More Design – Make – Test

Science & Technology based problem solving
& creative thinking

A kidcyber book
by Shirley Sydenham & Ron Thomas

TEST floating and sinking

You will need a glass or bowl of water, plasticine or play doh, a nail.

1. Make a list of objects you can test in your cup or bowl of water.
2. Circle the ones you guess will float.

TEST the items on your list. Tick those that floated and cross the ones that sank. Compare the two groups: what is different about the ones that floated and those that sank?

MAKE AND TEST

Put your lump of plasticine into the water. Mark the drawing to show where it was in water.

Take the plasticine out and make it into a little, empty boat. Put it in the water. Mark the drawing to show where it was in water.

Use the nail to make a hole in the bottom of the plasticine boat. Put the boat in the water. Mark the drawing to show where it was in water.

Use the same plasticine to make another shape that floats. Put it in the water. Mark the drawing to show where it was in water.

RECORD: Draw your two boats:

THINK: Why did the plasticine boat float but not the lump of plasticine?

DESIGN a boat that floats

You will need scrap materials such as styrofoam, milk cartons, wood and cardboard scraps, plastic bottles, scissors, glue, sticky tape, plasticine

Look at pictures of different kinds of boats to see different shapes and kinds to get ideas of what the range is to choose from.
Have a look at **www.kidcyber.com.au/ships-and-boats-timeline** and also enter 'boats through the ages' into a search engine, and click 'images' at the top.

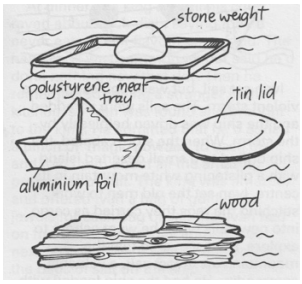
DESIGN your boat, drawing it out on paper first. List the materials you will use. **MAKE** your boat. It has to be waterproof and not fall apart in water.

TEST your boat in a bathtub, plastic tub or sink.
Does it float? Is it level, or does it tilt to one side?
Make adjustments to improve its performance.

TEST AGAIN, this time adding pieces of plasticine a bit at a time to see how much weight your boat can carry and still remain afloat and even.

RECORD
Write about your design and materials used.
What improvements or changes did you make?
How did the boat perform as you added and increased the weights?
How much weight altogether did the boat take?

REFLECT
If you were to design a boat again, what elements would you change? What elements would you like to try?



MAKE a balloon-powered boat

You will need a milk carton or large plastic bottle, a drinking straw, balloons, sticky tape, elastic band or string, a tub or sink or bathtub with water in it.

1. Cut the milk carton or plastic bottle lengthways: ask an adult to help.
2. Make a hole for the straw to go through at the flat end of the half carton or half bottle.
3. Use elastic band or string to attach a balloon to one end of the straw.
4. Place the balloon inside the boat and tape it down. Position it so that the straw goes through the hole in the end of the boat. If you use a bottle you may need to put a little plasticine in the nose of the boat to keep the boat level in the water.
5. Inflate the balloon by blowing through the straw, and place the boat in the water with straw pointing into the water. Let it go.

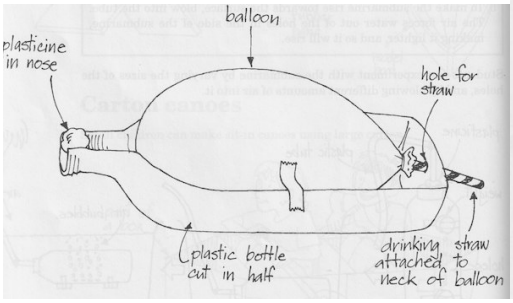
THINK

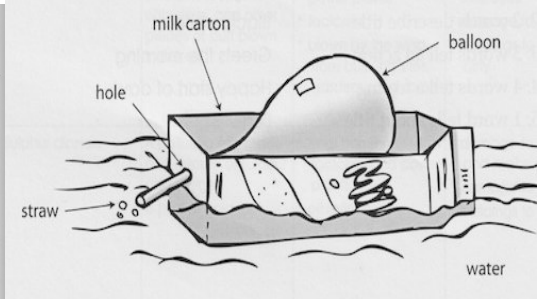
What makes the boat move?
What direction does it go in?

