



# Engineering Education Scheme Wales

## Cynllun Addysg Peirianeg Cymru

# PROJECT BROCHURE 2018-19

For more information go to [www.stemcymru.org.uk](http://www.stemcymru.org.uk)



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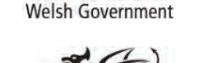
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Engineering Education Scheme Wales is grateful for the EU funds which have supported STEM Cymru II and the National Science Academy support through the Welsh Government.

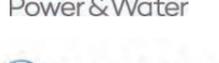
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## Sponsorship of EESW Awards

 **The Big Bang Fair**  
North Wales **Wednesday 27<sup>th</sup> March 2019**

	Best Application of Engineering and Technology		Best Engineering Design
	Best Energy Appreciation		Best Application of Science
	Most Innovative Solution to the Project Set		Project with the Most Commercial Potential
	The Ian Binning Award for the Best Use of Mechanical Engineering Principles		
	Best Application of IT		Best Overall Written Report

 **The Big Bang Fair**  
South Wales **Thursday 11<sup>th</sup> April 2019**

	Most Innovative or Adapted Design		The Professor Philip Morgan Award for the Best Application of Science
	Best Overall Team Performance		Most Innovative Application of an Existing Technology
	Best Chemical/Process Engineering Design		Best Energy Appreciation
	Best Application of Engineering and Technology		Best Working Model or Prototype
	Best Appreciation of Safety Issues		Best Use of Mechanical Engineering Principles
	Most Effective Presentation of the Chosen Solution		Most Innovative Solution to the Project Set
	Best Engineering Design/Exhibit		Best Overall Written Report

## Our Sponsors and Partners







   
The Big Bang Fair North Wales/Gogledd Cymru South Wales / De Cymru













   
Cronfa Gymdeithasol Ewrop  
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# Engineering Education Scheme Wales

We welcome you to the annual EESW Awards and Presentation Day at the Big Bang Near Me Fairs. Our events have become some of the biggest STEM events in Wales and are designed to celebrate the success of our students engaging with the EESW sixth form project.

We are very pleased to be holding the Big Bang North Wales in Venue Cymru, Llandudno once again. The South Wales event is being held at MoD St Athan for the first time and we are very grateful to Wing Commander Stephen Rowley and his staff for allowing us to use the facilities and for all their help in preparing for the event. As part of the Big Bang competition, teams attending our events will be selected to represent Wales at The UK National Big Bang Fair in March 2020.

The EESW 6<sup>th</sup> Form Project encourages young people to consider engineering as a career. Professional engineers from link companies have worked with teams of Year 12 students and their teacher for six months on a real engineering problem. Since the project has been approved by the WJEC to satisfy the Enterprise and Employability Challenge of the Welsh Baccalaureate we have seen an increase in the numbers taking part. Students are also able to gain a Gold CREST Award whilst developing a range of skills through participation in the scheme.

We have invited students and visitors to attend these final events which will feature the students' work as well as a range of industry exhibitions and activities to raise awareness of the wonderful world of STEM.

Following the success of the STEM Cymru Project, we were pleased to have once more received funding from the European Social Fund through the Welsh Government to operate in the North, West Wales and the Valleys region. We also receive funding from the Welsh Government to undertake activities in other areas of Wales.

We are delighted that many organisations have kindly sponsored a variety of awards again this year. We gratefully acknowledge the support of all the companies and sponsors shown on the following pages and the engineers involved with the scheme. We would also like to thank the schools and teachers for continuing their partnership with us and the Welsh universities and colleges for their help in hosting the welcome events and workshops to facilitate the scheme.

**Finally, congratulations to all students who have participated this year and good luck for the future.**



**Robert Cater**

**EESW CEO**

# EESW Teams 2018-19

## Big Bang North Wales

Wednesday 27<sup>th</sup> March 2019 – Venue Cymru, Llandudno

<b>Team</b>	<b>School/College</b>	<b>Company</b>	<b>Page</b>
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4	Ysgol Dyffryn Conwy 1	TATA Steel, Shotton	2
5	Ysgol Dyffryn Conwy 2	Airbus UK, Broughton	3
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<b>Denbighshire</b>			
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## Big Bang South Wales

Thursday 11<sup>th</sup> April 2019 – MOD St Athan, Barry

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-	Cardiff Sixth Form College 1	Network Rail	17
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20	St John's College	Newport Waferfab	22
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22	Whitchurch High School 1	GE Aviation	23
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<b>Team</b>	<b>School/College</b>	<b>Company</b>	<b>Page</b>
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30	Ysgol Dyffryn Taf	Whitland Engineering	27
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## Team 9

### **Prestatyn High School & WSP UK**

#### ***Reducing CO2 Emissions from Concrete***

Team: Abigail Armstrong  
Rebekah Fell-Crook  
Benjamin Garbutt  
Meryn Lloyd-Thomas  
Alicia Quinn  
Liam Thomas  
Olivia Williams

Teacher: Dr Penny North

Engineer: Mike Wellington

WSP is a global engineering company with over 60 offices in UK with the office in Wrexham North Wales. They mainly focus on civil engineering projects, providing built environment and infrastructure consultancy.

