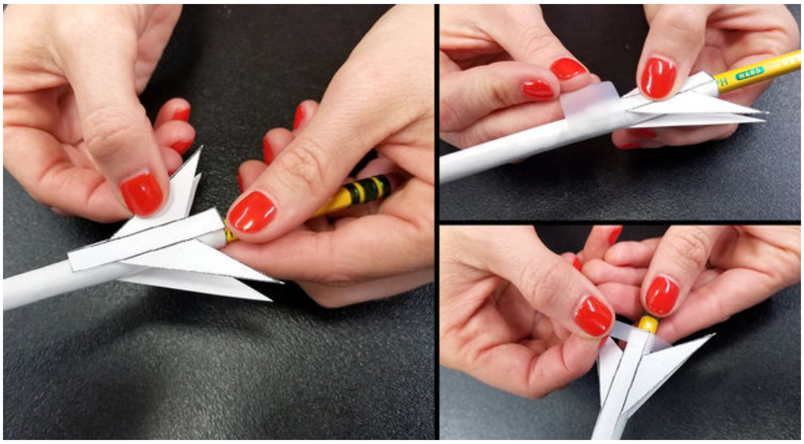
Modern rocket design began near the beginning of the 20th century. While much has been learned and rockets have grown larger and more powerful, rocket designs are still improving. Engineers developing new rockets must control variables and consider failure points when improving rocket designs. By changing one variable at a time, engineers can determine if that change leads to an increase or decrease in performance. They must also consider how their design might fail, and work to improve their design. These incremental changes allow engineers to improve rocket performance and increase the amount of mass they can lift into space.

1. Cut out and shape the rocket body

Carefully cut out the large rectangle on the rocket template. This will be the body of the rocket. Wrap the rocket body around a pencil length-wise and tape it closed to form a tube.

2. Cut out and tape on the fins

Carefully cut out the two fin units. Line up the rectangle in the middle of the fin with the bottom of the rocket body and tape it to the rocket body. Nothing should stick out past the bottom of the rocket body.



3. Make a fin sandwich

Tape the other fin to the rocket body the same way as above, but on the other side, making a "fin sandwich."

CLASSROOM ACTIVITY #1

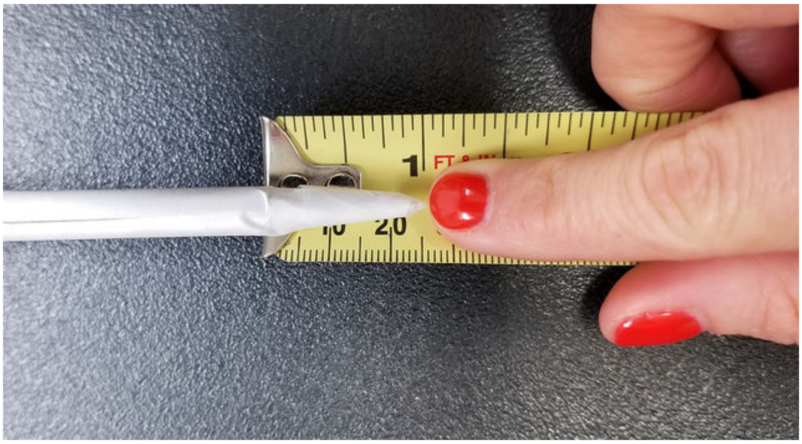
MAKE A SODA STRAW ROCKET

4. Bend the fins

Bend the part of each fin that looks like a triangle 90 degrees so that each fin is at a right angle to its neighbour. Looking from the bottom of the rocket, the fins should look like a +.

5. Make the nose cone

Twist and pinch the top of the rocket body around the tip of the pencil to create a “nose cone” for your rocket. Tape the nose cone to prevent air from escaping and to keep it from untwisting.



6. Measure the nose cone

Measure the nose cone from its base (right where it starts to narrow) to its tip and record the length in your data log and on the rocket itself.

CLASSROOM ACTIVITY #1

MAKE A SODA STRAW ROCKET

Once completed, the rocket will be about 13 cm (about 5 inches) tall.

7. Prepare for launch

Remove the pencil and replace it with the soda straw.

8. Three, two, one ... launch!

Be sure that your launch area is clear of people and other hazards. Mark your launch point with tape or an object. Then, blow into the straw to launch the rocket!

9. Measure the distance travelled

Use the meter stick or measuring tape to measure the distance your rocket travelled. Then, record the distance on your data log.

10. Improve your design

Can you make your rocket fly farther? Make new rockets by altering the template. Try different rocket lengths, fin shapes, fin sizes, or fin angles. Repeat steps 6 and 9 for every launch, recording each design change and distance in your data log. Make only one change at a time, so you will know which design changes result in changes in performance.

If you're using a reusable metal straw, check that the diameter of the rocket body fits around the straw. If it's too narrow, wrap the paper around the metal straw instead of the pencil. The rocket body should be loose enough that it slides off the straw, but not so loose that there are large gaps between the straw and paper.

Extensions

Create a class data table. Students can share data and discuss how rocket length affects distance. Let students personalize their rockets by colouring or drawing on them.

CLASSROOM ACTIVITY #1

Jet Propulsion Laboratory
California Institute of Technology

jpl.nasa.gov/edu/learn

K-12 Students

Make a Straw Rocket

Create a paper rocket that can be launched from a soda straw – then, modify the design to make the rocket fly farther!

Materials

- Pencil
- Scissors
- Tape
- Soda straw (plastic or reusable)
- Meter stick or measuring tape
- Rocket template and data log

1. Cut out and shape the rocket body

Cut out the rectangle. This will be the body tube of the rocket. Wrap the rectangle around a pencil length-wise and tape the rectangle so that it forms a tube.

2. Cut out and attach the fins

Cut out the two fin units. Align the bottom of the rectangle that extends between the fins with the end of the rocket body, and tape the fin to the body tube. Do the same thing for the other fin on the opposite side, making a "fin sandwich."

3. Bend the fins

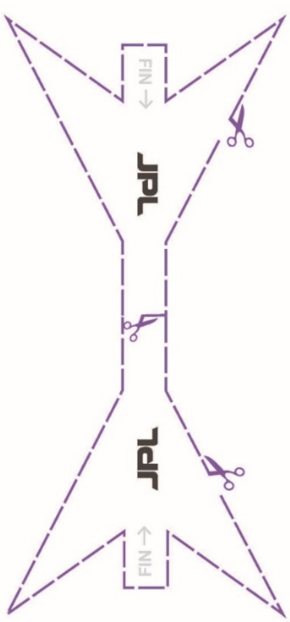
Bend the fins on each fin unit 90 degrees so that they are each at a right angle to each other. When you look along the back of the rocket, the fins should form a "+" mark.

4. Make and measure the nose cone

Twist the top of the body tube into a nose cone around the sharpened end of your pencil. Measure your nose cone from its base to its tip and record the length on the data log and on the rocket itself.

5. Prepare to launch!

Remove the pencil and replace it with a soda straw. Be sure your launch area is clear of people and hazards. Then, blow into the straw to launch your rocket! Record the distance the rocket travels on your data log.



