Scorpio Technology NEWSLETTER

INSIDE **THIS** ISSUE

TEACHER CONFERENCES & WORKSHOPS

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

SCITECH 2020 - 12-9-2020, *Conference for Science & Technology Teachers,* Daramalan College, Dickson Canberra
DATTA AUSTRALIA – 12 to 18-10-2020, Design & Technologies Week *Developing creative problem solvers*.
ITE (NSW) - 25 to 27-11-2020, Sydney Masonic Centre, Sydney
DATTA VIC – 3 & 4-12-2020 *Design Disruption*, Harvester Technical College Sunshine

WELCOME

This school semester has been a challenging one for all educators and students. Scorpio has continued to work hard to support you during this time by providing assistance and prompt despatch of orders. We always strive to make your job easier!

As always, we are here to help, so if you have any issues or questions, don't hesitate to contact us at (03) 9802 9913 or sales@scorpiotechnology.com.au

PRIMARY: STEM - SIMPLE MACHINES

A simple machine is any of the basic mechanical devices for applying a force, such as an inclined plane, wedge, or lever. They are used to make work easier.

JUNIOR PRIMARY: The **STEM SIMPLE MACHINES ACTIVITY SET** (Code: LER2824) provides 6 simple machines with hands-on activities and experiments. This kits provides opportunities for students to explore lever board, wedge, pulley with rope and hook, cart with 4 removable wheels, Archimedes screw, 4 barrel weights. Measure, record and compare data to draw conclusions. Kit includes 19 pieces, activity cards and guide. Suits ages 5-9

MIDDLE & UPPER PRIMARY: Explore simple machines with these working models.

HYDRAPULT (Code: WM6720) uses hydraulics to throw projectiles in 3 different ways. Suitable for programs related to robotics, levers & simple machines, fluid dynamics, density, air resistance & engineering. For ages 8+

HYDRAULIC MINI EXCAVATOR (Code: WM6716) teaches the principles of levers & hydraulic power. Build your own working hydraulic machine with pre-cut wooden pieces. Mechanism includes 2 hydraulic cylinders & can be adjusted to provide either digging or scooping action. Includes instruction manual. Model size (approx.): 9cm x 32cm x 40cm (extended). For ages 8+

LEARN TO MAKE, MAKE TO LEARN

You cannot create experience. You must undergo it.

Albert Camus

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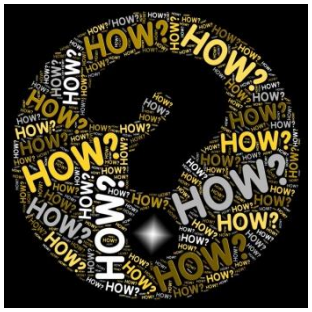
REVERSE ENGINEERING STEM STATION

DISCOVER HOW IT WORKS

AIM	1. Dismantle item and then reassemble item back to working condition. 2. To investigate what is inside item and how it works
TOOLS REQUIRED: 	• Variety small screwdrivers • Nut driver • Small wire cutters, hammer • Tweezers • Magnetic grabber or Three prong parts retriever • IC (integrated circuit) extractor
ITEMS REQUIRED:	e.g. Mobile phones, pencil sharpeners, calculators, computer towers, printers, old appliances.
	**WARNING**: • Check labels on appliances. **DO NOT** open anything that it is dangerous such as a microwave oven, television or monitor. • Always **remove** batteries or **unplug** electrical cords.
HOW TO GUIDE 	Reverse engineers photograph the item before taking it apart. Photos show close up pictures of how it looks from all sorts of angles, inside and outside. They make notes of things that they may need to remember. 1. During disassembly one part is removed at a time. The parts are put in the order that they were removed. This helps to reassemble it later on. 2. As each piece is removed try to discover what part it plays in the original item. Why is it placed where it is? 3. Take a photo(s) of all the parts removed. Later you may wish to label the parts. 4. Begin to put the parts back together in the reverse order that you took them out. 5. You should have no parts left over.