Concrete is the single most widely used material in the world. It is used in such large amounts as it is such a reliable building material, evidenced by the fact that Roman concrete over 2,000 years old is still standing today.

However, the production, transportation and curing of concrete produces a huge amount of carbon dioxide, which is a harmful greenhouse gas, contributing to climate change and other anthropogenic effects on the environment.

Discuss the use of concrete in built environments. Can the chemical composition be altered so that it produces less CO<sub>2</sub>? Look for innovative ways to alter either the components used to produce concrete or alternatively the way in which concrete is used. Explore options at all stages of the process.

The solution may be theoretical, or a model or prototype. Making and testing concrete in the lab may be an option to discuss different compositions and tensile strengths.

## Team 10

### **Ysgol Glan Clwyd & Innogy Renewables UK**

#### ***Self Retractable Landline***

Team: Owain Fisher  
Alex Jones  
Deiniol Jones  
Jacob Jones  
Lydia Jones  
Owain Jones  
Trystan Roberts  
Dylan Sandland

Teacher: David Williams

Engineer: John Porter, Nathan Jones  
& Robert Thomas

Each turbine has an SRL (Self Retractable Lifeline) attached to a rope, which is then tied to the transition piece ladder, which allows us to pull down the SRL clip-on-point down. Sometimes the rope becomes damaged or breaks and needs replacing.

The problem is with tidal access to the lower portions of the ladder. We must wait until the tide is at its lowest point to be able to get down and replace the rope. The rope will have to be refitted later if fitted high upon first installation.

As well as the issue of not being able to fit the rope down low enough, the job is carried out at close proximity to the sea whilst located on the ladder.

Design a new method and tool(s) which:

- Enables us to secure the rope, to ladder, at the lowest point, in any tide
- Enables us to work whilst remaining on the boat
- Is both light and portable
- Enables us to tether any tools or equipment used to our harness (Must be self-detaching in the event of an emergency).

# North Wales

## Conwy

### Team 1

#### Ysgol Bryn Elian 1 & Knitmesh

*Accurately calculate the number of units running through the production line*

Team: Caitlin Cope  
Chloe Gough  
Emily Rogers  
Josh Swan

Teacher: Neil Humphreys

Engineer: Peter Evans & Aled Williams

KnitMesh started life over 80 years ago in the non-automotive sector and in that time a huge range of products have been developed for a countless number of applications in virtually every industry sector.

The properties of knitted mesh are virtually infinite, and our team of engineers and manufacturing specialists are well versed in the design and development of bespoke solutions for customers who are often market leaders in their own sectors.

Accurately calculate the number of units running through the production line.

### Team 2

#### Ysgol Bryn Elian 2 & Warwick Chemicals - Lubrizol

*Vacuum Plate Drier Gearbox Replacement*

Team: Owen Fordham  
Zack Hayward  
Finley Hoysted  
Ioshan Nelson  
Hari Vincent

Teacher: Neil Humphreys

Engineer: Kevin Hirst & Mark Davies

Warwick Chemicals is based at Mostyn on the North Wales coast. When removing and reinstalling the dryer gearboxes we come across several problems that make it difficult to carry out the job safely. Access of the job is one of the leading problems that we face. The area in which the gearbox is situated is confined due to pipework, steel beams and other pieces of equipment, this gives us less space to carry out the job which makes the manoeuvring awkward and makes it more difficult for us as we can't use the required amount of manpower.

Overall the weight of the mounting table, gearbox and motor is approximately 750kg. With the gearbox being offset it creates an unbalanced lift and again, makes it awkward to manoeuvre and secure the equipment into position.

We need a solution to overcome the problems we face and reduce the downtime of the plant as it has an impact on site's manufacturing capacity.

We would like a number of options to solve the problem we have allowing the safest and most cost-effective option to be implemented.

## Team 3

### **Ysgol Bryn Elian 3 & Mott MacDonald Bentley**

#### ***Effective and Efficient Mixing of Chemicals for Wastewater Treatment Process***

Team: Natasha Berry  
Jack Frost  
Oliver Marshall  
Chris Thomas

Teacher: Neil Humphreys

Engineer: Prithula Choudhury, Prys Roberts  
& Evan Lewis

The work which MMB get involved with varies from inspection contracts to multi-million pound schemes on major water treatment works. The business has been working in Dwr Cymru for over 4 years and has been commended for its performance. The work involves sites across Wales which span the engineering disciplines of Process, Civil, Mechanical and Electrical Engineering.

To protect the environment there is a minimum quality standard that the final effluent from a waste water treatment works must achieve. There are numerous processes to achieve this, including adding chemicals enabling more of the solids to be removed. To ensure that the chemical is used to its full potential, it must be mixed effectively with the flow through the treatment works. It is also important that the correct amount of chemical is used to make the process as economical as possible.

Design an effective and efficient method of mixing a chemical with the flow through a treatment works. It must be able to adjust the amount of chemical added depending on the level of flow, which then must be mixed thoroughly.