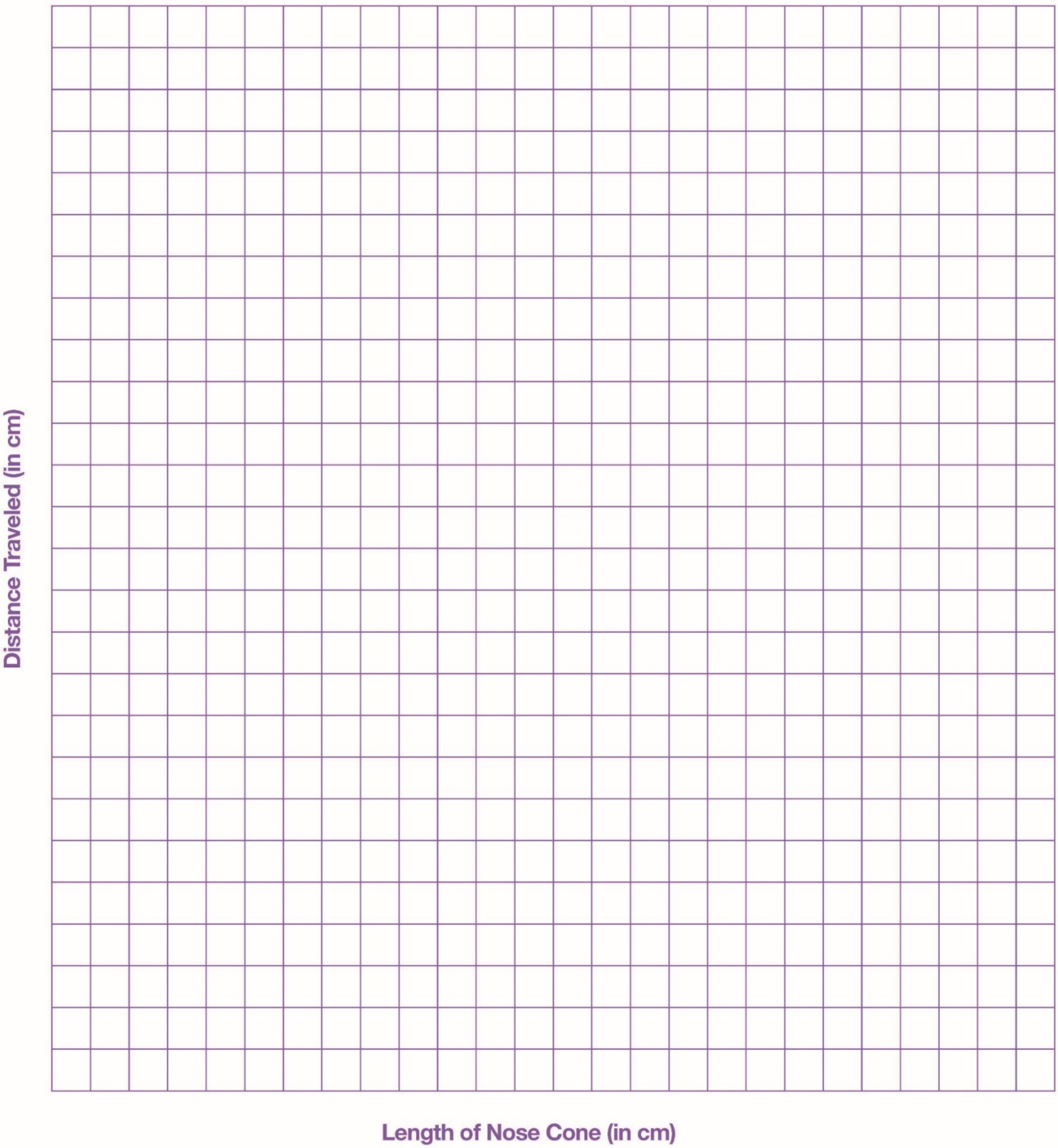
CLASSROOM ACTIVITY #1

Straw Rocket Data Log

Length of Nose Cone (in cm)	Distance Traveled (in cm)					Notes
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	

CLASSROOM ACTIVITY #1

Straw Rocket Data Analysis



CLASSROOM ACTIVITY #2

SOLAR SYSTEM BEAD ACTIVITY

by NASA JET PROPULSION LABORATORY EDUCATION

Learning Areas: Science, Mathematics **Grade Levels:** 5 – 9

Overview

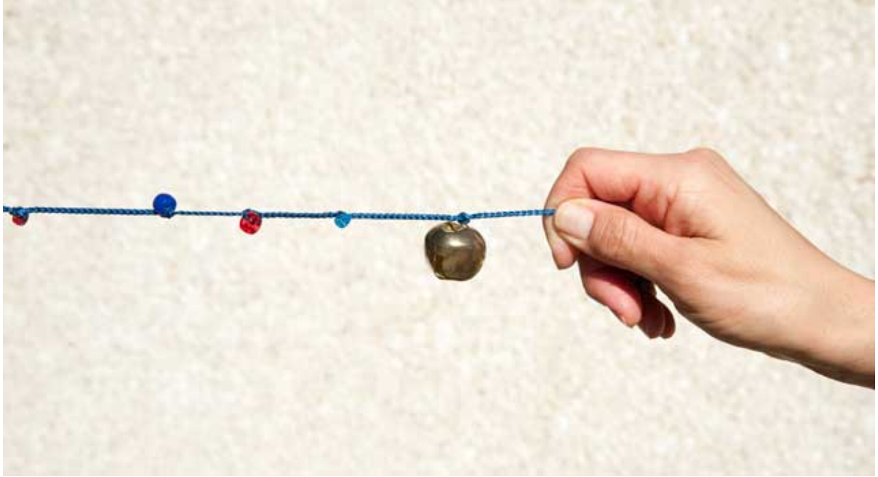
Students construct -- and where appropriate, calculate -- a scale model of the solar system using beads and string. Students will observe the relative distances of the planets, asteroid belt and dwarf planet Pluto from one another and from the sun; and gain a better understanding of the vast distances between planets in the outer solar system compared with those in the inner solar system.

Sources

https://www.jpl.nasa.gov/edu/teach/activity/solar-system-bead-activity/

Materials

- Large craft pony beads in 11 colours -- roughly approximating the appearance of the planets and the sun
- Five metres of string for each student
- Small piece of cardboard to wrap solar system string around (10 cm x 10 cm)
- Metre sticks or rulers with centimetre markings for each student or group to share
- Student worksheet, one per student (at bottom of the exercise)
- Answer key (at bottom of the exercise)



CLASSROOM ACTIVITY #2

SOLAR SYSTEM BEAD ACTIVITY

Management

- To speed up the activity for younger students, the string may be pre-cut and a set of solar system beads may be put into a plastic zip-lock bag for each student. Also, for younger students, a measured marking grid can be put on a table top so the students can mark their measured distances and then tie off the beads. If the pre-marking method is used, extra distance must be added to each planet distance to accommodate the string within each knot (approximately 4 centimetres for a double knot around the bead).

