Scorpio Technology NEWSLETTER

INSIDE THIS ISSUE

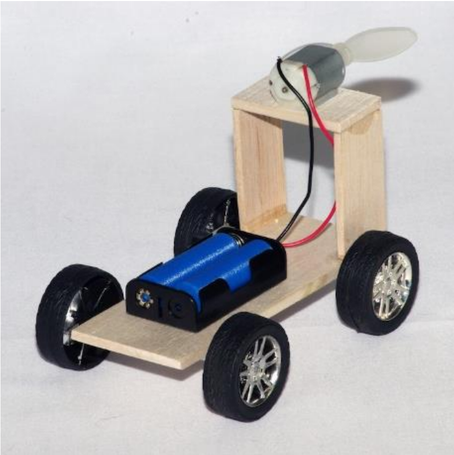
WELCOME

This month's newsletter looks at experimentation and innovation by Australian inventor Lawrence Hargrave. He was a pioneer of flight and a great role model for STEM.

PRIMARY: MOTION - FLIGHT, ROCKETS & RACERS

"Learning is not the product of teaching. Learning is the product of the activity of learners". John Holt 1984 (writer and educationalist).

Motion and propolsion are great **STEM** topics for investigation and experimentation. This can be related back to the work of Australian Lawrence Hargrave whose box kites led to the development of the first planes. (See feature article).



Some of Scorpio's introductory kits involve construction and assembly of a working model. We recommend choosing the no-solder version for Primary students. These include **Balance Plane** (Code: BALAN-NS), **Captive Aeroplane** (Code: CAPTIVE-NS). The **Propelled Car** (Code: PROPC-NS) introduces the student to propeller driven vehicles such as the Helica.

You may choose a commercial kit which contain all the components and require some assembly. These also provide scope for experimentation, measurement and much more.

ITEM	CODE	DESCRIPTION
The Aero Car	HJ1800	Air powered car
Liquify Rocket	LQ5000	Rocket flies over 30m
Cosmic Rocket	FSG3235	Rocket powered by baking powder
Transparent Solar Cell Dolly	100013C	Solar Car useful for experiments
Fan Car	FANCAR	Large fan propels car forward
Air Power Engine Car	FS631	The air chamber is pressurised and the vehicle moves forward.
Tin Can Cable Car	FSG3358	Reuse a soft drink can to create a cable car.

TEACHER CONFERENCES & WORKSHOPS

Scorpio is attending or supports these Design & Technology teacher activities:

DATTA VIC - Friday 1-05-2020 *Design Interruption,* Harvester Technical College
DATTA QLD - 25/26-06-2020 *Creative Integration*, Brisbane Convention & Exhibition Centre, Sth Brisbane
DATTA WA - 03-07-2020, Edith Cowan University – Mt Lawley
SCITECH 2020 - 12-9-2020, *Conference for Science & Technology Teachers,* Daramalan College, Dickson Canberra
DATTA AUSTRALIA - Design & Technologies Week
ITE (NSW) - 25 to 27-11-2020

SECONDARY: WHAT'S NEW?

PLASTIC BOTTLE CUTTER DIY ROPE TOOL (Code: PLBOTTCUT) Price: $ 17.00 each

We have found an easy to use tool that lets you create a useable resource from PET bottles.

The PET plastic from used bottles can be reused to generate products of added value. By cutting the bottles into strands of consistant width they can be reused for many purposes. A 0.5 litre bottle can produce about 4-5 metres of strong cord.

- The **Plastic Bottle Cutter** lets you 'upcycle' / reuse any plastic (PET) bottles into a strand (rope).
- This is portable and practical
- It is environmentally-friendly and easy to use; The tool is safe and convenient
- This plastic bottle cutter is allows you to cut faster and more evenly than using a craft knife or scissors.
- Material: Wood, Metal/ Weight: 100g
- Size: 2.2 cm x 2.2 cm x 14 cm

WHERE TO USE THE PLASTIC STRIPS

- The strips can be used to tie things as you would with regular rope.
- DIY crafts such as lanyards, weaving pencil holders, flower pots, baskets, bags, jewellery making and much more.
- Use as heat shrink
- Gardening

HOW DOES IT WORK?

The device consists of a wooden handle, razor blade, and a cutting guide.

1. To use the 'Plastic Bottle Cutter', first cut the bottom off of a plastic soft drink or water bottle.
2. Cut into the bottle a small distance. Choose the width of your strand. Place the tool into this groove.
3. Pull the stand. The tool then slices the rest of it into a long thin strand of plastic that is flexible enough to be used in the place of twine. You may wish to use pliers to hold the plastic strand.