## Team 4

### **Ysgol Dyffryn Conwy 1 & TATA Steel, Shotton**

#### ***Replacement of isolation handles within electrical control panels***

Team: Caspian Sunerton-Burl  
Llyr Cawley  
Carwyn Evans  
Cieran Kelly  
Rocklyn Dalton O' Shea  
Sam Roberts

Teacher: Penri Jones & Llio Japheth

Engineer: Julie Baddock

The majority of the machinery on site is timeworn and, in some cases, has become obsolete. This subsequently makes it difficult for us, as parts then also become unavailable, giving the dilemma of either going to a new supplier and hoping their product fits or looking at the option of getting in new machinery. The latter option is not very cost effective as the budgets do not always allow for new equipment.

The biggest issue for us is the replacement of isolation handles within electrical control panels and on the lines.

Research a manufacturing method/technique to produce the isolation handles, considering the cost efficiency and benefits as to why the chosen method should be taken on by us. Produce a prototype which will be eventually be tested on site after the completion of the challenge. You are allowed to come up with any idea/solution so long as you justify your decisions for doing so.

There are no limitations as to what materials you use to produce the prototype and it would be great if your chosen solution is capable of producing various other obsolete pieces of equipment or more intricate parts.

## Team 5

### **Ysgol Dyffryn Conwy 2 & Airbus UK, Broughton**

#### *Develop and validate a local leak system*

Team: Dylan Coleman  
Catrin Elenid Dafydd  
Kerry Ann Ellis  
Kenneth Hewitt  
Lewis Jones

Teacher: Llio Japheth & Penri Jones

Engineer: Richard Williams

Broughton – located in North Wales – has a proud tradition of aerospace manufacturing going back three-quarters of a century. Nowadays, the site assembles wings for the entire family of Airbus commercial aircraft.

The aim of the project is to develop and validate a local leak system which would mean that the retest would be done quickly and easily on the track can area preventing delays in production.

The main objectives of the project are as follows:

- Create a new tool/system enabling local helium tests of track can.
- Eliminate the need to carry out a full helium tank retest reducing time and cost.
- Develop prototype unit(s) and validate functional characteristics through tests
- Analyse results and make recommendations based on performance costs and benefits

The following considerations should be made when designing the tool/system:

- Safety (size, weight, ergonomics, trap hazards etc.)
- Material selection (i.e. reusability, cost, durability/repairability, access etc.)
- Time to set-up, ease of use and accuracy.

## Team 6

### **Ysgol Eirias & Bangor University**

#### *Authenticating Student Attendance*

Team: Matthew Browne  
Dominic Frank  
Daniel Hughes  
Luke Palethorpe  
Isaac Wetton

Teacher: Mike Hodges

Engineer: Dave Perkins & Cameron Gray

Bangor University has implemented a system similar to that provided by Ysgol Eirias students in the past where students will swipe their RFID badges at the start of a lecture.

Unfortunately an unforeseen problem has arisen. Students have now become aware that they are able to get another classmate to swipe their card while remaining in bed or doing anything other than going to lectures. The University needs a solution to this problem, mainly to monitor student obligations.

Some students are required to attend a minimum level to retain funding and others are required to attend as a condition of their travel visas. We are unable to unfairly discriminate against these groups by singling them out for special treatment so a solution must apply to all students.

With anything up to 150 students participating in a session, the process needs to be mainly automatic and has to be quick.

# Denbighshire

## Team 7

**Denbigh High School  
& Airbus UK, Broughton**

*Design and manufacture a collapsible workbench which can store the necessary tools for the airbus engineers*

Team: Scott Bradford  
Joshua Hall  
Harri Jones  
Will Roberts  
Harri Taylor  
Nathan Williams  
Huw Wisby

Teacher: Gareth Jones

Engineer: Richard Williams, Adam Horabin  
& Andrew Taylor

Airbus SE, from 2000 to 2014 known as the European Aeronautic Defence and Space Company (EADS), is a European aerospace corporation, registered in the Netherlands and trading shares in France, Germany and Spain. It designs, manufactures and sells civil and military aerospace products worldwide and manufactures in the European Union and various other countries. The company has three divisions: Commercial Aircraft, Defence and Space, and Helicopters, the third being the largest in its industry in terms of revenues and turbine helicopter deliveries.

Airbus engineers work from a specific toolbox which stores specific tools depending on which job is required. The tool box is put on the floor while they work which means repeated bending down to get the necessary tools for the job, therefore they need a workbench which could be raised or lowered to different heights. There are already have some workbenches but they are big and take up a lot of space.

## Team 8

**Myddelton College  
& TATA Steel, Shotton**

*Implementing modern day technology to increase efficiency and productivity*

Team: Lucid Dong  
Albert Gao  
Cici Gong  
Ieuan Griffiths  
Leon Hodgson  
Ben Jia  
Megan Lloyd-Williams

Teacher: Paul Greene

Engineer: Julie Baddock

Steel has been processed on the Tata Steel site at Shotton in North Wales for more than 120 years. The plant produces a wide range of galvanised and pre-finished (painted) steel building systems using steel coil supplied from integrated steelmaking site at Port Talbot.