- Tape newspaper to the surface where the students will be marking their strings so they do not mark the counter or floor.

- For older students, measurements are made each time from the sun to the planet and tied on after each measurement.

Background

Our solar system is immense in size. We think of the planets as revolving around the sun, but rarely consider how far each planet is from the sun or from each other. Furthermore, we fail to appreciate the even greater distances to the other stars. Astronomers refer to the distance from the sun to the Earth as one "astronomical unit" or AU. This unit provides an easy way to calculate the distances of the other planets from the sun and build a scale model with the correct relative distances.

Astronomical Unit (1AU) = Approximately 150 million kilometres (93 million miles)
(149,597,871 kilometres or 92,955,807 miles to be exact!)

Keep two important Solar System facts in mind:

1. **The planets never align in a straight line.** Occasionally, though, sky-watchers are treated to the sight of two bright planets apparently close together as viewed from our planet.
2. **The string solar system is a radius of the orbits of the planets.** To see how large the solar system is, hold the sun in one location and swing the planets in a circle around it. If you move counter-clockwise you will be moving the planets in the direction they move as viewed from above their plane.

CLASSROOM ACTIVITY #2

SOLAR SYSTEM BEAD ACTIVITY

Procedures

Students will construct a distance model of the solar system to scale, using coloured beads as planets. The chart below shows the planets and asteroid belt in order, along with their distance from the sun in astronomical units.

Planet	AU	Scale Value (centimetres)	Bead Colour
Sun	0.0 AU	0 cm	Yellow
Mercury	0.4 AU	4 cm	Solid Red
Venus	0.7 AU	7 cm	Cream
Earth	1.0 AU	10 cm	Clear Blue
Mars	1.5 AU	15 cm	Clear Red
Asteroid Belt	2.8 AU	28 cm	Black
Jupiter	5.2 AU	52 cm	Orange
Saturn	9.6 AU	96 cm	Clear Gold
Uranus	19.2 AU	192 cm	Dark Blue
Neptune	30.0 AU	300 cm	Light Blue
Pluto (closest)	29.7 AU	297 cm	Brown
Pluto (average)	39.5 AU	395 cm	Brown
Pluto (most distant)	49.3 AU	493 cm	Brown

Jet Propulsion Laboratory
California Institute of Technology

Student Worksheet

Planet Distance Chart

Calculate the scale value for each Solar System object using a scale factor of 10 centimeters per astronomical unit (AU). 1 AU is equal to about 150 million kilometers (93 million miles)!

Object	AU	Scale Value (centimeters)	Bead Color
Sun	0.0 AU		Yellow
Mercury	0.4 AU		Solid Red
Venus	0.7 AU		Cream
Earth	1.0 AU		Clear Blue
Mars	1.5 AU		Clear Red
Asteroid Belt	2.8 AU		Black
Jupiter	5.2 AU		Orange
Saturn	9.6 AU		Clear Gold
Uranus	19.2 AU		Dark Blue
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CLASSROOM ACTIVITY #2

Jet Propulsion Laboratory
California Institute of Technology

Answer Key

Planet Distance Chart

Calculate the scale value for each Solar System object using a scale factor of 10 centimeters per astronomical unit (AU). 1 AU is equal to about 150 million kilometers (93 million miles)!

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Neptune	30.0 AU	300 cm	Light Blue
Pluto (closest)	29.7 AU	297 cm	Brown
Pluto (average)	39.5 AU	395 cm	Brown
Pluto (most distant)	49.3 AU	493 cm	Brown

CLASSROOM ACTIVITY #3

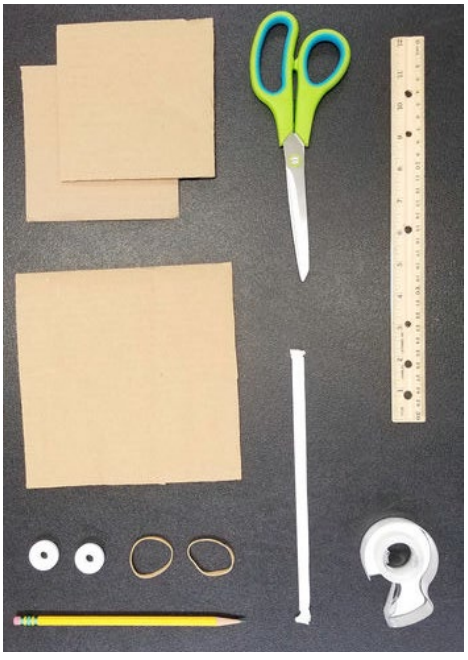
MAKE A CARDBOARD ROVER

by NASA JET PROPULSION LABORATORY EDUCATION

Learning Areas: Science, Mathematics, Engineering **Grade Levels:** 6 – 10

Overview

In this challenge, students build their own rubber-band-powered rover that can scramble across the room. Students build their rover out of cardboard, figure out how to use rubber bands to spin the wheels and use the engineering design process to improve their rover based on testing results.



Sources:

https://www.jpl.nasa.gov/edu/teach/activity/roving-on-the-moon/

https://www.jpl.nasa.gov/edu/learn/project/make-a-cardboard-rover/

Materials

- 1 6-inch (15cm) square of corrugated cardboard for the body of the rover
- 2 5-inch (13cm) pieces of corrugated cardboard for the wheels
- 1 sharpened cylindrical pencil
- 2 rubber bands
- 2 pieces of round hard candy with a hole in the middle
- 1 plastic drinking straw
- Ruler
- Tape
- Scissors
- *Sample Rover made by teacher*

Procedures

1. Introduce the challenge

Tell students some of the ways rovers will be used on the moon:
NASA plans to land astronauts on the moon by the year 2024. The astronauts will need moon cars—called rovers—to drive across the moon's surface, carry supplies, help build their outpost, and explore the area. Today you'll build and test a rubber band-powered rover.

Show students your sample rover and tell them:
This is a prototype of a rover, just like the one you are going to build. Prototypes are used all the time in engineering. They give you a basic design to build, test, and evaluate. Once you understand a design's strengths and weaknesses, you can then find ways to improve it. Today, for example, as you test your rover prototype, you'll find ways to make it work better. Improving a design based on testing is called the engineering design process.

CLASSROOM ACTIVITY #3

MAKE A CARDBOARD ROVER

Procedures

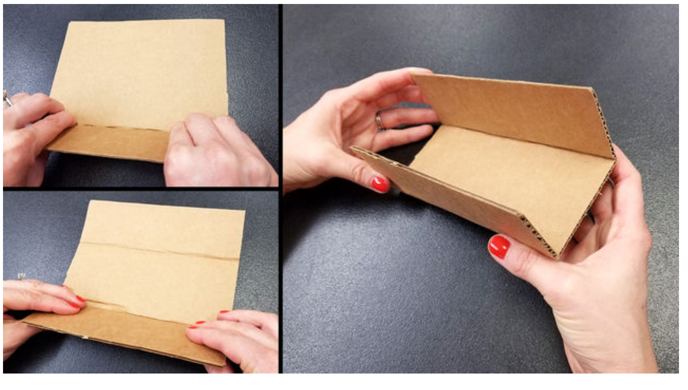
2. Brainstorm and design

Get kids thinking about the rover prototype. Ask:

What do we have to do to make the rover move?
Turn the wheels to wind up the rubber band. Place the rover on the floor. Then let go. Note: Depending on the direction you wind the wheels, the rover can move either forward or backward.