MODIFY the boat to go faster or slower, or you may choose to re-design a different version of the boat.

RECORD

What changes or modifications did you make?
Did they work, that is, make the boat do what you intended?
Make drawings to show the changes you made.

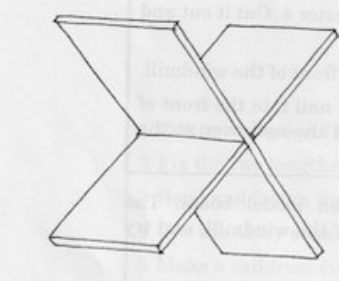




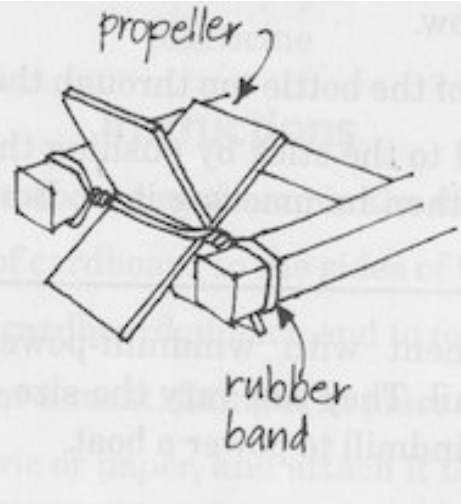
MAKE a paddle boat

You will need 2 milk cartons, rubber bands, icy pole sticks (or 2 balsa sticks cut the same length as an icy pole stick), tape, stapler

1. Cut off one side of a milk carton to form the boat.
2. Attach an icy pole stick or balsa stick to each side of the back of the boat , sticking out about two thirds.
3. Make the paddle by cutting 4 equal widths from the other carton, including a corner of the carton in each so you have 4 right angles. Staple the four pieces together.



4. Wind up a rubber band by turning the paddle around to twist the elastic tight.
5. Put the boat in water and release.



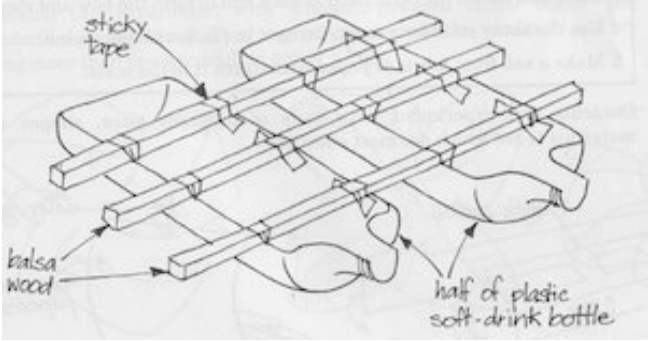
TEST your boat: measure distance, time travelled. Did it leak?
RECORD what you observe.
MODIFY and **TEST** any changes you make that improve performance, for example, making a boat or paddle out of other materials, or changing the rubber band to a longer, thicker, or thinner one.

NOTE: when cutting tough milk cartons, wood or other tough materials please ask an adult to supervise.

MAKE a catamaran (twin-hulled boat)

You need a plastic soft drink bottle, thin strips of balsa wood, tape (such as painter's , packing or masking tape), a bathtub or plastic tub or sink of water.

1. Cut the bottle in half lengthwise to form the two hulls of the boat. NOTE: please ask an adult to help.
2. Using tape attach three strips of balsa wood across the two hulls.

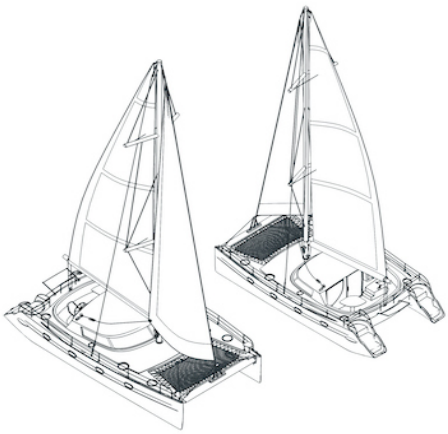


TEST the catamaran in water.
Make adjustments if necessary.
Make some variations such as different size or shape drinking bottles.

Some catamarans are motor boats and some have sails.
Make your catamaran into either a sail boat by adding a mast and sail, or make it look as though it is a motorised boat.
TEST again.