On the Production lines at Tata Steel, Shotton many parts are used that require replacement on a regular basis. Reasons for this include wear and tear which leads to an item or piece of machinery becoming obsolete.

This has a knock-on effect on departmental budget, forcing engineers to carry out maintenance and repairs where it would be simpler to replace.

## Team 9

### Prestatyn High School & WSP UK

#### *Reducing CO2 Emissions from Concrete*

Team: Abigail Armstrong  
Rebekah Fell-Crook  
Benjamin Garbutt  
Meryn Lloyd-Thomas  
Alicia Quinn  
Liam Thomas  
Olivia Williams

Teacher: Dr Penny North

Engineer: Mike Wellington

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## Team 10

### Ysgol Glan Clwyd & Innogy Renewables UK

#### *Self Retractable Ladder*

Team: Owain Fisher  
Alex Jones  
Deiniol Jones  
Jacob Jones  
Lydia Jones  
Owain Jones  
Trystan Roberts  
Dylan Sandland

Teacher: David Williams

Engineer: John Porter, Nathan Jones  
& Robert Thomas

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# Flintshire

## Team 11

### Alun School 1 & JCB Transmissions, Wrexham

#### *Demo Vehicle to Convey Steering Modes*

Team: Nerys Davies  
Sam Jackson  
Ruairi Leonard  
Ashleigh Roberts  
Adam Wilding  
Tyler Wilkes  
Jonathan Williams

Teacher: Alison McLellan

Engineer: Julie Jones, Dan Penlington,  
Alfie Beeson & Tomas Davies

JCB employs around 11,000 people across the world and has an annual revenue of around £2.75 billion. Although based in England, JCB is an international company selling products all across the world. Locally JCB has a manufacturing plant in Wrexham which specialises in creating transmission systems for many of the Company's products. Many JCB sites attend events in their area to help spread information and guidance not only about JCB products| but to youth who are looking for information to go into engineering.

For these events JCB has many activities to engage visitors such as assembling parts or putting together toy tractors. The current activities don't accurately show how JCB vehicles handle or operate. Some products in JCB's line - such as the Loadall - have the ability to use a few different modes of steering to allow them to navigate in many different situations.

The task is to design and create a remote-controlled vehicle which can demonstrate these various types of steering modes as an example for how the real Loadalls work. The vehicle should be able to demonstrate the 3 different steering types shown by the JCB Loadall and be portable to be easily transported between events.

## Team 12

### Alun School 2 & UPM Shotton

#### *Paper Mill Couch Roll Cleaning System*

Team: Sam Albiston  
Ellen Casey  
Will Casey  
Lucy Day  
Dylan Hanson  
Matthew James

Teacher: Neil McBain

Engineer: Gez Williams, Jan Ellis & David Clancy

UPM Biofore at Deeside produce paper for newsprint using predominantly recycled materials.

The suction roll plays a vital role in the paper making process, removing vast quantities of water from the paper sheet.

Find a solution which will enable the mill's Couch Suction Roll to be continuously cleaned to prevent the build-up of pulp in the roll holes and contamination the process.

The Couch Roll Cleaning solution must ensure that the holes remain open and clear preventing the need for mill shutdowns to clean out the suction roll.

The design must ensure the process is safe to people and the rolling process. It must also be efficient, environmentally friendly, and not to impact negatively on the quality of the paper being produced. This may include watermarks and air holes.

## Team 13

### **Coleg Cambria, Bersham Road & Raytheon UK**

#### ***Aircraft Cockpit Sun Visor electronic equipment (Tablet/Smart Phone) Cradle***

Team: Tyler Armstrong  
Matthew Edwards  
Nicholas Harding  
Adele Hughes  
Ffion Parry

Teacher: Chris Garston, Adele Hughes  
& Carol Francis

Engineer: Laurence Baron

Raytheon UK is a prime contractor and major supplier to the UK Ministry of Defence and have developed strong capabilities in mission systems integration in Defence, National & Cyber security and commercial markets.

Aircraft Special Missions such as Search and Rescue require pilots to have access to mission data and to monitor what the mission crew are seeing.

Design a stowable removable cradle for electronic items such as a tablet or large smart phone that can be mounted onto or near to or instead of, an existing pilot sun visor. Power and data connections to be accommodated as well. Electronic items and the mount itself should be easily removed or adjusted without the need for tools. Materials choice, strength and structural loads to be a consideration.

- Establish all requirements prior to scheme commencement. Consider health and safety as well as functional requirements.
- Schemes to be produced, assessed and down selected to a preferred solution.
- Record rationale for all down selection decisions.

## Team 14

### **Ysgol Maes Garmon & Toyota UK, Deeside Engine Plant**

#### ***Grey Water Re-use***

Team: Gareth Edwards  
Owain Tomos Jones  
Morgan Owen Roberts

Teacher: Adrian Evans & Iwan Williams

Engineer: Yian Baty & Phil Lancelotte

Toyota has two manufacturing plants in the UK representing a total investment of £2.1billion, and the company currently employs 3800 members.