How can you make different kinds of wheels?
Kids can make different-sized wheels by cutting larger or smaller squares or make different-shaped wheels by trimming the squares. NOTE: Square wheels offer two advantages: they're quick to make, and it's easy to find the exact centre by drawing diagonal lines. The centre is where the lines cross.

How do you think square wheels affect how the rover moves across the floor?
The points of the squares dig into soft surfaces, such as rugs, sand, or grass. This improves traction—the ability to grip a surface—and helps prevent the wheels from spinning out. Since the moon is covered in a thick layer of fine dust, good traction is essential, especially going up and down hills.



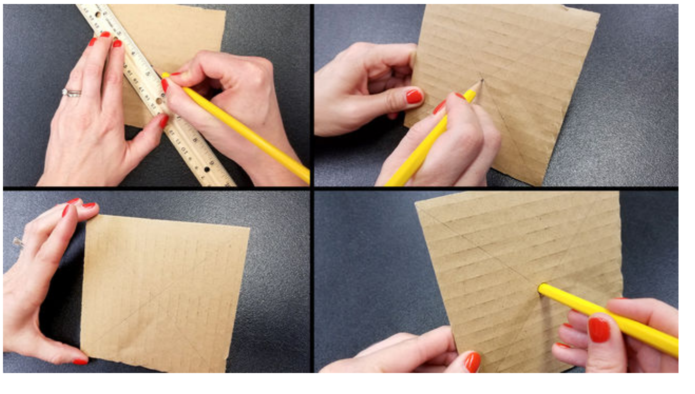
3. Make the rover body

Fold the cardboard into thirds along – not across – the corrugation (the open veins inside the piece of cardboard), pushing up the sides of the rover body to form a trench. Each section will be about 2 inches (5 cm) across.

4. Make the front wheels

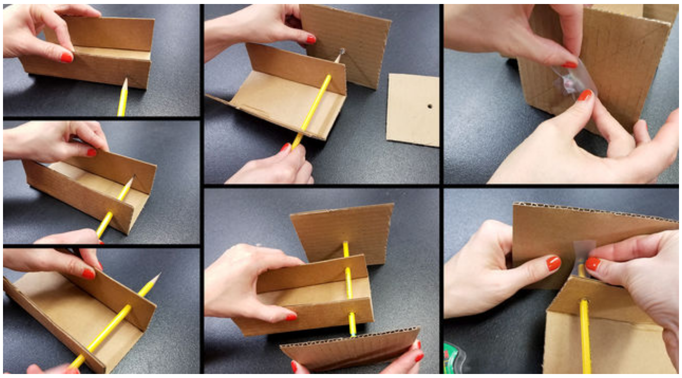
On the two 5 inch (13-cm) cardboard squares, draw diagonal lines from each of the corners, forming an "X". Poke a small hole in the centre with a pencil, where the lines cross.

Important! Avoid accidentally poking yourself with the pencil. Keep your hands away from where the pencil will go through the cardboard.



CLASSROOM ACTIVITY #3

MAKE A CARDBOARD ROVER



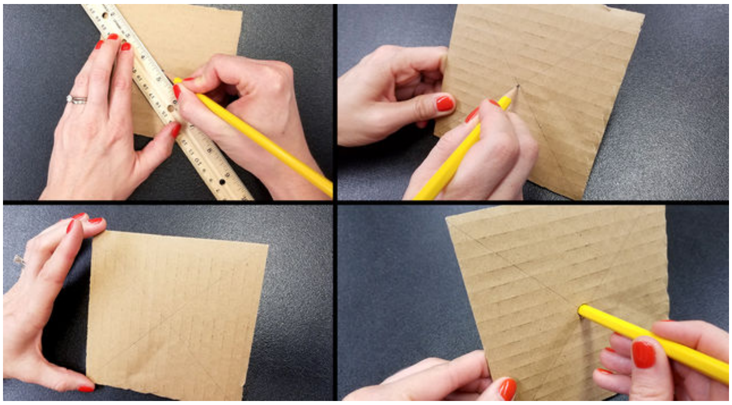
5. Attach the rear axle and wheels

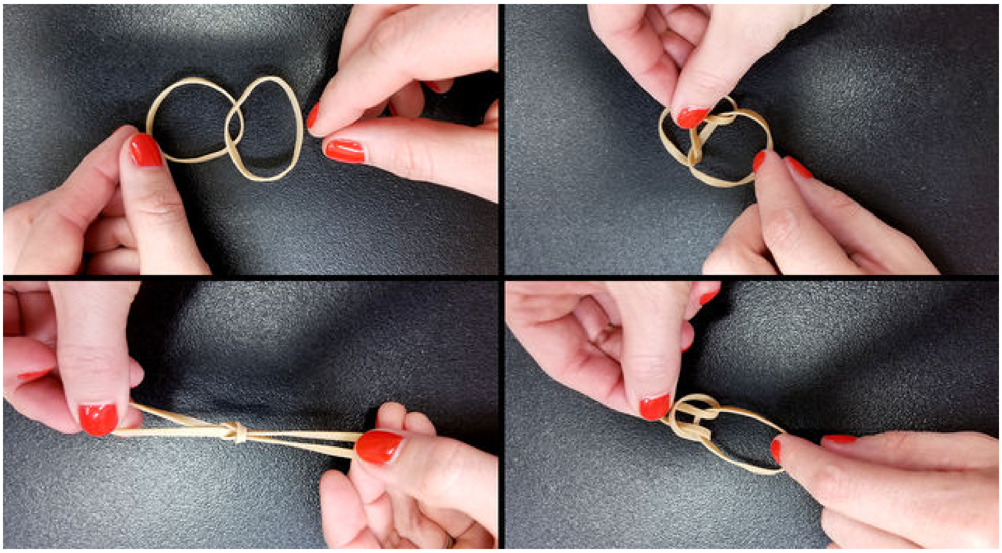
Use a pencil to carefully poke a hole near the top of each of the two outermost sections on the rover body.

Again, keep your hands away from where the pencil will go through the cardboard. Make sure the holes are directly across from each other and are big enough for the pencil to spin freely. This is where your axle will go. Slide the pencil through the axle holes. Carefully slide the cardboard wheels onto each end of the pencil and secure them with tape.

6. Make the front axle and wheels

Tape the straw across the bottom of the rover body on the opposite side from the pencil. Slip a candy onto each end of the straw. Bend and tape the ends of the axle to stop the candies from coming off.





7. Make a rubber-band chain

Create a chain with the two rubber bands as shown in the image to the left.

