

RACV



ENERGY BREAKTHROUGH

21-25 NOVEMBER 2018 | MARYBOROUGH, VICTORIA

POWERED BY IMAGINATION

THE PREMIER SCIENCE, TECHNOLOGY, ENGINEERING AND MATHS, ACTIVE LEARNING PROGRAM

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INNOVATIONS IN TECHNOLOGY

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1. OVERVIEW



Challenge 1: Crafty Design – Working With Water.

Ages: Open to Primary students in Years 3, 4, 5 & 6 & Secondary students.

Class: A, B/C

Challenge: Teams must create a stable craft looking like an invertebrate which will carry a full soft drink can – under its own power – along a channel of water 9.4 metres x 81.5 cm.

Challenge 2: Junkyard Challenge – Crafty Cranes.

Ages: Open to Primary students in Years 4, 5 & 6.

Class: A

Challenge: The Junkyard Challenge involves teams of 4 who will be provided with a range of materials useful to create an innovative structure that will move a 4 kilogram weight a distance of 1 metre horizontally from its start position. Crafty Cranes will present participants with the challenge to build a crane device out of the resources provided in a 90 minute construction session (1.5 hrs). Each team will have a star picket (fence post) securely driven into the ground to provide the base for their crafty crane.

Challenge 3: Junkyard Challenge – Crafty Cranes.

Ages: Open to Secondary students in Years 7 – 10.

Class: B

Challenge: Teams of four students are given a mystery box of recycled ‘junkyard’ materials. Over 90 minutes they must work together as a team to create a device, or machine that will move 4 litres of water across a 1.5 metre gap, with only one significant base point or footing.

2. ENTRIES

2.1 Categories, Classes and Quotas

Category	Class	Quota
Innovations In Technology	Crafty Design A Crafty Design B/C	40
	Junkyard Challenge Class A Junkyard Challenge Class B	12

2.2 Team composition

- All entries are to be team entries and must consist of current school students.
- All team members must be familiar with the operation of their craft, and must participate equally in the assessments at the event in Maryborough.
- Team members do not have to all come from the same school. They could be part of a scout, church, or other community group, however they must all be current school students and be covered by the group's insurance.
- Teams in the Innovations in Technology category must have:
 - a minimum of four (4) and maximum of six (6) in Crafty Design.
 - a team of four (4) for Junkyard Challenge.
 - at least half of whom must be female.

2.3 Category caps, changes and waitlists:

- Crafty Design has no limit with the number of entries per school while a maximum of two entries per school will be accepted in Junkyard Challenge
- Additional entries from a school will be placed on a waiting list and will be notified if accepted into the event.
- Correspondence regarding the status of entries on a waiting list will be made directly to a Team Manager only.

3. ASSESSMENT

3.1 Overview

The RACV Energy Breakthrough Innovations in technology is unique in that all teams must compete across the two areas of assessment: Design and Construction/Display and Presentation and Trials.

All sections must be attempted and points are awarded in the following sections:

Section	Innovations in Technology
Design & Construction, Scrutineering, and Display and Presentation	65
Appearance like an invertebrate	10
Trial Elements	
Time Trial	25
Total	100

It is the responsibility of each team to ensure they complete both sections. The schedules for each of these sections are outlined in this Handbook and further details are provided in an Information Kit distributed in November.

3.2. Scrutineering

Crafty Design models will be checked during the Display and Presentation section for safety issues.

Junkyard Challenge designs will be observed during their construction for any safety issues.

4. CHALLENGE 1 - CRAFTY DESIGN



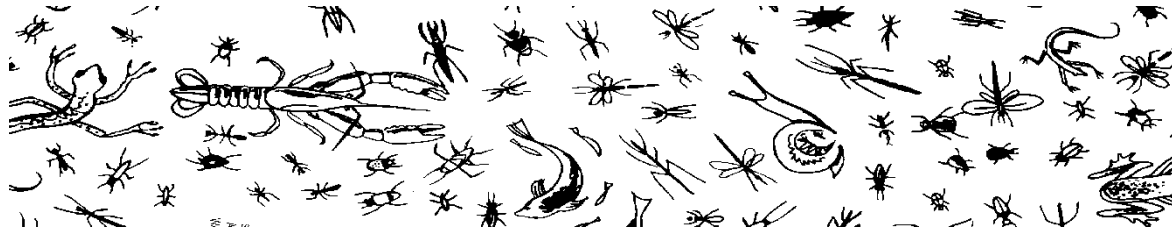
4.1 Overview

The challenge for Crafty Design is to **create a craft that resembles a Macro invertebrate** that live in and around water. Macro means that we can see it with our eyes. Invertebrates

are small animals and are a collective term used for all animals without a backbone which include spiders, crustaceans, worms, insects and molluscs.