The vehicle plant in Derbyshire manufactures the Corolla and get most of its engines from the unit plant in Deeside. This plant also provides engines to South Africa, Japan and Turkey, and engine parts are also sent to Brazil.

Toyota is challenged globally within the company to reduce their environmental impact; they do this through a process of kaizen, information sharing and auditing. They look at new technologies as well as existing solutions to try to reduce their CO<sub>2</sub>, water and power usage, and also to reduce their waste.

The task is to reduce the amount of water that the site uses and to potentially re-use their water waste.

They initially want to look at re-using water from their sinks as a prototype and see if the solution can be scaled up to improve water usage across the site.

# Gwynedd

## Team 15

### Coleg Meirion Dwyfor, Dolgellau 1 & Magnox

#### *Interactive Display Unit*

Team: Adam Alexander Mowatt  
Jack Robinson  
Tomos Rhys Williams

Teacher: Marius Jones

Engineer: Graham Nutt

Magnox is the management and operations contractor responsible for managing twelve nuclear sites and one hydroelectric plant in the UK, working for the sites' owner, the Nuclear Decommissioning Authority (NDA).

Magnox are required to attend several events throughout the calendar year which are aimed at young people to encourage them to consider a career in STEM.

To engage the attention of students across the 9-18 age range, an interactive display stand is required.

Create a new interactive activity that can be used on a repeat basis by Magnox staff at STEM events. The activity must include the following elements:

- A table top
- To be used by between 1 and 4 individuals
- Have a timed element where repetition of the activity can improve the outcome
- Not require replenishment apart from items such as water, batteries and bulbs etc
- Boxed for easy storage and transportation
- Include laminated instruction sheets for use by either the students or staff.

## Team 16

### Coleg Meirion Dwyfor, Dolgellau 2 & Magnox

#### *Interactive Display Unit*

Team: Owain Sion Cunnington  
Jamie Hills  
Ffion Katie Jones  
Jay Porter

Teacher: Marius Jones

Engineer: Graham Nutt

Magnox is the management and operations contractor responsible for managing twelve nuclear sites and one hydroelectric plant in the UK, working for the sites' owner, the Nuclear Decommissioning Authority (NDA).

Magnox are required to attend several events throughout the calendar year which are aimed at young people to encourage them to consider a career in STEM.

To engage the attention of students across the 9-18 age range, an interactive display stand is required.

Create a new interactive activity that can be used on a repeat basis by Magnox staff at STEM events. The activity must include the following elements:

- A table top
- To be used by between 1 and 4 individuals
- Have a timed element where repetition of the activity can improve the outcome
- Not require replenishment apart from items such as water, batteries and bulbs etc
- Boxed for easy storage and transportation
- Include laminated instruction sheets for use by either the students or staff.

# Isle of Anglesey

## Team 17

### Ysgol David Hughes 1 & Dŵr Cymru Welsh Water

*Water turbine which allows Welsh Water to be more energy efficient*

Team: Eve Brookes  
Jamie-Anne Davey  
Llinos Joannou  
Seren Jones  
Eleanor Lomax  
Courtney Reid  
Ceri Robinson  
Lauren Williams

Teacher: Dion Roberts

Engineer: Stephne Puddy, Andrew Dixon  
& Ben Burggraaf

The UK energy market has dramatically changed in the last 5 years, transitioning to a low carbon electricity market. As a large energy user, Welsh Water has the ambition to become energy neutral by 2050, meaning energy consumption is equal to the energy generated by the company. Energy use is fully dependant on how much water our customers are using.

Look at a typical day of a Welsh Water customer and calculate how much water on average customers will use in 2050. Design the following plants considering the most optimal water cycle from an energy efficiency point of view:

- A drinking water treatment plant that doesn't use power from the electricity grid
- A sewage treatment process plant that doesn't use power from the electricity grid
- A pumping station that transports drinking water in the most energy efficient way to customers
- A pumping station that transports sewage from customers' homes to waste water treatment plants.

## Team 18

### Ysgol David Hughes 2 & Dŵr Cymru Welsh Water

*Developing the efficiency of Welsh Water's pipeline*

Team: William Fitzpatrick  
Ioan Hughes  
Lydia Jones  
Elin Roberts  
Mari Rogers Jones  
Jay Thomas Nesbitt  
Sion Williamson

Teacher: Dion Roberts

Engineer: Stephne Puddy, Andrew Dixon  
& Ben Burggraaf

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- A pumping station that transports sewage from customers' homes to waste water treatment plants.

## Team 19

### Ysgol Gyfun Llangefni & WSP UK

#### *Reducing Carbon Footprint in Construction*

Team: Huw Evans  
Rhys Jones  
Thomas Lindley  
Elin Pierce  
Elin Williams

Teacher: Zoe Jones

Engineer: Rhys Evans

From our local beginnings over 130 years ago to our vast international presence today, WSP has enjoyed continuous growth and enrichment of its service offering. Every milestone reached has enabled us to better fulfil our purpose of preparing our communities and environment for the future.