CLASSROOM ACTIVITY #3

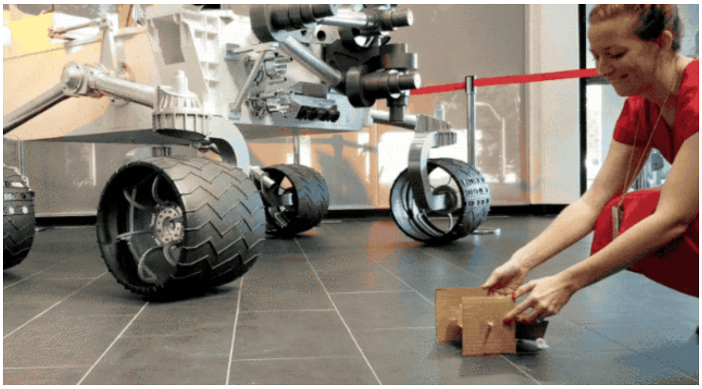
MAKE A CARDBOARD ROVER

8. Attach the rubber band

Loop one end of the rubber band chain around the pencil, as shown in the image. Cut small slits into the front end of the rover body. Slide the free end of the rubber band chain into the slits.

9. Ready, set ...

Turn the back wheels to wind the rubber band around the axle and power up your rover.



10. Put your rover to the test

With the rover on the floor, let go! Observe what the rover does. Measure the distance it travelled.

11. Evaluate the design

Think about how your rover performed and what could be improved. Ask yourself these questions:

- Did the wheels turn freely?
- Did the rover travel in a straight line?
- How far did it go?
- Did the wheels spin out without the rover moving much, or did they have traction on the ground and cause the rover to move?

12. Redesign

Make changes to your rover to improve its performance.

13. Test it again

After you've made changes, test your rover to see if the improvements worked!

CLASSROOM ACTIVITY #3

MAKE A CARDBOARD ROVER

TROUBLESHOOTING GUIDE:

Wheels don't turn freely - Make sure they are firmly attached to the axles and are parallel to the sides. Also make sure the holes punched in the cardboard body are directly across from one another and are large enough to allow the pencil to turn easily.

Won't travel in a straight line - Make sure the axles are straight and the front wheels are the same size. If one wheel is smaller, the rover will turn in that direction.

Doesn't go far – Have students wind up the wheels more. Also have them try using larger wheels. Bigger wheels have a larger perimeter (outer edge). As a result, one rotation of a large wheel will move the rover farther than one rotation of a small wheel.

Wheels spin out - Wheels spin in place when a rubber band delivers too much power at once or when there's not enough friction between the wheels and ground. To increase friction, have kids add weight over the drive wheels or add more wheels to each axle. To reduce how quickly a rubber band releases its power, kids can reduce tension by using a rubber-band chain or by cutting open a rubber band and using only a single strand of elastic.

DISCUSSION

What kinds of Earth vehicles are similar to rovers?
Snowmobiles, tanks, dune buggies, and all-terrain vehicles are similar. They all have good traction, are very stable, have powerful engines, and don't require a roadway.

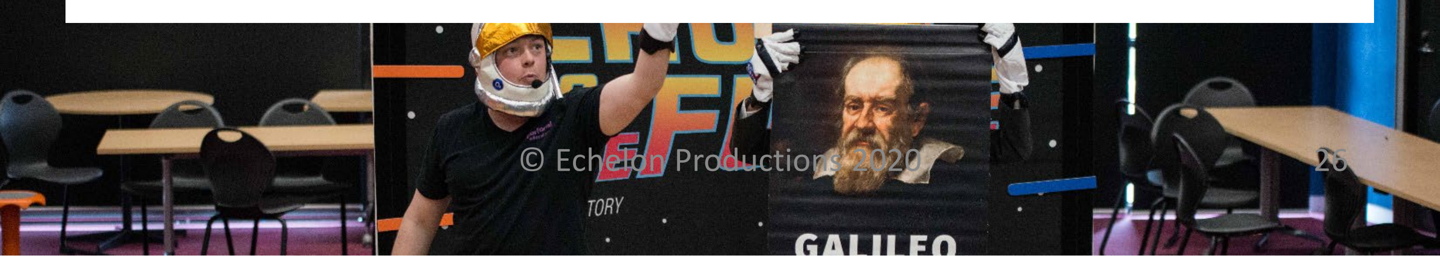
How did starting with a prototype help you end up with a rover that worked really well?
With a prototype, kids can quickly see what's working and what isn't. They then know where to make improvements.

How did friction affect your rover?
To be efficient, there needs to be minimal friction between the axle and the axle hole in the cardboard. To move, there needs to be lots of friction between the wheels and the ground.

How did the rover use potential and kinetic energy?
Potential energy is energy that is stored. Kinetic energy is the energy of motion. Winding the front wheels increased the amount of potential energy stored by the rubber band. When the wheels spin, this potential energy is turned into kinetic energy, and the axle and wheels turn.

GLOSSARY

Apollo 11:	the name of the NASA mission in which astronauts Neil Armstrong and Buzz Aldrin were the first humans to set foot on the moon on July 20, 1969.
Artificial Intelligence (AI):	the ability of a computer program or a machine to think and learn.
Autonomous:	Acting independently or having the freedom to do so.
Brain-computer interface:	neural impulses in the brain are intercepted and used to control an electronic device.
Elon Musk:	space entrepreneur whose company Space X is working on developing reusable rockets and a sustainable human presence on Mars.
Engineer:	A person who has scientific training and who designs and builds complicated products, machines, systems, or structures.
Galileo Galilei:	Italian scientist, astronomer and physicist, born 1564, who made many discoveries using his telescope.
GPS:	stands for Global Positioning System - a radio navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time 24 hours a day, in all weather conditions, anywhere in the world.
Innovation:	A new idea, device, or method. : the act or process of introducing new ideas, devices, or methods.
Machine Learning:	an application of Artificial Intelligence where we give machines access to data and let them use that data to learn for themselves.
NASA:	National Aeronautics and Space Administration which is the space agency of the US.
Rocket Lab:	New Zealander Peter Beck's company which builds and launches rockets and satellites both in NZ and the US.
Space Junk:	disused objects in orbit around Earth, like broken satellites, empty rockets and pieces of metal.
Satellite:	A satellite is an object that moves around a larger object. The moon for example is a natural satellite that orbits the Earth. But usually when people say 'satellite' they mean a human made machine that we launch into orbit around the Earth to send, receive or bounce back information to different areas of Earth.
Tatai Arorangi:	early Maori astronomical knowledge.
William Pickering:	legendary NZ rocket scientist whose work for NASA enabled the Apollo 11 moon landing.