This Month's Q&A Technology Tips: Matching the motor & the power source

When designing a project, you MUST consider a number of things to make sure that the project performs as required. The critical thing to do is to match the motor's performance / power requirement to the power source, as not any battery or solar panel will drive any motor.

Q. What do I need to consider when choosing the motor and the power source?
A. The critical things to consider (ie. match) are:
- **VOLTAGE**:each motor has a nominated operating voltage range: eg. 3.0V-6.0V
- **CURRENT** (Amps / milli Amps): different motors have different current needs, which the power source needs to provide, and you must consider the motor's current draw – not just at "no load", or "maximum efficiency", but also under normal "operating load" –
which consumes more Amps / milliAmps than at maximum.

efficiency. This is especially critical for matching solar panels to motors.
This means that:
- in a "no load" situation, such as. a car held in the air, it will spin its wheels.
- When the car is put on the ground, it is under load and has a much higher current draw, which the power source has to be able to supply (usually any AA, C or D cell will provide that – so long as they are in good condition)

Q. I want the model car to go faster. Can I do that by increasing the voltage input to the motor?
A. Yes, as the voltage increases so does the motor speed. However, if you increase the voltage beyond the motor's rated voltage, the motor will spin faster, but it will not last as long – if you do that, you should aim to operate the motor for short periods.

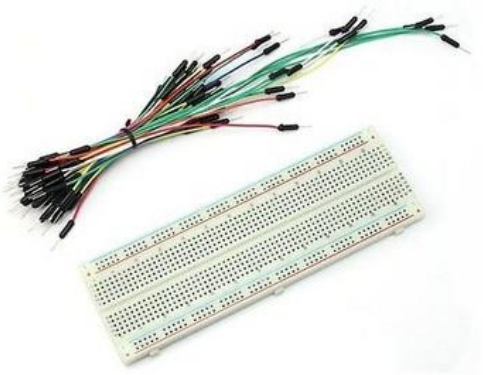
SECONDARY: WHAT'S NEW?

ARDUINO COMPATIBLE

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analogue inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program. These kits and components are Arduino compatible products.

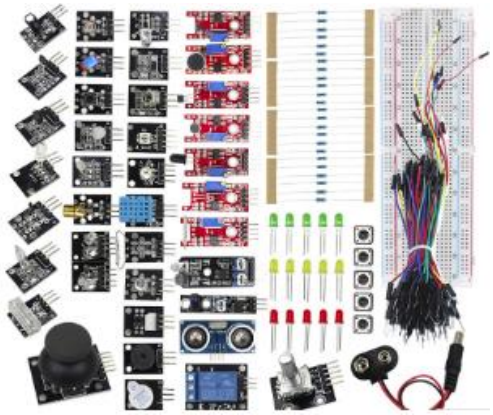
UNO R3 ATMEGA328P-AU DEVELOPMENT BOARD WITH CABLE (Code: UNOR3CH340G)

The UNO R3 development board is an open-source microcontroller, and is Arduino-compatible. It has easy-to-use hardware and software, to allow students to experiment with the UNO R3 controlling different sensors, vehicles or other devices, and to program the board to suit those applications. UNO R3 boards are also able to read an input and turn it into an output. The Shield design makes adding expansion boards easy.
This board includes a USB type B Cable.



SOLDERLESS BREAD BOARD WITH JUMPER WIRES (Code: BRBRD830J)

MB102 830 Tie Points Solderless PCB Bread Board and includes 65 pieces Jumper wires.
The Jumper wires are Male to Male solderless flexible Jumper wires and come in a variety of lengths: 110mm, 160mm, 200mm, 240mm.



37-IN-1 SENSOR KIT (Code: 37SENSOR)

The *37 in 1 SENSORS KIT* contains a 830 tie points Breadboard, jumper wires, and 37 sensors. This Arduino compatible kit's 37 individual modules can be used to create many interesting experiments. The sensors are controlled using a microcontroller. This is a great package to gain hands on experience with a broad range of different sensors. Once you have gained experience with these, you can move on and use these for larger projects or vehicles.