Produce a report outlining the areas of highway design and construction that typically produce high amounts of CO<sub>2</sub>, by analysing the Carbon Baseline Report of a similar scheme along with their own independent research. Students should pay particular interest to the design and construction of any bridges this will include all aspects of design and construction and should feature prominently in the report.

In addition to researching the areas of high CO<sub>2</sub> production, students should research methods to mitigate this and analyse their effectiveness and provide a final suggestion for each area of concern.

Investigate and assess different bridge construction methods and materials. They should produce a model of their final design choice to assist them in demonstrating the advantages, in terms of reduced carbon production, of their chosen bridge design.

## Team 20

### Ysgol Uwchradd Bodedern & Holyhead Marine Services

#### *Engine Cooling Monitoring System*

Team: Anya Jones  
Sian Owen  
Louise Thomas

Teacher: Eurwyn Hughes

Engineer: Nick York & Dan Firth

Holyhead Marine is a commercial boat yard building and repairing boats up to 30m for the Company commercial and governmental customers both in the UK and abroad.

We have a problem with engine overheating in very hot jungle environments. We need to design and build a system that can control the temperature of the engines cooling water to simulate jungle environments allowing us to run tests to find the maximum allowable water temperature our boat can operate in.

Given a dyno, engine and shipping container, design a dynamometer rig which allows the temperature of the engine cooling water to be controlled incrementally from ambient temperature up to 40 degrees to simulate a jungle environment. The engine must be run for at least 10 minutes at a given temperature. The setup must be safe to use and survive for a few days in a harsh salt water environment.

The rig will be built on the harbour wall close enough to use the sea for raw water supply, power can be supplied at 240V or 115V, and fresh water can be supplied from mains at normal mains pressure.

## Wrexham

### Team 21

#### **Ysgol Uwchradd Caergybi & BAE Systems & Babcock International**

##### ***Plastic Waste Removal from Anglesey Shoreline***

Team: Sarah Goodsir  
Casey Hughes  
Sam Jenkins  
Anna Jones  
Laura Strydhorst  
Adam Vallely

Teacher: Coran Jones

Engineer: June Strydhorst, Richard Warburton  
& Matt Wheeler

Since the 1950s RAF Valley has seen numerous variants of training and visiting aircraft utilise the facilities and surrounding landscapes to prepare military pilots for operational squadron duties around the country. RAF Valley takes their relationship with the community and the environment seriously and continually looks to contribute towards local causes and projects.

An estimated 12.7 million tonnes of plastic, everything from plastic bottles and bags to microbeads, end up in our oceans each year. Big pieces of plastic are choking, entangling and clogging the stomachs of sea creatures.

Design a product that will identify and collect waste plastics from the seashore around RAF Valley. The design should be able to collect waste with minimal disturbance to the shoreline and be able to distribute collected waste into a collection point. Key elements of this project will be identification of the scale of the problem of plastic pollution around Anglesey, natural trending of areas the waste plastic accumulates and potential distribution streams for collected waste to be recovered.

### Team 22

#### **Ysgol Morgan Llwyd & JCB Transmissions, Wrexham**

##### ***JCB 3CX Assembly Model***

Team: Aled Boardman  
Jack Byrne  
Keane Fenlon  
Jack Humphreys  
Oliver Jones  
Ifan Owen  
Joe Pritchard

Teacher: Dylan Davies & Aled Hughes

Engineer: Julie Jones, Cameron Pemberton  
& Dan Penlington

JCB is a company that creates transmission shafts based on Wrexham Industrial Estate.

JCB Transmissions attend a number of events in the local area in which they advertise their apprenticeship and undergraduate schemes. One activity that JCB has had on the stand for several years is a model of JCB that has been built as a timed-time trial. The models have been well used and have become a little worn and tired.

Design and manufacture a new JCB 3CX model for JCB for use at these events.

These models need to be included in multiple sections that can be easily constructed by all age groups (no more than 10 parts). They will need to be made of relatively strong material as they will be reconstituted at once. The model must also be of a suitable size to be easily transported into a car boot, however, large enough for a team of people to build it immediately. It should also be kept in a 50cm x 40cm x 40cm box.

## South Wales

### Blaenau Gwent

#### Team 1

**Coleg Gwent – Blaenau Gwent  
Learning Zone  
& Northern Automotive Systems**

##### *Clipping and Inspection*

Team: Hannah James  
Melissa May  
James Murphy  
Kian O'Connell  
Ethan Pascoe  
Jacob John Perry  
Regan Skilton  
Stephen White

Teacher: Shaun Andrews

Engineer: Scott Lloyd & Dean Michael

Northern Automotive Systems is an automotive Tier 1 supplier situated in Gilwern, Abergavenny, a world leader in the manufacture and supply of decorative aluminium trim for the automotive industry.

NAS have an issue with adding clips to parts and the inspection of them. Our clipping machines are causing an issue with the process, they are not very user friendly or productive causing a bottle neck. We often have to run customer concessions to clip by hand which causes a problem with manual inspection, running the risk of sending a part unclipped to our customer. We have now incorporated the inspection in a vision system for some parts but still feel we can achieve a more efficient and cost-effective process for clipping.