USEFUL WEBLINKS

NZ Space Agency
https://www.mbie.govt.nz/science-and-technology/space/

Science Learning Hub – Revitalising Maori Astronomy
https://www.sciencelearn.org.nz/resources/1274-revitalising-maori-astronomy

NASA STEM engagement
https://www.nasa.gov/stem

Rocket Lab
https://www.rocketlabusa.com/

International Space Station
https://www.nasa.gov/mission_pages/station/main/index.html

Science Learning Hub – Constellations in the Night Sk
https://www.sciencelearn.org.nz/resources/635-constellations-in-the-night-sky

Science Learning Hub – Rockets
https://www.sciencelearn.org.nz/topics/rockets

Stardome
https://www.stardome.org.nz/

If you or any of your students would like to find out more details about our company please visit our website: **www.PerformEducation.com**

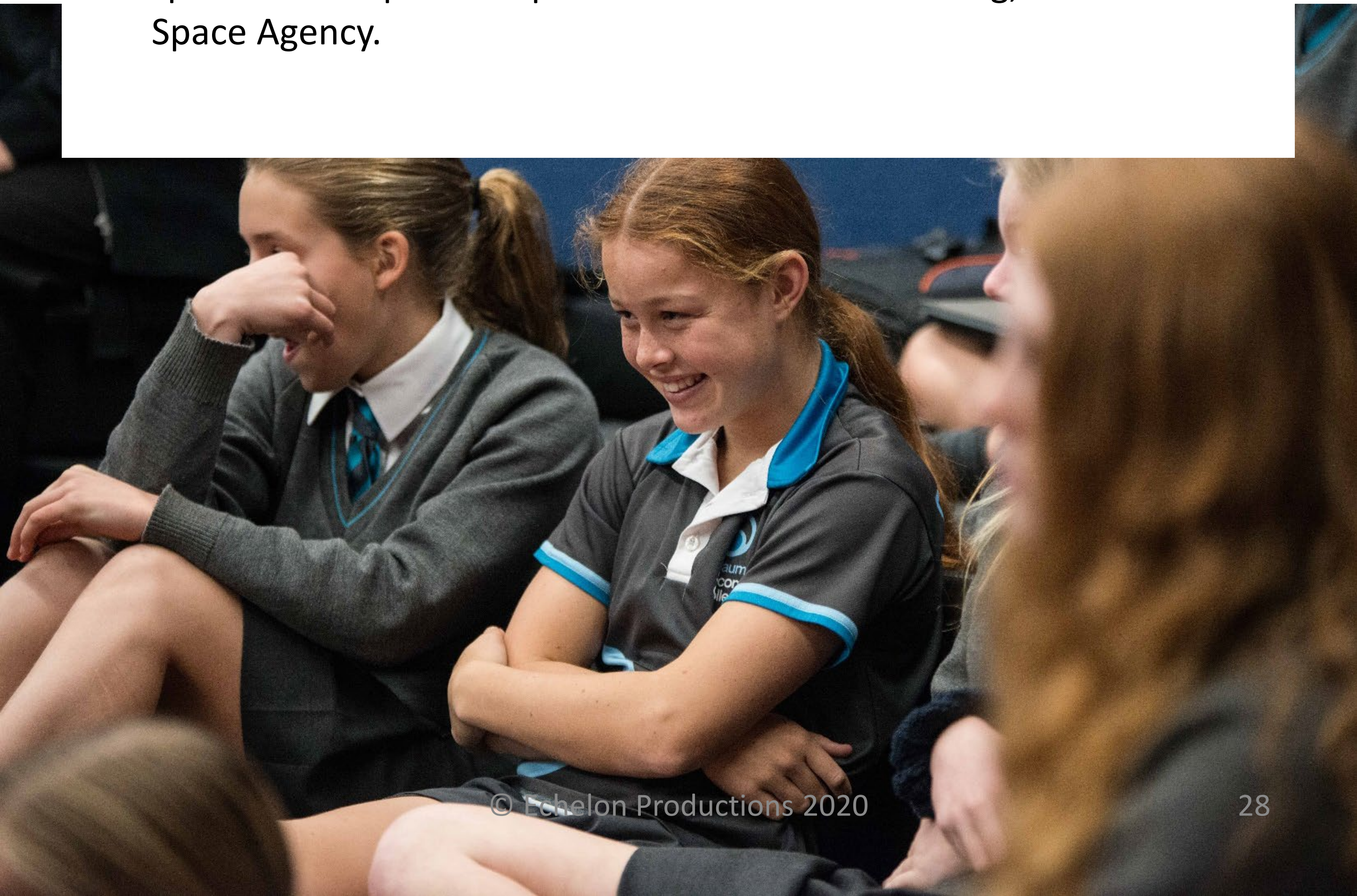
CURRICULUM CONTENT

LEARNING AREAS

- Science
- Technology
- Mathematics and Statistics
- Social Sciences
- English
- The Arts

THEMES

50th Anniversary of the moon landing, Everyday technologies invented by space science (camera phones, baby formula, wireless headphones, laptops), Galileo Galilei, Satellites, GPS, WiFi, Machine learning and AI, New Zealand's contribution to space science past and present: Dr. William Pickering, The NZ Space Agency.



CURRICULUM CONTENT

ACHIEVEMENT OBJECTIVES

LEVEL 3

SCIENCE

Nature of science

Understanding about science
Appreciate that science is a way of explaining the world and that science knowledge changes over time. Identify ways in which scientists work together and provide evidence to support their ideas.
Communicating in science
Engage with a range of science texts and begin to question the purposes for which these texts are constructed.
Participating and contributing
Use their growing science knowledge when considering issues of concern to them.
Explore various aspects of an issue and make decisions about possible actions.

Living world

Life processes
Recognise that there are life processes common to all living things and that these occur in different ways.
Ecology
Explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced.

Planet Earth and beyond

Earth systems
Appreciate that water, air, rocks and soil, and life forms make up our planet and recognise that these are also Earth's resources.
Astronomical systems
Investigate the components of the solar system, developing an appreciation of the distances between them.

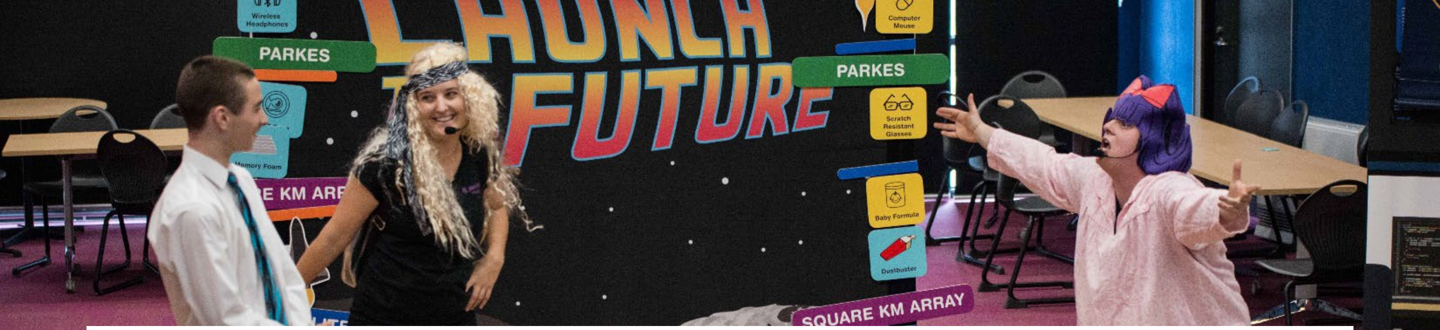
Physical world

Physical inquiry and physics concepts
Explore, describe, and represent patterns and trends for everyday examples of physical phenomena, such as movement, forces, electricity and magnetism, light, sound, waves, and heat. For example, identify and describe the effect of forces (contact and non-contact) on the motion of objects; identify and describe everyday examples of sources of energy, forms of energy, and energy transformations.