There will be a special prize (**Best looking Invertebrate**) for those who demonstrate they have met the objective.

Secondary students are encouraged to create other ways for craft to travel, e.g. craft must still have contact with water, but could travel under water.



4.2 Materials and Specifications

- Using construction materials such as TEKOS, LASY and LEGO in conjunction with scrap or recycled material, create a stable craft (in keeping with the above theme) which **will run under its own power**, along a channel of 9.4 metres x 81.5 cm, carrying a full soft drink can. Please note that the water depth of the channel is approximately 12 cm.
- Craft must complete one full length of the channel.
- The craft must be able to maintain a direction within a lane, towards a designated target area on the end and must complete the course within a set time of three minutes.
- Craft dimensions: length and width to be under 81.5 cm.
- The fuel source must be an alternative to fossil fuel. No dry cell batteries or capacitors permitted.
- To encourage greater innovation in design, students may no longer use compressed air as a means of propulsion.

4.3 Judging Criteria:

- All information relating to assessment of **Crafty Design** is to be presented on a **poster** approximately 65cm wide x 85cm high (thick cardboard backing is recommended).
- Each team will be allocated 20 minutes in which to **present and discuss** their entry with the judges.

Judging will include assessments in the following areas and may be included on the poster:

- **Safety** - including energy source; the load (soft drink can); moving parts are shielded.
- **Innovative Construction** - materials used; design originality and imagination; artistic form, student input, community involvement. Use of recycled material (teams should look to improving craft each year and modify). Recycling does not mean use of exactly the same model - recycling of materials is encouraged, NOT the recycling of crafts! (As indicated in 2015, models used in previous years will not be acceptable.)

- **Planning and Testing** - includes challenges and problems encountered during planning/construction; ability to identify how the model could be improved, modified, given time and appropriate materials.
- **Presentation** - [Introduction, speaking without notes, clear speech](#), use of diagrams, photos colour; originality; evidence of teamwork; involvement of school, community and/or industry. Highlighting environmental issues, water conservation, use of alternate energy sources and recycling.
- **Model/Craft** - [The craft has been designed and constructed mostly by students. Appearance/ Artistic Form. Resembles a macro invertebrate that lives in and around water \(not just sitting on top of the craft\).](#)
- **Environment** - [How this activity relates to the aims and values of the Energy Breakthrough. Knowledge about the chosen invertebrate](#)

4.4 Performance Test and Time Trial:

All entries are required to demonstrate their crafty design in operation, and complete a Performance Test.

The craft/model will be judged:

- [how it shows advancement in technology](#)
- [along with its reliability, sustainability and efficiency.](#)
- [Higher marks will be awarded for completion of task in a given time without any assistance from the team.](#)
- [Time for the trial will be awarded scores with the fastest obtaining the highest score, the slowest the least.](#)

5. CHALLENGE 2 - JUNKYARD CHALLENGE - PRIMARY



5.1 Overview

PRIMARY Grades 4, 5 & 6: Crafty Cranes

Do you have creative problem solvers and budding engineers?

The Junkyard Challenge involves teams of 4 who will be provided with a range of materials useful to create an innovative structure that will move a 4 kilogram weight 1 metre away from its start position. Crafty Cranes will present participants with the challenge to build a crane device out of the resources provided in a 90 minute construction session (1.5 hours). Each team will have a star picket (fence post) securely driven into the ground to provide the base for their crafty crane.

This is a class for Primary students only.

This is a project for Primary students only. Each team will have 10 minutes to survey the mystery resource pile, and then 90 minutes to design, construct and test their crafty crane. Adults may supervise the students for the first 20 minutes and may only provide ideas and safety after that. Points will be deducted for adult intervention after the first 20 minutes. Remember this is a thinking-doing-learning engineering experience for young people.