Improve current process of applying and inspecting clips ensuring the customer requirements are still met. Look to reduce production cost through cycle time, labour costs and eliminating non-value added operations.

Customer requirements - Clips are fitted correctly, Clips and features are inspected, Bar code label is attached.

## Bridgend

#### Team 2

**Brynteg School  
& SAS International**

##### *WEBS - Waste Energy Battery System*

Team: Inyoung Baek  
Elinor Cornish  
Jonathan Loo  
Dylan Pritchard  
Megan Lambert

Teacher: Jon Catton

Engineer: David Edwards, Catherine Griffin  
& Geraint Lewis

SAS International is a market leading, internationally operative British manufacturer of interior building products. On-going investment in modern manufacturing facilities and processes ensures we provide value-engineered solutions across the built environment.

Design a tile that can transfer sound and vibrational energy into energy that can be stored into a battery and charge devices such as phones. This could be done using piezoelectric transducers.

## Team 3

### Coleg Cymunedol Y Dderwen & Zimmer Biomet

#### *The Eye (Stem Positioning System)*

Team: Ioan Davies  
Leon Davies  
Bethan Dubber  
Ben Morgan  
Joshua Sadd  
Jacob Smart

Teacher: Sarah Thomas

Engineer: Lloyd Dewar & Sian Williams

Our state-of-the art engineering processes and our commitment to innovation in the design and manufacture of orthopaedic implants have provided the basis for our long-standing relationships with hospitals. With a manufacturing site in the UK, we are able to deliver high quality orthopaedic products in UK and around the globe.

Currently development product batches are generated and produced outside of the ERP systems that controls the manufacturing lots. These batches are therefore controlled within a paper-based system that when released to the shopfloor does not allow for easy tracking and location.

Every week approx 1,600 new manufacturing product batches are launched to the 10,000sqm shopfloor, therefore locating development batches is a manual and time-consuming task.

Create a low-cost system to automatically trace the physical location of product development batches within the manufacturing shop floor. Each batch has to be uniquely identifiable and has to be located from a central planning office.

## Team 4

### Cynffig Comprehensive School & Zimmer Biomet

#### *Develop an effective and efficient method of masking Hip stems for Plasma porous coating*

Team: Emily Davies  
Leah Evans  
Britney Griffiths  
Jacob Hesketh  
Ryan Legg  
Charlotte Roberts  
Lowri Thomas

Teacher: Richard Daniel & Daniel Morrish

Engineer: Daran Griffiths

Founded in 1927 with headquarters in Warsaw, Indiana, USA, Zimmer Biomet is a global leader in musculoskeletal healthcare.

Hip stems are one other key products manufactured within the Bridgend site. Our cementless stems require porous plasma spray on well defined regions of the implant. Since it is a line of sight process, areas of the stem not to be coated must be masked. Currently this is a manual taping process which is inefficient and labour intensive.

Develop a new masking process which is quicker and more efficient than the current method.:

- Using acceptable materials for applications within human implants.
- Resistant to exposure to elevated temperatures (300c),
- Maintain well defined edges between coated and non-coated regions.
- Easily removed post coating.
- Preferably re-usable.

# Caerphilly

## Team 5

### Bedwas School & Eastman Chemical Company

#### *Production of Brine Water*

Team: Rhys Bartlett  
Joshua Davies  
Jack Lambert  
Liam Stone  
Ellis Walters  
Niall Young

Teacher: Mark Powell

Engineer: Sean Smith, Daniel Madden  
& Lauren Davies

At Newport, Eastman manufactures several products including Saflex, an Ester interlayer used in laminated glazing and photovoltaic module encapsulation, and Therminol, a heat transfer fluid.

Demineralised water plays an important role in many chemical processes worldwide. Water is demineralised so that it is absent of any solids and minerals. To produce demineralised water, brine water can be used as a feed. The brine removes organics.

Currently, we create brine by manually adding salt to water in a hotwell tank. This is transferred to a measuring tank before being processed by the Demin (Demineralised) plant.

The hotwell tank is very old and has suffered from heavy corrosion over the years of its usage. Therefore, Eastman requires an engineering solution that will allow us to continue brine water production.

Identify a range of plausible solutions to the problem. Research each solution to determine their advantages and disadvantages. Determine which solution to put forward using both qualitative and quantitative justification, with the consideration of safety, cost and environmental impact.

## Team 6

### Coleg y Cymoedd, Ystrad Mynach & BBC Wales

#### *Audio - Skype Switch Box for the BBC*

Team: Kian Batt  
Dylan Bishop  
Kieran Cooke  
Josh Hardcastle  
Rhys Jones  
Callum Morgan  
Edvinas Vitkus

Teacher: Philip Jones

Mentor: Rebecca Webber

Engineer: David Williams & Fintan McNamara

Broadcasting House is the purpose-built headquarters for BBC Cymru Wales' radio, television and online services, situated in north Cardiff. The building opened in 1966 and consists of three blocks housing studios, offices and technical facilities.