Catamarans are very stable boats. Use boats made in other activities to compare them in the water.

RECORD the different ways you made the catamaran and note what you observed. Make drawings or take photos.



MAKE a land yacht

You will need materials such as thin dowel, satay sticks, wooden clothes pegs, cotton reels, polystyrene, milk cartons or boxes, and other items you find

DESIGN a yacht (sailboat) with wheels.
Draw your design and make a list of the materials you need.
Gather together your materials and MAKE your land yacht.

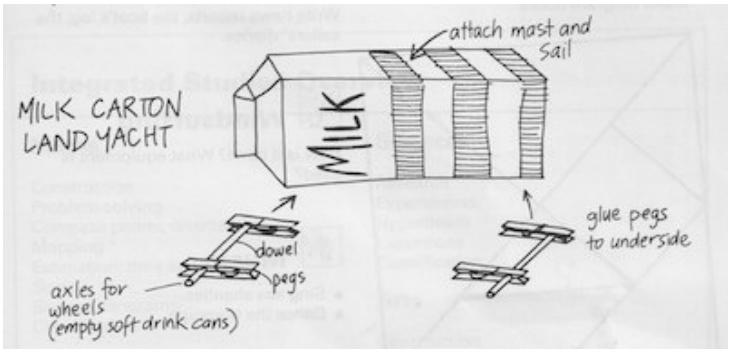
TEST your land yacht over a measured distance. One way of doing that is to set up a fan (with an adult's supervision for the sake of safety) behind the starting line: put the yacht in place and turn the fan on to blow the yacht.

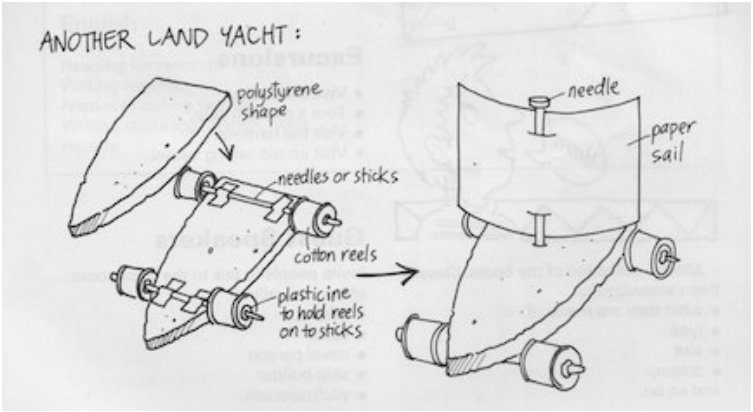
RECORD
Write about the performance of the yacht. What did you observe? Did the sail work? Did the yacht wheels stay on? Was the yacht's progress straight or did it turn or tip over?

MODIFY by making adjustments or changes to the yacht and **TEST** again.
Did the adjustments fix the problems? Did the performance improve?

RECORD your findings.

If you're stuck, here are some ideas to help, especially with attaching wheels. But if you have your own ideas, that's great: test them out!





MAKE a balloon-powered land yacht

You need balloons, wheels such as cotton reels, old DVDs or bottle tops, sticks or dowel for axles, tape, drinking straws, materials you find for making the yacht body

CHALLENGE: Make a balloon-powered land yacht.
It's really a combination of ideas you used when you made the balloon-powered boat (p 4) and the land yacht (p 7).

You can adapt any of the designs you've made, combine them or, using the discoveries you made when testing your designs, come up with a completely new a design for a land yacht powered by balloon.

DESIGN:
Draw your design on paper and gather your materials.

MAKE your vehicle.
TEST it over a measured distance. List the elements you will assess, such as speed, sturdiness, steadiness (no wobbles), whether or not it runs straight, and so on. Comment on each.

RECORD:

How far did it go?
Was it sturdy enough or did it break?
Did it perform as you had intended?

MODIFY
Make modifications to improve the performance or strengthen the vehicle and then **TEST** again.
Increase the test elements: add some weight to the vehicle, perhaps a Lego or play dough passenger

RECORD
Write about what modifications you made and about the performance: was it better?
How would you design it differently if doing it again?


Here's a hint: you used a drinking straw attached to a balloon before, but consider this...a thin stick such as a satay stick can fit through a straw.
Maybe as an axle?

