Elastic Band Cars

WMG
THE UNIVERSITY OF WARWICK

CATAPULT
High Value Manufacturing

ADVANCED PROPULSION CENTRE UK
ELECTRICAL ENERGY STORAGE SPOKE

What’s in this box?

You will be building a car kit that is powered by a rubber band. You can then test how far it goes, tinker with it, improve it, and make it better.

This is how engineers work on real problems! If we can work out how to store energy in vehicles better, we may be able to reduce our carbon emissions and make a greener future possible.


To get moving
cars need
energy

How do vehicles store energy?


GREENCELL
Extra Heavy Duty
DURACELL
AA
Super
ICR18650
2200mAh 3.7V 8.14wh

Go ‘green’

Renewable Energy

Climate Change

Reduce Emissions

What will cars look like in the future?

CO_2

Eco-friendly

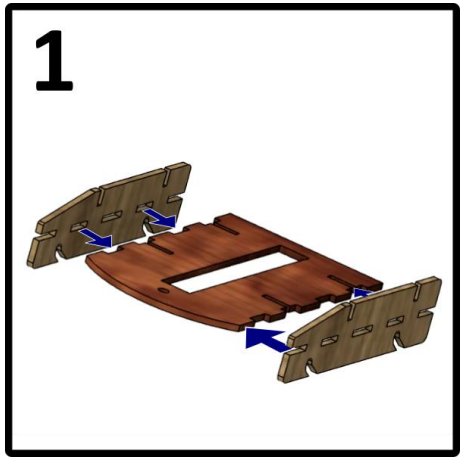
Sustainability

The Elastic Band Challenge

Your challenge today is to make a vehicle that stores and uses energy from an elastic band.

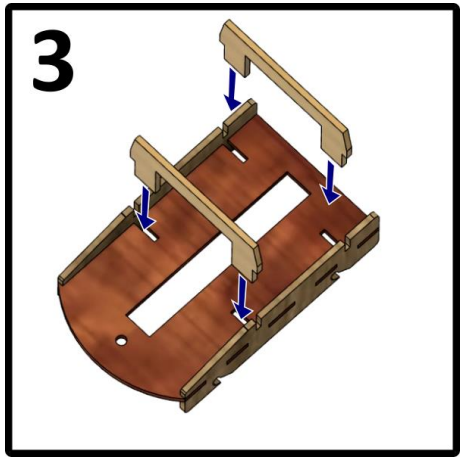
How far can your vehicle travel powered only by an elastic band?

BUILDING INSTRUCTIONS



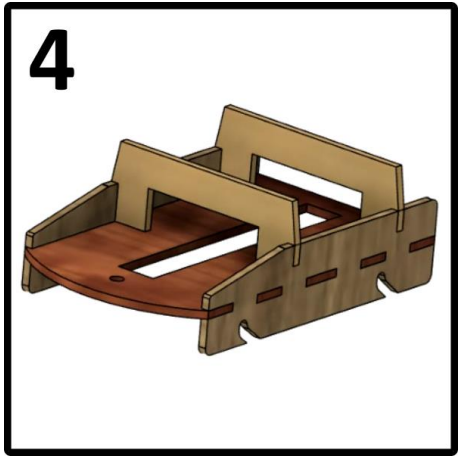
1. Slot the side panel pieces onto the chassis. These side panels have holes for your axles to fit through.

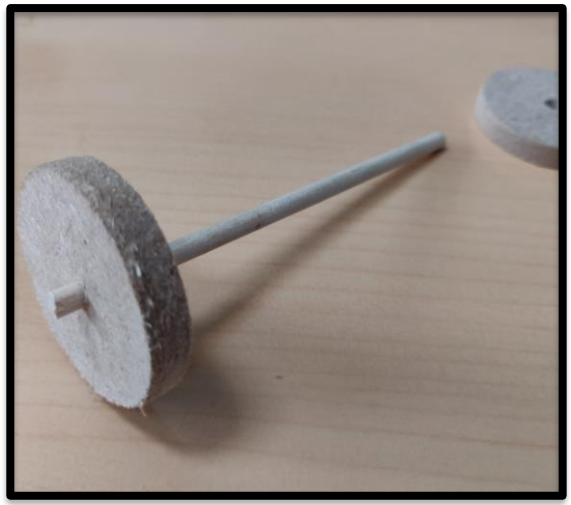
2. Check the side panels are flush against the chassis all the way along.