SPORTS TIMER (Code: STOP)

Price: $1.50 each

Functions:

- Basic quartz sports timer
- 1/100th second stopwatch
- Split / lap time
- Time: hour, minutes, second and day of week
- Alarm and Chime

Description:

- Material: Plastic
- Colour (2 toned): Yellow, Black, Red, Orange, Green, Blue, White.
- Includes battery

NOTE: Specify if you require a specific colour or colours.

STEM

Measuring equipment mentioned in this month's feature article "**Lawrence Hargrave**".

ITEM NAME	CODE	PRICE
ANEMOMETER – CUP 	**1055043** • Wind speed anemometer working model • Mounted on a low friction bearing and consisting of 3 black plastic & 1 red plastic cup • 210mm x 180mm (h) • Anemometer is sensitive at wind speed of 1.5km/h • Student can determine the wind speed quantitatively by counting the number of rotations.	$22.00
ANEMOMETER LCD WIND SPEED GAUGE  *(Model or colour supplied may vary from illustration)*	**ANEMOLCD** • Wind speed gauge with LCD. • Measures maximum and average air velocity; temperature and wind chill factor. • Displays Beaufort scale. • Air Velocity Range: 0-30 m/s; 0-55 Knots; 0-90km/h; 0-65mph. • Operating temperature: -10°C to +45°C • Operating humidity: Less than 90%RH • Current consumption: 3mA (approx.). • Manual / Auto power shut off. • Battery: CR2032 3.0V (included) Useful for testing items such as the Wind Generator (Code: WINDGEN)	$33.50
CLINOMETER 	**CLINO** • Simple to use measuring tool to calculate the height of any tall object. Simply aim, squeeze trigger, and view angle of inclination. • Clinometers are widely used in surveying, forestry, and civil engineering to determine the angles of slope and height of an object with respect to gravity • Sturdy plastic construction	$32.95
CLINOMETER-MK 2 	**CLINOMK2** • A compact Clinometer with no external moving parts and a combined 'sighting' angle-reading eyepiece • A viewing window on the side of the Clinometer allows a second person to check a reading • All angles in degrees followed by a plus or minus to indicate an upward or downward slope • Students calculate height by using the formula found in the included product guide. • Made of durable plastic • Size: 14cm dia.	$36.00

This Month's Q&A Technology Tips: Component Holder

Q: What is a strong, easy method of attaching small and difficult to handle components to a set of 2 or 3 4mm banana sockets?

A: We suggest **COMPONENT HOLDER – 2 WAY** PA0875-001 and **COMPONENT HOLDER – 3 WAY** PA0875-010

Constructed from strong fiberglass circuit board material – making it very sturdy for student use

The PA0875-001 has 2 x banana sockets & 2 x connectors

The PA0875-010 has 3 x banana sockets & 3 x connectors

Parts are fitted to the holders – there is no need to solder. Avoids the need for alligator clips. Components that can be supported include: transistors, diodes, resistors, MES lamp sockets, LEDs with their resistors or diodes All that is required to fit components is a Philips screwdriver. Fitted with plastic feet to protect benches from being scratched from sharp wires & parts

Size: 73 x 38mm.

COMPONENT HOLDER – 2 WAY
PA0875-001

COMPONENT HOLDER – 3 WAY
PA0875-010

MODEL SOLAR VEHICLE CHALLENGES

Renewable energy has become a significant focus for governments and communities world wide. Students can learn about using renewable energy by actually using it – Scorpio has a number of project kits that suit this criteria: **Wind Generator, Solar cars** and **Solar boats**.

We have seen the amount of schools taking on renewable energy pojects increasing each year. These projects are individualised to suit the students and the school community. A challenging aspect of Model Solar Vehicles is the competition. This provides students a **positive** framework to **develop skills**, **communicate** and **work together** in a team to construct a model that is raced against solar vehicle models from other schools.

The Australian-International Model Solar Challenges for cars and boats are held in the various states, with the culmination being the National competition.

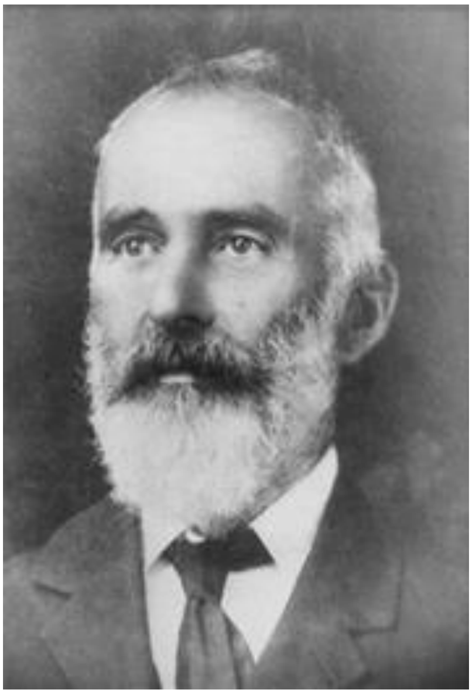
- Australian International Model Solar Vehicle Challenge https://www.modelsolarchallenge.com.au/
- Victorian Model Solar Challenge http://www.modelsolar.org.au/
- NT Model Solar Challenge
- Tasmanian Model Solar Challenge http://www.tassolarchallenge.org/

