KNOX
GRAMMAR
SCHOOL

REGIONAL

DA VINCI DECATHLON 2023

CELEBRATING THE ACADEMIC GIFTS OF STUDENTS IN YEARS 9 & 10

ENGINEERING

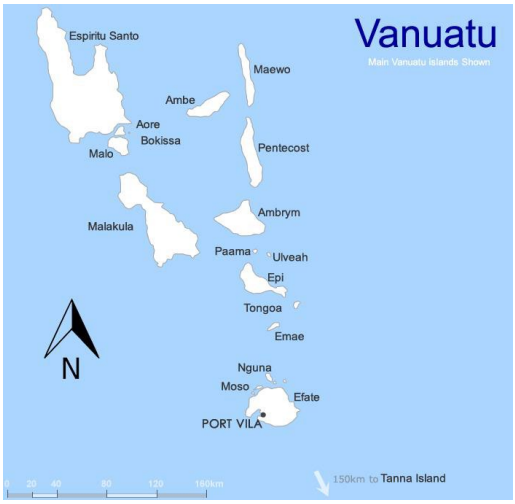
TEAM NUMBER _____

Question Booklet	Design Model	Total	Rank
/20	/30	/50	

CYCLONE CHAOS

A CASE STUDY OF VANUATU

Vanuatu is an archipelago nation east of Australia, located in the Southwestern Pacific Ocean. Home to 300,000 people, Vanuatu is comprised of 65 islands that stretch over 12,189 square kilometres. Despite the beauty and abundance of natural attractions, Vanuatu and its people are often forced to contend with cyclones, that threaten their livelihoods and wellbeing. Many residents have careers in tourism, fishing or farming of products such as copra, cocoa beans, lava and peanuts – all of which are decimated every time a cyclone hits.



After a cyclone, Vanuatu faces three key challenges:

Water Supply

Over 85% of drinking water in Vanuatu is collected locally and stored in rainwater tanks. This is particularly pertinent in rural areas, where access to drinking water relies solely on their water catchment and storage infrastructure, like roofs, guttering, pipes and tanks. When Cyclone Pam devastated Vanuatu in 2015, nearly 70% of water infrastructure was destroyed. Compounding this, natural water sources like ground water were contaminated with debris and bacteria, with the seepage of sewage systems. Engineers must develop new technologies to increase the availability of fresh, potable water after a cyclone in Vanuatu.

Energy Availability

Approximately 70% of Vanuatu's population has access to electricity. After Cyclone Pam, that dropped to 23%. Three quarters of energy in Vanuatu is produced by fossil fuels; coal, oil and gas. While the energy-refining technology itself is robust, it is the transmission systems that are very susceptible to cyclonic damage. In rural areas, residents have turned to solar technology to provide their energy, however, these systems are typically fragile and are therefore at very high risk of

damage. After a cyclone, households have been left using petrol-powered generators for up to 6 months before energy infrastructure is rebuilt. Engineers must develop a solution to provide reliable, environmentally-friendly energy across Vanuatu after a cyclone.

Housing Destruction

In Vanuatu, 43% of housing is classified as “traditional housing”. This refers to local materials being used in construction, like thatch, woven palm, cane, and lightweight timber frames. While other housing is comparatively durable, they remain highly susceptible to cyclonic damage, with walls constructed of timber and roofs of corrugated iron. After Cyclone Pam, 30% of Vanuatu’s residents were left without a home, with local governments left scrambling to shelter families in community spaces, which had been damaged. Engineers must develop new housing technology to quickly and safely provide shelter to residents after a cyclone.

THE TASK

Your task is to design a new technology that will assist Vanuatu's recovery after a cyclone. Your technology must combat on one of the following challenges:

- Water Supply
- Energy Availability
- Housing Infrastructure

Reference the stimulus to determine the key issues associated with your chosen area, and use your creative and technical skills to solve this problem. Originality is key, so be creative!

DESIGN PARAMETERS

You will have **ninety minutes** to design, construct and reflect upon your cyclone recovery technology. Your creation will be marked based on its:

- Ability to solve the challenge you nominated,
- Ability to represent your idea (e.g. if your design involves movement, does your model have moving parts?)
- Creativity and originality,
- Design aesthetics,
- Structural build quality,
- Use of materials.

You will be provided with various materials. It is up to you to decide what materials to use to construct your prototype. The materials available are as follows:

- 6 pieces of A4 paper,
- 2 pieces of A4 cardboard,
- 8 popsicle sticks,
- 8 pipe cleaners,
- 20 match sticks,
- 1 metre of string,
- 100 grams of plasticine,
- Your own sticky tape (use sparingly).

Glue and staples are prohibited and will result in disqualification from the task.

SECTION 1

PRELIMINARY DESIGN

QUESTION 1: THIS MIGHT BE A CHALLENGE... 4 MARKS

Outline which of the three challenges you have chosen to focus on and why. In your answer, describe the key issues that you will be solving.

QUESTION 2: TIME TO THINK 4 MARKS

Describe your design and explain how it combats the key challenges you outlined in the previous question. Refer to specific features of your design that contribute to your solution.

QUESTION 3: DESIGN SKETCH 4 MARKS

Draw a detailed sketch of your technology. Draw with approximate proportions and label key features.

SECTION 2

DESIGN REFLECTION

QUESTION 4: HOLDING UP A MIRROR... (4 MARKS)

Reflect on your designs ability to solve the challenges that you identified. Identify key flaws in your design and propose solutions to these challenges.

QUESTION 5: WHAT ABOUT THE REAL WORLD? (4 MARKS)

Critique your design for its viability in Vanuatu. Consider whether the technology will have a tangible social, environmental and economic impact.

END OF PAPER

MARKING CRITERIA

QUESTION BOOKLET

Question	Skilful	Sound	Limited
Question 1	4	3-2	1
Question 2	4	3-2	1
Question 3	4	3-2	1
Question 4	4	3-2	1
Question 5	4	3-2	1
Total	/20		

PROTOTYPE

Criteria	Skilful	Effective	Sound	Basic	Limited
Ability to solve challenge	5	4	3	2	1
Ability to represent idea	5	4	3	2	1
Creativity and originality	5	4	3	2	1
Design aesthetics	5	4	3	2	1
Structural build quality	5	4	3	2	1
Use of materials	5	4	3	2	1
Total	/30				

TOTAL

/50