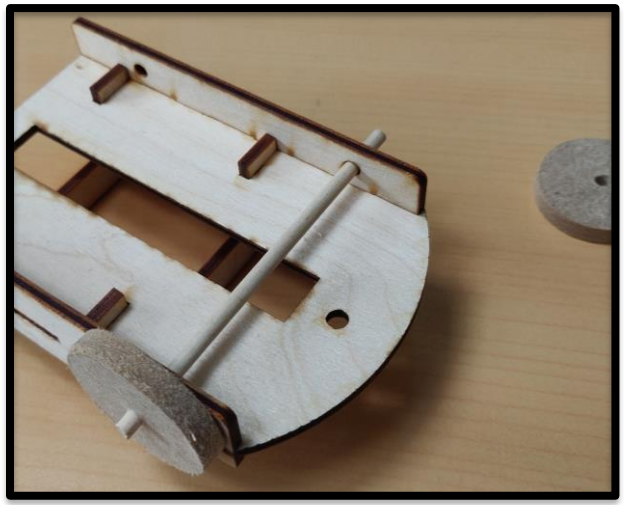
3. Slot the rib pieces into the chassis and the side panels. These ribs will give the vehicle strength and hold the parts in place firmly.

Your vehicle should now look like this.

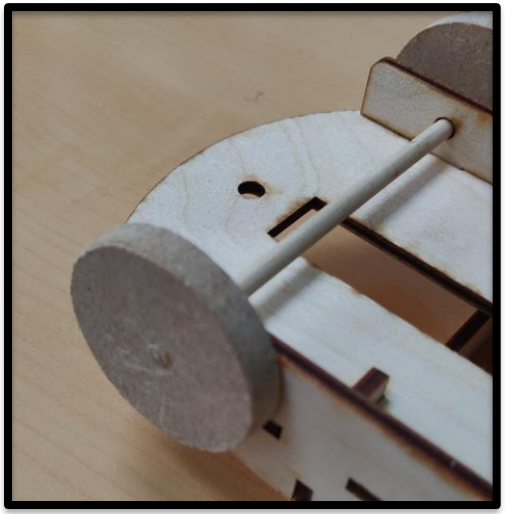




1. Slide one wheel on to one of your axles.

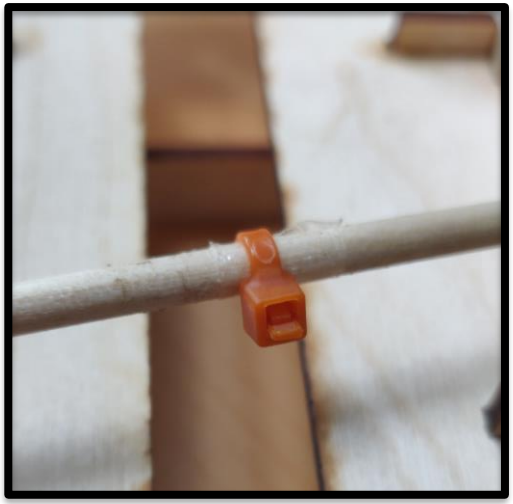


2. Slide the axle through the front hole in both side panels

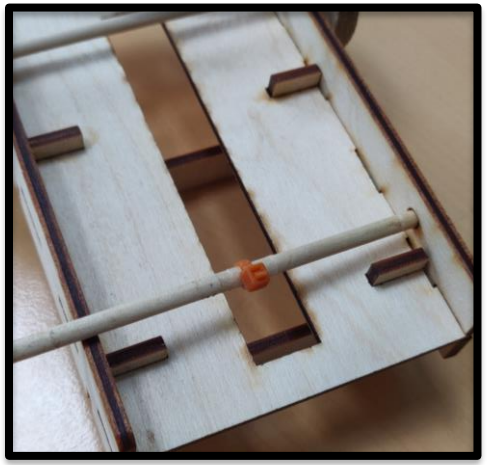


3. Slide your second wheel on to the axle