Victorian Model Solar Challenge have added a document to the 'First Timers' section of their website on methods to get sponsorship. If you want to also increase business skills in your students along with STEM, or, if you would like to take the edge of the cost of the challenge, then this document is for you. See https://www.modelsolar.org.au/get-started/first-timers The regulations for the 2020 event are now on the website.

DATTA VICTORIA
Design And Technology Teachers Association

DID YOU KNOW? - DATTA Vic has an **OH&S Resources** page on their website, which includes the **DET's Safety Guidelines**, **info on the Safe Use of Machinery for Technology, Teaching courses**, **sample competency tests**, and much more.

Lawrence Hargrave (1850 - 1915)



"If there be one man more then another who deserves to succeed in flying through the air, that man is Mr. Lawrence Hargrave of Sydney, New South Wales."

Octave Chanute
(American Aviation Pioneer)
Progress In Flying Machines
1894

"*The flying machine of the future will not be born fully fledged and capable of a flight for 1000 miles or so. Like everything else it must be evolved gradually. The first difficulty is to get a thing that will fly at all. When this is made, a full description should be published as an aid to others. Excellence of design and workmanship will always defy competition*." (1893)

Lawrence Hargrave is now considered one of the great pioneers of aviation. His box kites and other experiments provided the knowledge to build early biplanes. He was the first Australian to fly.

On principle he chose not to patent his ideas or inventions so they could be freely available to the aeronautical world. He believed that patents slowed progress.

Hargrave's work provided a starting point for other developers such as Alexander Graham Bell, Octave Chanute, S.F. Cody, Charles Lamson. The Wright brothers knew of his work through O. Chanute but never acknowledged the part his experiments played in their design.

What can we learn from Hargrave?

- The necessity of maintaining detailed notes and logs so that work can be replicated or continued if needed by someone else.
- Diversity of experiments building on previous work.
- Perseverance and accepting failures as part of the Design process.
- Communicating with others – idea transfer, improvement of ideas, brainstorming, learning from others
- Hargrave used the **STEM** model and **Engineering Design Process** model in his work.

Hargrave's most important inventions

- His experiments were influential in the development of the **cambered aerofoil** (a structure with curved surfaces which gives lift when in flight e.g. Wing and fin).
- The box kite (1893), which greatly improved the lift to drag ratio of early aircraft
- Work on the rotary engine, which powered many early flying machines up until about 1920.

Highlights of Lawrence Hargrave's life's work.

Hargraves was a man of many talents and interests.

- explorer and cartographer
- draftsman
- model maker
- aerospace engineer
- assistant astronomer Sydney observatory
- coalmine owner
- inventor
- historian
- aviation pioneer

1866 At 16 joined a voyage to circumnavigate Australia.
Served an apprenticeship in the Australian Steam Navigation Company. Learnt skills later used in designing and constructing models.

1870 Rushcutters Bay - Walked on water in boat-shaped shoes with a system of flaps on the bottom to provide traction in the water.

1878 Began work as an astronomical assistant at the Sydney Observatory. Built four adding machines to assist his astronomical work.

1880 Hargraves used Horatio. F. Phillips findings to help him increase the efficiency of his box kite. Phillips' created the double-surfaced aerofoil which was capable of producing a lower pressure above the wing surface than below. The difference in pressures would certainly allow the wing to rise faster.

1882 Began to research the problems of flight by carefully studying the flight of birds and insects. Developed the **Trochoided plane theory**, explaining how fish swim, and snakes slide, in a side to side motion, and how this might be used in the wing movement of flying machines.

1884 Retired and was able to devote his time to aeronautical research.

1887 Experimented and constructed flying models – **ornithopters**. One of his ornithopters flew 82 metres. His experiments with monoplanes focused on wing shape.

1889 In 1889, after experimenting with 36 different designs, he developed the first three-cylinder compressed-air **rotary engine.** Hargrave experienced many problems with his rotary engine – weight of materials, quality of machining, ability to get sufficient power from the engine. It was one of the great inventions of his career.
This engine became a prototype for the aircraft engines that dominated the first 50 years of powered flight.