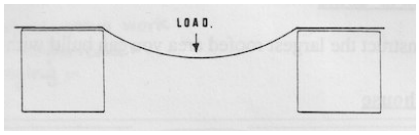
MAKE a beam bridge

You will need thin cardboard, enough to cut seven strips each 60cm x 15cm, kitchen scales.

The simplest beam bridge is just a plank or log laid across a gap.
A load crossing a beam bridge can cause the middle to bend.

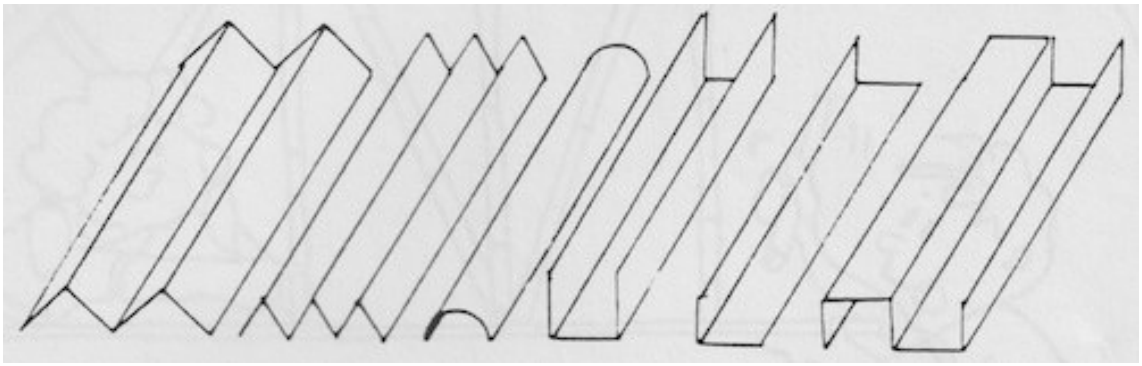
1. Make a gap of 40cm to be spanned by a bridge: for example move two chairs to face each other with a gap of 40cm seat to seat, or something similar.
2. Cut a piece of thin card into a strip 60cm x 15cm.
3. Place the card across the gap.

TEST the bridge by rolling a small toy truck across it. Add some weight to the truck until the beam begins to bend a bit in the middle. Take the loaded truck off and weigh it. Record the weight.



CHALLENGE: make a stronger beam bridge without adding more beams.