4. Make sure to leave a gap!

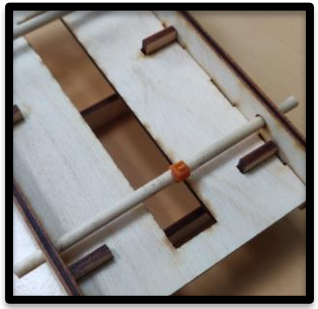


1. Wrap one small piece of tape around the middle of the axle. Tighten a cable tie over the tape. Trim the excess cable tie.



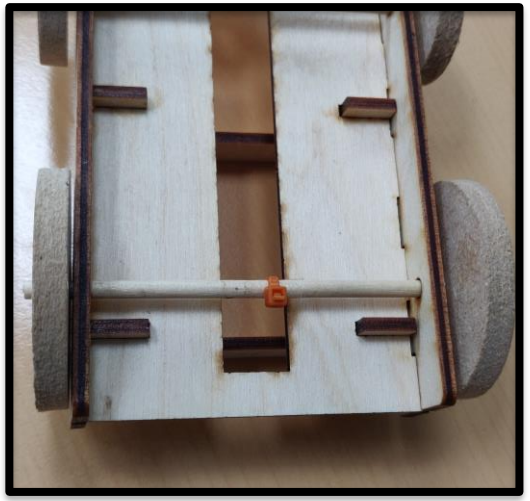
2. Slide the axle through one hole.

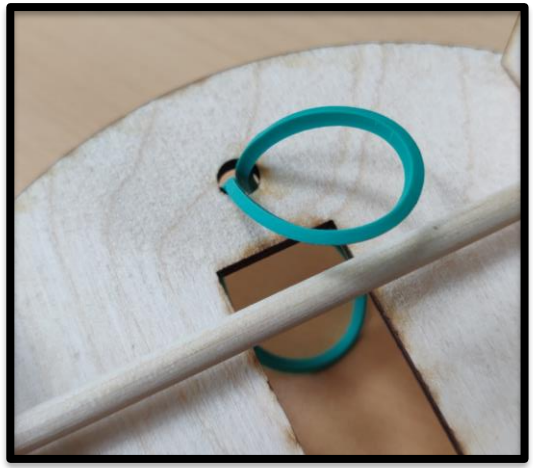
3. Slide the axle through that hole until it is past the opposite side panel.



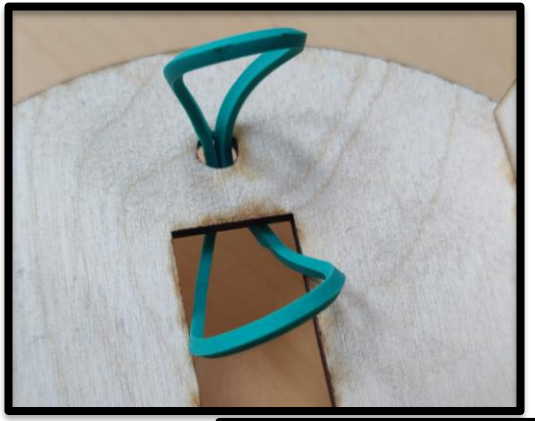
4. Slide the axle through the opposite side panel.