5.2 Equipment provided

The types of materials available will be a mystery to the teams, but they are likely to include recycled items – some useful, some not! It will be up to the team to decide which materials they would like to use and how they will build their structure.

EACH team will receive this BASIC PACK consisting of:

- Design pack: Paper & pencils.
- Retractable tape measure.
- Fine nib texta.

Tools:

- Scissors.
- Pliers.
- hacksaw (2 blades)
- [Pruning saw](#)
- Retractable Stanley knife.
- Safety Glasses (2 per team).
- Cutting board

(NOT TO BE USED IN STRUCTURE)

Connectors

- gaffer tape.
- rayon cloth tape.
- Roll of thin tie wire.
- zip ties.
- Bag of Rubber bands
- Ball of string.
- 2 bike tubes

Junkyard Materials:

Materials will be available on the day to assist your construction! (That's the mystery)

- There will be a work station where several adults will supervise the children using the drills, spare Stanley blades also available.
- All team members will have their tools and equipment licences signed off by their supervising teacher /mentor prior to the event. Licences will be provided in term 4.
- All team members MUST display good occupational Health and Safety practices at all times – or risk being excluded from the event.(Safety glasses are a MUST when drilling).
- Optional: teams may display a team banner up to A2 size.

5.3 Process:

- The teams will start with a 10 minute discussion time and then have 90 minutes to build their structure. Then teams will check their structure against the criteria.
- Each team may bring a mentor with them to help during the discussion phase and to assist in the sharing of ideas, supervise students and maintain safe practice. After the first 20 minutes of build time all adults must step back into advisory roles only. Points will be deducted for adult intervention after this initial 20 minutes period. Please respect that this is a thinking-doing-learning engineering experience for young people.
- The Mentors could be a parent/teacher. If the team is unable to organise a mentor, please let the Planning Committee know prior to the event.
- Students may Barter & Swap what is in their BASIC PACKS during the time.

5.4 Finished Product:

- The structure MUST be able to support and move a 4 litre bottle of water (4kgs) a distance of 1 metre from the start position.
- Presentations will be made immediately after the test period is completed.

5.5 Judging Criteria:

A judging rubric will be emailed to participating schools in Term 4.

“The Great Crane Trophy”

- Judges will be looking for the structure that resolves the task, effectively and elegantly. Fitness for purpose and aesthetically pleasing, will win the day.

Special Award – “Working under Pressure”

- For the team that has demonstrated throughout the entire project – consistently sharing ideas & tasks and therefore working together to solve issues as they arise. Your machine may not work the best, but you could be the best working team.

5.6 Useful Links:

Websites which will encourage the students’ exploration of the broad range of crane structures from around the world, plus information links that can be useful are:

<https://youtu.be/e0sCFHUuLgU>

<https://youtu.be/Eh0kyhEa8g8>

<https://youtu.be/oMoBcnHexzo>

<https://youtu.be/HZOCvGZE5nA>

Bridges

<http://www.civil.iitm.ac.in/node/473>

<http://www.youtube.com/watch?v=a2jEq4XP0IM>

<http://www.gravitykills.net/PhysicsOlympics/Bridge.htm>

<http://www.youtube.com/watch?v=baiPAPsWK0g&feature=related>

<http://science.howstuffworks.com/engineering/civil/bridge.htm>

6. CHALLENGE 3: JUNKYARD CHALLENGE (YEARS 7 – 10: CRAFTY CRANES)

6.1 The Challenge

Teams of secondary students will be provided with a range of materials and be required to create a structure, device, or machine that will move horizontally 4 litres of water across a 1.5 metre gap. The major restriction is that your project can have only one significant base point or footing (think crane) – a star picket.

6.2 Materials Provided

The types of materials available will be a mystery to the teams, but they are likely to include recycled items – some useful, some not! It will be up to the team to decide which materials they would like to use and how they will build their structure.

Mystery... Intrigue... Planning... Negotiating... Challenge... Competition... Innovation...

What more could you want?

EACH team will receive this BASIC PACK consisting of:

- Design pack: Paper & pencils.
- Retractable tape measure.
- Fine nib texta.