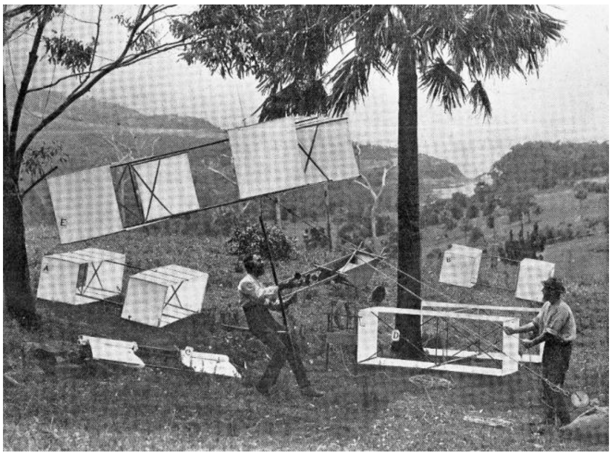
1890 Used compressed air to power "**Trochoided Planes**" #10, which flew about 112 metres. He powered his #15 with a chemical-reaction "explosion" engine which did not succeed, while his #17 and #18 machines were powered by lightweight yet powerful steam engines.

1892 By the end of 1892 he had constructed 16 different model flying machines.

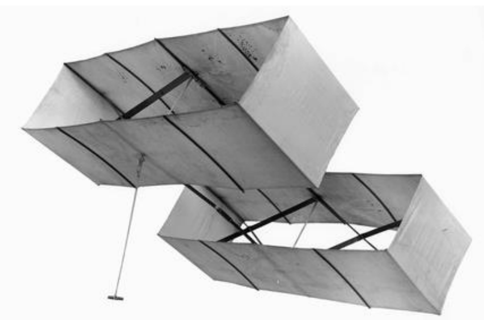
During experimentation he discovered that a curved surface had twice the lift as a flat one. Discovered that a kite with two separated "cells" or double planes, had the greatest stability and oaring power.

1893 Confirmed the superior lifting qualities of cambered wings and began experimenting with kites Hargrave's cellular / box kite design structure design was introduced to the International Aerial Navigation Congress held in Chicago. William Eddy wrote to Hargrave seeking permission to use his box kites for meteorological experiments in the United States.

1894 At Stanwell Park, NSW, Hargrave conducted his most important experiment. He linked four of his box kites together, added a sling seat. The kites were tethered to the ground with piano wire. Hargrave was lifted into the air. The four box kites were capable of lifting 109 kilograms about 5 metres off the ground in a 21 knot wind. They proved to be a stable aerial platform.



Hargrave carried instruments between the kites. An **anemometer** to measure wind speed and a **clinometer** to check the angle of the kite line.



Hargrave's box kite (1893) could be folded for transporting. The poles (spars) were streamlined to reduce wind resistance and the middle cords could be adjusted so that there would be maximum vertical and horizontal tension on all surfaces. The string is the balance point (fulcrum) of the kite.

1895-96 Alexander Graham Bell begins experiments with kites, gliders, flight-rotors, and wings. Initially he used Hargrave's box kite for his experiments. Bell and Hargrave correspond and became friends. Bell visited Australia in 1910 to meet Hargrave.

1896 US National Weather Service used a modified Hargrave box kite until the mid-1920s to test temperatures at different altitudes. The German weather station at Lindenberg used Hargrave type kites routinely until weather balloons took over.
The box kite was used by aerial photographers. The camera could be attached to the box kite frame instead of being hung from below, making it much steadier.

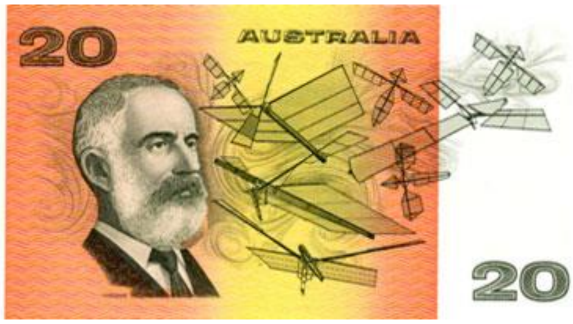
1903 Hargrave's box kite designs were quickly taken up by other inventors, including the American aviation pioneer Octave Chanute, whose designs were later incorporated by the Wright brothers into their Wright Flyer, the first aircraft to achieve powered flight with a pilot on board in December 1903.

1906 Produced a number of successful power-driven aeroplanes. the 'No 14 bi plane was flown in France by Alberto Santos-Dumont in September 1906.

1909 Hargrave designed a single cell box kite with reverse curve supporting surfaces like a shallow 'S'. This design provided both lateral and longitudinal stability eliminating the need for a tail plane. The design is still used in hang gliders today.

1965 Postage Stamp

1994 Postage Stamp



Lawrence Hargrave with some of his gliders on the reverse of the Australian $20 banknote from 1966 to 1994

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