TECHNOLOGY

Nature of Technology

Characteristics of technology
Understand how society and environments impact on and are influenced by technology in historical and contemporary contexts and that technological knowledge is validated by successful function.
Characteristics of technological outcomes
Understand that technological outcomes are recognisable as fit for purpose by the relationship between their physical and functional natures.



CURRICULUM CONTENT

SOCIAL SCIENCES

Social studies

Understand how people make decisions about access to and use of resources.

ENGLISH

Listening, Reading and Viewing

Processes and strategies

Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.

Purposes and audiences

Show a developing understanding of how texts are shaped for different purposes and audiences.

Ideas

Show a developing understanding of ideas within, across, and beyond texts.

Language features

Show a developing understanding of how language features are used for effect within and across texts.

THE ARTS

DRAMA

Understanding drama in context

Investigate the functions and purposes of drama in cultural and historical contexts.

Communicating and interpreting

Present and respond to drama, identifying ways in which elements, techniques, conventions, and technologies combine to create meaning in their own and others' work.

LEVEL 4

SCIENCE

Nature of science

Understanding about science

Appreciate that science is a way of explaining the world and that science knowledge changes over time.
Identify ways in which scientists work together and provide evidence to support their ideas.

Communicating in science

Begin to use a range of scientific symbols, conventions, and vocabulary.
Engage with a range of science texts and begin to question the purposes for which these texts are constructed.

Participating and contributing

Use their growing science knowledge when considering issues of concern to them.
Explore various aspects of an issue and make decisions about possible actions.

CURRICULUM CONTENT

Living world

Life processes
Recognise that there are life processes common to all living things and that these occur in different ways.
Ecology
Explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced.

Planet Earth and beyond

Earth systems
Develop an understanding that water, air, rocks and soil, and life forms make up our planet and recognise that these are also Earth's resources.
Astronomical systems
Investigate the components of the solar system, developing an appreciation of the distances between them.

Physical world

Physical inquiry and physics concepts
Explore, describe, and represent patterns and trends for everyday examples of physical phenomena, such as movement, forces, electricity and magnetism, light, sound, waves, and heat. For example, identify and describe the effect of forces (contact and non-contact) on the motion of objects; identify and describe everyday examples of sources of energy, forms of energy, and energy transformations.

TECHNOLOGY

Nature of Technology

Characteristics of technology
Understand how technological development expands human possibilities and how technology draws on knowledge from a wide range of disciplines.
Characteristics of technological outcomes
Understand that technological outcomes can be interpreted in terms of how they might be used and by whom and that each has a proper function as well as possible alternative functions.

SOCIAL SCIENCES

Social studies
Understand how exploration and innovation create opportunities and challenges for people, places, and environments.

ENGLISH

Listening, Reading and Viewing
Processes and strategies
Integrate sources of information, processes, and strategies confidently to identify, form, and express ideas.
Purposes and audiences
Show an increasing understanding of how texts are shaped for different purposes and audiences.
Ideas
Show an increasing understanding of ideas within, across, and beyond texts.

Language features
Show an increasing understanding of how language features are used for effect within and across texts.

CURRICULUM CONTENT

THE ARTS

DRAMA

Understanding drama in context
Investigate the functions, purposes, and technologies of drama in cultural and historical contexts.
Communicating and interpreting
Present and respond to drama, identifying ways in which elements, techniques, conventions, and technologies create meaning in their own and others' work.

LEVEL 5

SCIENCE

Nature of science

Understanding about science
Understand that scientists' investigations are informed by current scientific theories and aim to collect evidence that will be interpreted through processes of logical argument.
Communicating in science
Use a wider range of science vocabulary, symbols, and conventions.
Apply their understandings of science to evaluate both popular and scientific texts (including visual and numerical literacy).
Participating and contributing
Develop an understanding of socio-scientific issues by gathering relevant scientific information in order to draw evidence-based conclusions and to take action where appropriate.

Living world

Ecology
Investigate the interdependence of living things (including humans) in an ecosystem

Planet Earth and beyond

Earth systems
Investigate the composition, structure, and features of the geosphere, hydrosphere, and atmosphere.
Interacting systems
Investigate how heat from the Sun, the Earth, and human activities is distributed around Earth by the geosphere, hydrosphere, and atmosphere.
Astronomical systems
Investigate the conditions on the planets and their moons, and the factors affecting them.

CURRICULUM CONTENT

Physical world

Physical inquiry and physics concepts
Identify and describe the patterns associated with physical phenomena found in simple everyday situations involving movement, forces, electricity and magnetism, light, sound, waves, and heat. For example, identify and describe energy changes and conservation of energy, simple electrical circuits, and the effect of contact and non-contact on the motion of objects.
Using physics
Explore a technological or biological application of physics.

TECHNOLOGY

Nature of Technology

Characteristics of technology
Understand how people's perceptions and acceptance of technology impact on technological developments and how and why technological knowledge becomes codified.
Characteristics of technological outcomes
Understand that technological outcomes are fit for purpose in terms of time and context. Understand the concept of malfunction and how "failure" can inform future outcomes.

SOCIAL SCIENCES

Social studies
Understand how people's management of resources impacts on environmental and social sustainability. Understand how the ideas and actions of people in the past have had a significant impact on people's lives. Understand how people seek and have sought economic growth through business, enterprise, and innovation.

ENGLISH

Listening, Reading and Viewing

Processes and strategies
Integrate sources of information, processes, and strategies purposefully and confidently to identify, form, and express increasingly sophisticated ideas.
Purposes and audiences
Show an understanding of how texts are shaped for different purposes and audiences.
Ideas
Show an understanding of ideas within, across, and beyond texts.
Language features
Show an understanding of how language features are used for effect within and across texts.

THE ARTS

DRAMA
Understanding drama in context
Investigate the characteristics, purposes, and function of drama in a range of contexts.
Communicating and interpreting
Present and respond to drama and describe how drama combines elements, techniques, conventions, and technologies to create structure and meaning in their own and others' work.

CURRICULUM CONTENT

LEVEL 6

SCIENCE

Nature of science

Understanding about science
Understand that scientists' investigations are informed by current scientific theories and aim to collect evidence that will be interpreted through processes of logical argument.
Communicating in science
Use a wider range of science vocabulary, symbols, and conventions.
Apply their understandings of science to evaluate both popular and scientific texts (including visual and numerical literacy).
Participating and contributing
Develop an understanding of socio-scientific issues by gathering relevant scientific information in order to draw evidence-based conclusions and to take action where appropriate.