4. Finally, attach the rear wheels!





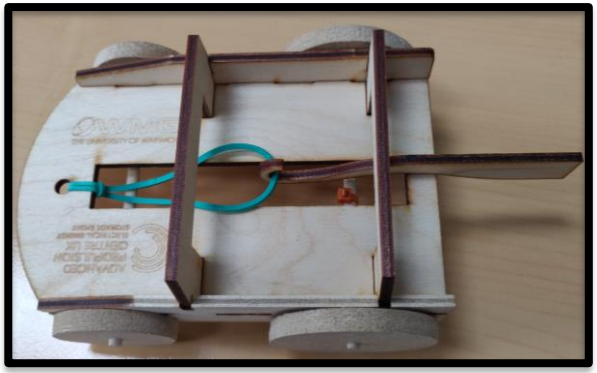
1. Poke an elastic band through the hole in the front of the chassis.



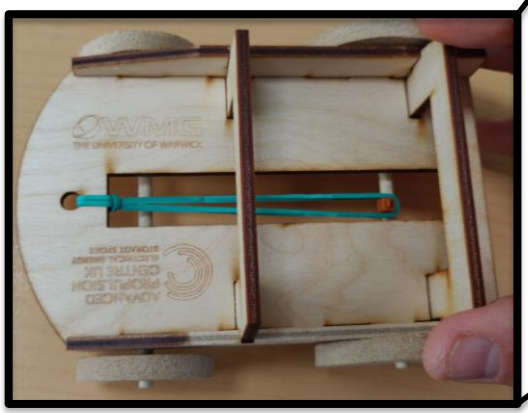
2. Pull the elastic band through the slot in the middle of the chassis.

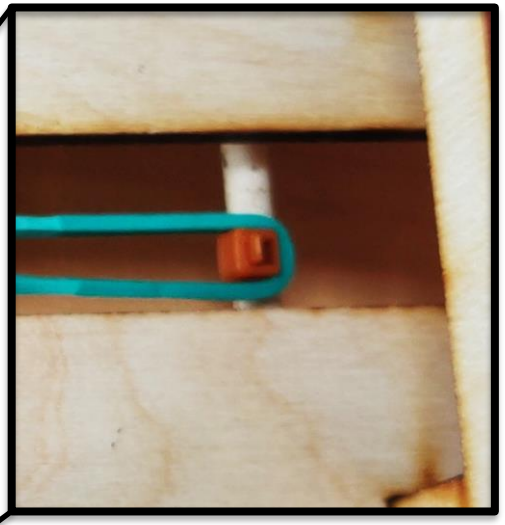
3. Poke one end of the elastic band through the loop made by the other end.

4. Pull your knot tight.

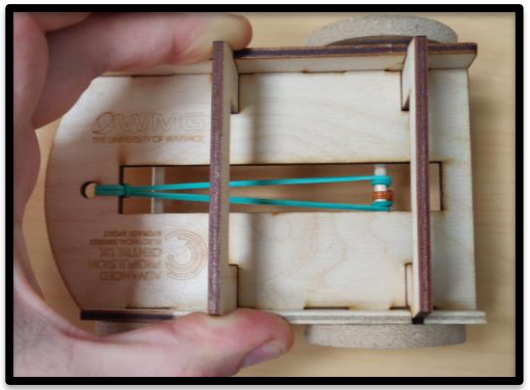


1. Hook your elastic band with the curved hook





2. Pull the elastic band back and hook it over the cable tie on the rear axle.



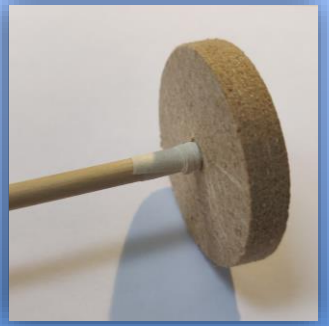
3. Wind your car backwards and then let go!

What should you do if there are problems with assembly.