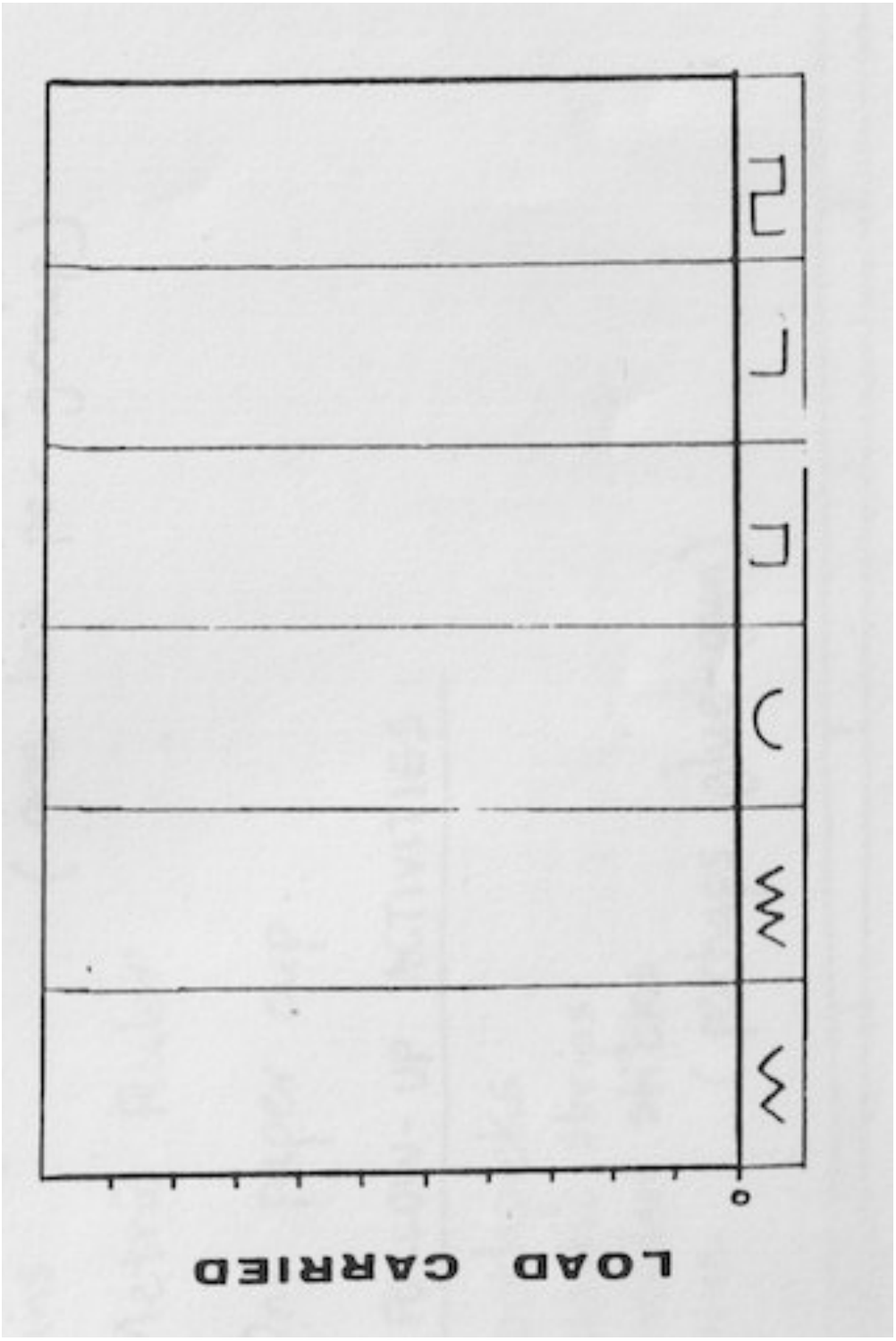
EXPERIMENT to find the strongest beam bridge that can be made from one 60cm x 15cm piece of thin cardboard, each folded or bent differently:



TEST: Place each different beam across the 40 cm span and test it with the same truck, load it as before until the beam starts to bend. Weigh the loaded truck and record it.

RECORD: Make a graph of the load carried by each beam: on the next page, mark weights along the left hand side and make a mark in each each column at the weight it carried.

Conclusion: which shape beam was the strongest?
Why do you think it made a difference to change the shape of the beams?


LOAD CARRIED
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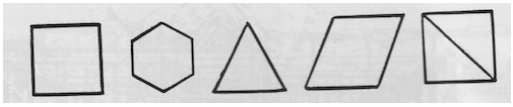
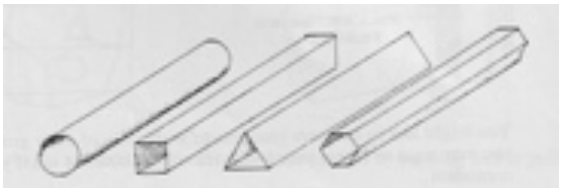
CHALLENGE!
Build a 30 cm high bridge with a 40 cm span that can carry a load of 500g. Use any materials you like, but you will need drinking straws and pins, and cardboard.

To help you decide, read about the different kinds of bridges:
https://www.kidcyber.com.au/bridges

TEST SHAPES:
Use drinking straws and pins to make the shapes below.
Devise a way to test them to see which are the strong shapes to consider when building a bridge.



Now make different shaped columns or supports out of cardboard:



TEST the strength of each column: stand a column with a square of cardboard on top and put a weight on it (such as a can of soup or a toy). Make variations such as changing the height or width of columns to see if that affects the strength: guess first and then test.

RECORD the results of your strength tests. They should help you make choices about your bridge.

DESIGN your bridge by drawing it in detail, including the measurements and materials.
BUILD your bridge then **TEST** it.

RECORD the results of your tests. Did it manage the 500g load? If not satisfactory, what can you do to improve the performance of the bridge?

MODIFY to improve the results and **TEST** again.

- Include photos and drawings in your record.
- Write about how you built the bridge: was it easy or difficult?
- Are you pleased with your design?
- What kind of bridge is it?

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