Living world
Life processes
Relate key structural features and functions to the life processes of plants, animals, and micro-organisms and investigate environmental factors that affect these processes.
Ecology
Investigate the impact of natural events and human actions on a New Zealand ecosystem.

Planet Earth and beyond

Earth systems
Interacting systems
Develop an understanding of how the geosphere, hydrosphere, atmosphere, and biosphere interact to cycle carbon around Earth.
Astronomical systems
Investigate the interactions between the solar, lunar, and Earth cycles and the effect of these on Earth.

Physical world

Physical inquiry and physics concepts
Investigate trends and relationships in physical phenomena (in the areas of mechanics, electricity, electromagnetism, heat, light and waves, and atomic and nuclear physics).
Using physics
Investigate how physics knowledge is used in a technological or biological application

CURRICULUM CONTENT

TECHNOLOGY

Nature of Technology

Characteristics of technology
Understand the interdisciplinary nature of technology and the implications of this for maximising possibilities through collaborative practice.

SOCIAL SCIENCES

Social studies
Understand how cultures adapt and change and that this has consequences for society.

History
Understand how the causes and consequences of past events that are of significance to New Zealanders shape the lives of people and society.

Geography
Understand how people interact with natural and cultural environments and that this interaction has consequences.

ENGLISH

Listening, Reading and Viewing

Processes and strategies
Integrate sources of information, processes, and strategies purposefully and confidently to identify, form, and express increasingly sophisticated ideas.
Purposes and audiences
Show a developed understanding of how texts are shaped for different purposes and audiences.

Ideas
Show a developed understanding of ideas within, across, and beyond texts.
Language features
Show a developed understanding of how language features are used for effect within and across texts.

THE ARTS

DRAMA

Understanding drama in context
Investigate the forms and purposes of drama in different historical or contemporary contexts, including New Zealand drama.
Communicating and interpreting
Perform and respond to drama and make critical judgments about how elements, techniques, conventions, and technologies are used to create form and meaning in their own and others' work.

2021 BOOKING FORM

BOOK WEEK IN SCHOOLS 2021 – *BiGDREAMS*

Primary Grades 0-8 (Junior and Senior primary versions available)

Right from when he was very young Henry has had ideas of who he'd like to be and where he'd like to go. The world always seems full of opportunities. The problem is that he keeps on encountering someone who has become an obstacle to achieving any of his ambitions – the Dreamsnatcher, who can appear at any moment – at school, at home, from the pages of books, magazines or through the television or computer screen. Henry has to contend with the Dreamsnatcher almost on a daily basis but when he finds out that he isn't the only person having this problem, he and his new friend Lou become determined to do something about it!

Watch a selection of the **BEST New Zealand Children's Books of 2021** come to life. This heartfelt and inspiring in-school production looks at different episodes in each character's journey where they learn not to be discouraged by negative messages in order to follow their heart's desire. Filled with humour, suspense and featuring student interaction throughout, this educational musical adventure encourages your students to pursue their ambitions. If you're going to dream, let them be **Big Dreams!**

SCIENCE/STEM IN SCHOOLS 2021 – *THE MARINE TEAM*

Primary & Intermediate Grades 5-10 (Ages 9-14)

The Marine Team *is a 40 minute, live-in-school performance that consists of two professional actor/educators with two goals. The first goal is to highlight what is* ***ocean sustainability, how oceans impact our planet, solutions that generate healthy oceans and how YOU can help embrace innovative ocean technology****. The second goal is to make your students* ***laugh so hard that they forget they're learning****!*

LEARNING AREAS: Science, Technologies, Maths, English, The Arts
GENERAL CAPABILITIES: Literacy, Numeracy, Critical and Creative Thinking, Ethical Understanding
THEMES: Marine Science, Innovative Technologies, Environmental Science, Sustainability

The in-school program is a series of improvised comedy sketches between characters in all sorts of hilarious situations. Taking suggestions from the audience, the actors engage students to help create the show they see, forming a customized performance with each presentation.

SCHOOL:________________________________

SUBURB:________________________________

CONTACT NAME:__________________________

CONTACT EMAIL:_________________________

PREFERRED DATES: 1)_____________________

2)________________ 3)____________________

ESTIMATED NUMBER OF STUDENTS: _________

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LIVE Tour Dates 2021

- *Term 2:* CHCH Mon 17th May – Fri 21st May
- *Term 2:* WELL Mon 24th May – Fri 28th May
- *Term 2:* AUCK Mon 31st May – Fri 25th Jun
- *Term 3:* CHCH Mon 2nd Aug – Fri 6th Aug
- *Term 3:* WELL Mon 9th Aug – Fri 13th Aug
- *Term 3:* AUCK Mon 16th Aug – Fri 27th Aug

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PUZZLE SOLUTIONS

Word Find Solution:

K	A	A	C	N	P	L	Y	C	U	O	C	S	V	U	R	C	T	J	F	B	N	Y	E	P
E	S	H	J	B	Z	E	Y	S	D	I	Y	F	R	Y	A	S	O	B	T	S	O	B	R	C
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G	D	G	C	P	A	H	X	L	P	Q	P	B	K	L	E	M	D	A	O	P	I	I	S	B
U	V	K	Q	H	R	O	I	O	Y	W	L	N	Z	E	L	J	I	L	Q	L	L	Z	N	Y
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V	M	M	I	W	N	N	E	I	L	A	R	M	S	T	R	O	N	G	N	O	T	F	V	K
Y	X	K	A	C	G	O	J	J	G	X	W	E	V	V	Z	J	I	W	F	C	E	J	N	Y
G	C	G	B	R	I	H	F	S	J	R	I	K	B	R	N	X	G	X	G	L	E	O	I	E
J	H	H	W	S	S	S	X	E	V	O	J	D	E	N	T	P	X	N	R	F	P	D	N	G

SATELLITE
TATAI ARORANGI
GALILEO
MARS
ROCKETLAB
NEIL ARMSTRONG
TELESCOPE
WILLIAM PICKERING
ARTIFICIAL INTELLIGENCE
ENGINEERING

Crossword Solution:

HORIZONTAL

2. The Martian atmosphere is mostly made up of carbon _________ (**dioxide**)
5. The name of disused human made materials floating in space (**space junk**)
9. Using his telescope, he was the first person to discover the earth revolved around the sun (**Galileo Galilei**)
10. New Zealander Peter Beck's rocket company (**RocketLab**)
11. The world's smallest, lightest satellite weighs as much as an _______ (**apple**)

VERTICAL

1. His company SpaceX is working towards creating a liveable city on Mars (**Elon Musk**)
3. The world's largest satellite is the ____________ Space Station (**International**)
4. The NASA program aiming to develop a permanent presence on the moon by 2024 (**Artemis**)
6. He took the first ever human step on the moon (**Neil Armstrong**)
7. Early Maori ancestors referred to their detailed astronomical knowledge as ___ ______ (**Tatai Arorangi**)
8. The Apollo moon landing could not have happened without Kiwi rocket scientist William ___________ (**Pickering**)