TROUBLESHOOTING

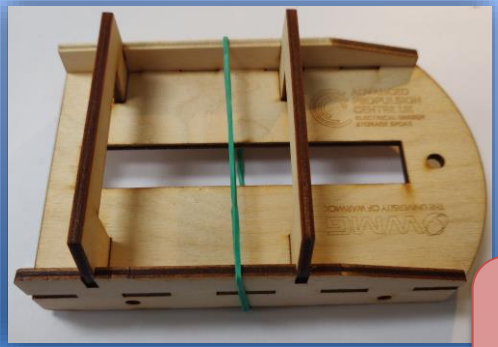
Use sandpaper to remove material from where it's hard to clip the parts together.

The parts of the car won't clip together



Put a single thickness of tape around the axle and gently twist the wheel over it.

My wheels are too loose on the axles



Put an elastic band around the whole vehicle to hold it together.

The parts of the car are too loose

Try out your vehicle as you've just built it. Wind it back along the floor and let it go!

Measure how far it travels and write it down on the next page.

FIRST TEST

Try out your vehicle

Test #	Distance travelled / cm
1	
2	
3	

What should you do if your vehicle just isn’t working?

TROUBLESHOOTING

The wheels spin but the car doesn't move

You need more grip! Try a different surface or make tyres for your wheels

Or, you could make the car heavier by adding weights to it.

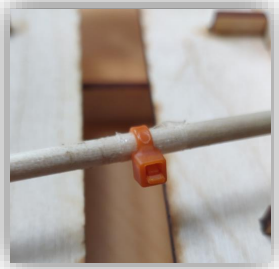
The car veers off to one side

Check your wheels are on the axles straight. Make sure there is a gap between the wheel and the car on both sides.

Or, you could make one wheel slightly larger with tape or an elastic band.

The car only goes as far as I wind it back

Is the elastic band releasing from the clutch you made out of the cable tie? Make sure you've trimmed the cable tie close to the axle



Did you see anyone else’s car go further than yours? What worked well with their car?

Do you have any ideas of how you could make your car go further?

REFLECT AND IMPROVE

Weight

Imagine pushing something light and something heavy. Which one will go further? Which one will go faster? The energy stored in our elastic band will make a light object travel further and faster. The trade off is a light vehicle is not pushing the tyres into the ground very hard, and this reduces the grip those tyres have!

Weight can be changed by:

- Taping heavy items like coins to the vehicle
- Using different sized wheels

Wheels

The distance all the way around a large wheel (its circumference) is bigger than around a small wheel. When the axle rotates once, if you have perfect grip, the car will travel forwards the same distance as the wheel circumference.

Large wheels will:

- Increase distance the car travels per rotation of the axle
- Make the car heavier

Small wheels will:

- Make the car lighter
- Change the angle of the chassis to the ground

Grip

Your car should move forwards whenever the wheels spin. If the wheels are spinning but slipping over the floor and the car stays still, there is too much power trying to turn the wheels. To fix this, you need more grip!

Grip can be improved by:

- Coating the wheels with a soft, rubbery material.
- Increasing the weight of the vehicle so it is pushed into the ground more.

Power

Your car is powered by elastic bands. Stretching these bands stores energy that is released as they return to their normal size. If the energy is released slowly your car will travel for a long time. If the energy is released quickly, your car will accelerate really fast!

Power can be increased by:

- Using more or thicker elastic bands

Fair Test

Doing a good experiment means being fair.

Each time you test something try and keep things as close to the same as possible.

Variables

Only change one thing at a time. The things you change are called **variables**.

A variable you change is called an **independent variable**. This could be the weight, the wheels, grip, *etc*.

The variable that you measure – how far the car went – is the **dependent variable**.

Make, Test, Improve

You'll never make the perfect thing on your first try.

There are always ways to improve. Engineers go through a cycle of making, testing, and improving until they get the best results.

Put your ideas to the test! See if you can improve your car and make it go further than it did before.

Write down what you've changed and how far it goes now.