LINE TRACKER (Code: LINETRACKER)

***NB**: **not** an Arduino product*

The *LINE TRACKER* is an Intelligent Line Tracking Vehicle that can follow a dark track - drawn, printed or taped on a white background. Light produced by two LEDs is reflected onto two LDR's. The LDR's provide the inputs to control the circuit. This information is used to control the operation of the *LINE TRACKER* to keep it following the track.

Reverse engineering

Reverse engineering, also called back engineering, is an analysis that provides information regarding product design features and production. The term also used to describe the legal process of reconstructing an existing product accurately.

"It can be said that reverse engineering begins with the product and works through the design process in the opposite direction to arrive at a product definition statement. In doing so, it uncovers as much information as possible about the design ideas that were used to produce a particular product." (https://www.npd-solutions.com/reverse-engineering.html)

Reverse engineering is an useful engineering tool. Rapidly changing and developing technology allows less development time and dramatically cuts costs. Information gained can then be applied to new products or inventions.

Throughout history reverse engineering was used by the military to gather information and improve knowledge. During the Second World War and the Cold War technology, devices and parts and even aircraft were captured and used to improve military capabilities. An example is the US aircraft—the B-29 Superfortress was cloned by the Soviet Union to make the Tu-4 bomber.

Experimentation is an active science.

Claude Bernard

French Scientist 1813 – 1878

WHAT IS THE PURPOSE OF REVERSE ENGINEERING?

Reverse engineering is used in multiple industries. These include:

- Original equipment manufacturing (OEM) and Product Design Companies
- Industries including engineering (aerospace, automotive, mechanical, medical, chemical, electronics, software), systems biology and entertainment
- Emulation software e.g. compatible computers and software
- Heritage and Preservation

Reverse engineering may be used for the following reasons:

- There is inadequate documentation (e.g. specifications and drawings) of the original design
- Create a reliable CAD model for future reference
- Replacement of obsolete parts discontinued by the original equipment manufacturer (OEM)
- Gain understanding of how the device works
- Maintenance - Helps understand how best to access, remove and replace a certain part.
- To update obsolete materials or antiquated manufacturing processes with more current, less-expensive technologies
- Develop components that connect older with newer equipment models.
- Identifying potential patent infringement.
- Speeds up development time
- Diagnostics and Problem-Solving - To improve a products performance or design.

- Improving manufacturing processes to make manufacturing easier and faster while keeping the quality standard high.

- Re-create parts for historical restoration e.g. classic car restoration
- Competitor analysis - To obtain knowledge of a competitor's products and develop better their products for benchmarking and technological advances.
- Acquiring sensitive data e.g. Military or commercial espionage.

Reverse engineering is not always a suitable solution. The engineer needs to make a judgement on such things as:

- Size and complexity of component. The time taken may exceed the benefits.
- A life-cycle analysis and cost/benefit analysis should show that the process is cost and time efficient.
- Condition of original part e.g. a damaged part will not be suited to 3D scanning.
- Legal implications of copying a product that is copyrighted or patented.

As an engineering tool reverse engineering has a process. This is modified according to the industry in which it is used but the basic process remains similar.

REVERSE ENGINEERING PROCESS

1. Identify problem or goal of the project
2. Acquire the physical product
3. Obtain information from original through 3D scan or disassembling product.
4. Engineer – analyse each component (measuring, materials used, and manufacturing techniques). Determine why it was designed that way.
5. Prototype – create 3D model if required
6. Compare prototype to original
7. Determine possible improvements to the original design.
8. Make upgrades and changes.
9. Create documentation e.g. manufacturing drawings, schematic diagrams, material lists.
10. Reproduction / manufacture.

Reverse engineering opens up opportunities to learn, explore and develop new ideas, processes and refinements. The process may be the cornerstone for innovative design for a project we will see in the future.

REFERENCES

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Videos exploring the way things work.

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