Tools:

- Scissors.
- Pliers.
- [Pruning saw](#)
- Hacksaw (2 blades)
- Retractable Stanley knife.
- Safety Glasses (2 per team).
- Cutting board.

(NOT TO BE USED IN STRUCTURE)

Connectors

- gaffer tape.
- rayon cloth tape.
- Roll of thin tie wire.
- zip ties.
- Bag of Rubber bands
- Ball of string.
- 2 bike tubes

Junkyard Materials:

Materials will be available on the day to assist your construction! *(That's the mystery)*

- There will be a work station where several adults will supervise the students using the drills - spare Stanley blades also available.
- All team members will have their tools and equipment licences signed off by their supervising teacher /mentor prior to the event. Licences will be provided in term 4.
- All team members **MUST** display good occupational Health and Safety practices at all times - or risk being excluded from the event. (Safety glasses are a **MUST** when drilling).

6.3 Process:

- The teams will start with a 10 minute discussion time and then have 90 minutes to build their structure. Then teams will check their structure against the criteria. A total of 100 minutes maximum time.
- Each team may bring a mentor with them to help during the discussion phase **to assist** in the sharing of ideas, supervise students, **but not to participate in the construction of the structure.**
- The Mentors could be a parent/teacher. If the team is unable to organise a mentor, please let the Planning Committee know prior to the event.
- Students may Barter & Swap what is in their BASIC PACKS during the time.

6.4 Finished Product:

- The finished structure **MUST** be able to move 4 litres of water (4kgs) horizontally across a 1.5 metre gap.
- Presentations will be made immediately after the test period is completed.

6.5 Judging Criteria:

A judging rubric will be emailed to participating schools in Term 4.

“The Crafty Crane Trophy”

- Judges will be looking for the structure that resolves the task, effectively and elegantly. Fitness for purpose and aesthetically pleasing, will win the day.

Special Award: *“The Practice under pressure Trophy”*

- Awarded to the team that displays outstanding shared-teamwork and coolness under pressure throughout the event. Your machine may not work the best, but you could be the best working team. As this challenge requires students to respond in diverse and interesting ways, it is suggested that participants utilise the internet to gain insights and options as to how they might respond to the task, in the lead up to the event. Information is power.

7. PROPOSED PROGRAM

INNOVATIONS IN TECHNOLOGY

THURSDAY 22 NOVEMBER

9am – 5pm

Registration open

Location: Administration Centre



FRIDAY 23 NOVEMBER

9am – 5pm

Registration open

Location: Administration Centre

Note: Innovations in Technology teams must register on Thursday or Friday.

Saturday registrations will only be completed by prior arrangement with organisers.

SATURDAY 24 NOVEMBER

9.00 am - 3.30 pm

Crafty Design and Junkyard Challenge Assessment

Location: Display & Presentation marquees

- Design & Construction
- Display & Presentation

11am - 1.30pm

Junkyard Challenge

Location: Display & Presentation Marquee

- Building, Testing constructions Presentation

2.00pm

Crafty Design Performance Test

Location: Water troughs, near Display & Presentation marquees

Approx 3.00 pm

Presentation Ceremony

Presentations will commence shortly after the completion of the Performance test.

Location: Near Water troughs

SUNDAY 25 NOVEMBER

No activities

*** PLEASE NOTE THAT THIS TIMETABLE IS SUBJECT TO AMENDMENTS.**



Central Highlands Water is committed to environmental education.

They are proud sponsors of the Innovations in Technology category of the RACV Energy Breakthrough and are looking forward to helping provide hands-on learning opportunities for participants again this year.

For more information about our education program, please contact:

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CIRCUIT LENGTHS
 RACV - 1.58 km
 VICROADS - 1.11 km

RACV ENERGY BREAKTHROUGH SITE

- | | | | |
|---------------------|---------------------------|---------------------|-----------------------|
| KEY | Assembly Point | Repair Station | Wrist Banding Station |
| Toilets | Marshall Point & Number | Recharge Station | RACV Stage |
| Showers | Track Direction | Parking Area | VicRoads Stage |
| Camping Area | Start/Finish | On-site Supermarket | Road Closure |
| First Aid | Pushcart Changeover Point | Hospitality Marquee | |
| Food & Refreshments | | | |