SECOND TEST

Try out your vehicle

Test #	What have you changed? Did it improve the car's performance?	New distance travelled / cm
1		
2		
3		
4		
5		

YOUR BEST DISTANCE

cm

THE MOST IMPORTANT FACTOR

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Weight	Wheels
Grip	Power

Circle one

What has this got to do with climate change?

All vehicles need to store energy

The more energy the vehicle can store, the further it can go

But sometimes it is better to use the energy you have **better** – more efficiently – instead.

What has this got to do with climate change?

Your vehicle stores energy in elastic bands

Electric vehicles store energy in batteries

Through the make, test, improve cycle, researchers are making those batteries and motors more efficient. Just like you have with your car!

This will help reduce emissions and help prevent a climate catastrophe.

What have you learned?

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Tinkering

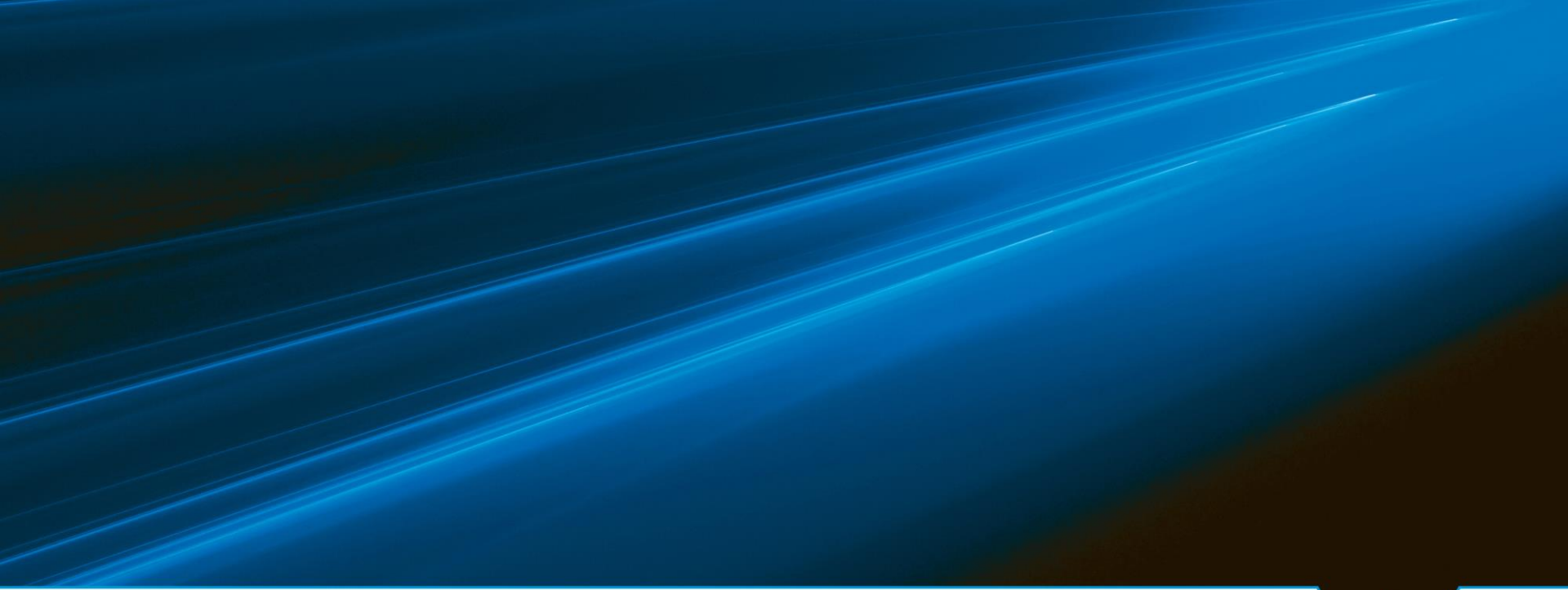
Energy storage

Doing a fair experiment

Efficiency

Make, Test, Evaluate, Improve

Variables



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