The building houses the national broadcaster for Wales, providing a range of English and Welsh language content for audiences across Wales on television, radio and online.

BBC Wales are currently not able to switch a Skype call into the Studio.

Design a product to allow a recipient to call in and be transferred on air via the Skype for Business application. The call must be controlled via the Skype based telephone interface that will allow the caller to ring in, be put on hold accordingly before being prepped to be put on air with the BBC.

## Team 7

### Heolddu Comprehensive School & University of South Wales

*Design a platform to support disaster relief personnel with their operations*

Team: Nia Clarke  
Thomas Clifford  
Joel Dando  
Holly Horton  
leaun Jones  
Joshua Pascoe  
Isobel Taylor  
Ross Williams-Griffiths

Teacher: Leah Brinkworth

Engineer: Paul Davies & Lee Park

At the University of South Wales, it's all about being bold, independent and fulfilling your potential. We have campuses located in Cardiff, Newport, Pontypridd and Dubai — with 95% of our graduates in work or study within six months of graduation (DLHE 2016/17).

The use of drones for humanitarian work is not limited to search and rescue missions but includes mapping of affected areas, delivery of aid materials, damage assessments, and strategizing of post-emergency and reconstruction projects.

Recently, in a study conducted by FSD on Drones in Humanitarian Aid, it was found that more than 60% of humanitarian professionals believe that drones, along with the use of GIS allow a bird's eye view for undertaking systematic assessments and monitoring.

The most pressing issue with today's drones is flight endurance. Find a solution to the short flight times so that humanitarian relief can be 24/7 without the need for re-fuelling gaps. You do not need to limit your solution to that of a drone.

## Team 8

### Lewis Girls' School & University of South Wales

*Display Hangar*

Team: Maddison Cox  
Ashleigh Davies  
Sophie Nelder  
Rachel Opie  
Thakshanaa Pathmasri  
Sophie Stenner

Teacher: Steve Pole

Engineer: Paul Davies, Bethan Llewellyn  
& Emma Jane Mantle

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USW has a B A Jetstream 41 that needs displaying to attract attention.

Design an Aircraft Hangar for the Treforest site. Designs should include:

- Contemporary design;
- Lighting considerations;
- Temperature & Heating;
- Construction & the Environment.

# Cardiff

## Team 9

**Bishop of Llandaff CIW High School  
& Cardiff University, School of  
Computer Science and Informatics**

### *Engagement Monitoring at Careers Fairs*

Team: Ioan Evans  
Ethan John  
Min Sol Lee  
Kadmiel McForrester  
Violet Munro  
Owen Putter  
Lewis Saunders  
Karim Selih

Teacher: Ben Hughes

Mentors: Luke Goodbody  
Lewis John

Engineer: Matthew Turner & Catherine Teehan

At Cardiff University, we host numerous careers fairs and events but often struggle to accurately measure student engagement during these events. We are looking for a solution using sensors to accurately measure how long a person is engaging with a stand at a careers fair.

Although we can collect names at each stand, we are keen to see what attracts a student to engage with a stand and how long on average they spend at each stand. We would also like to know how many students are waking by a stand without engaging compared to how many actually stop and engage. We would like to be able to advise companies on how to best set up their stands to encourage students to engage.

We envisage a solution that utilises strategically placed sensors and cameras to measure the footfall conversion rate and uses data analysis and data visualisation to inform employers.

## Team 10

**Cardiff and Vale College 1  
& Arup**

### *A LZC (Low & Zero Carbon) investigation for an art gallery refurbishment*

Team: Marc Cassar  
Modou Jobe  
Callum Langley  
Louis Lock  
Niall Routledge

Teacher: Marc Tothill

Engineer: David Emm

Arup Cardiff is based in Pierhead Street in Cardiff Bay and has over 350 employees ranging from civil & structural engineers to ecology consultants and scientists. Some of the notable projects worked on in Arup Cardiff are BBC Headquarters, A465 Heads of the Valleys, Admiral Building Cardiff & Haydn Ellis Building Cardiff University.

The challenge is to conduct a LZC study on the refurbishment of an art gallery. With sustainability and low carbon solutions a priority for any new building there is a growing demand for cutting-edge technologies aimed at reducing building energy consumption and reliance on traditional fossil fuels. Conduct a LZC study keeping in mind the 3 Rs of Sustainability: Reduce, Recycle & Reuse.

You should:

1. Identify novel & new technologies available to reduce the buildings energy demands.
2. Identify a single technology best suited for further study and testing.
3. Explore the implementation of that technology and the possible restraints regarding cost/construction.

## Team 11

### Cardiff and Vale College 2 & Arup

#### *A LZC (Low & Zero Carbon) investigation for an art gallery refurbishment*

Team: Mohammed Jonaid Basit  
Alex Deverson  
Mohammad Hussain  
Mohammed Jonaid Khan

Teacher: Ceri Hill

Engineer: David Emm

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### Cardiff Sixth Form College 1 & Network Rail

#### *System for measuring current*

Team: Suyash Agarwal  
Enyala Banks  
Wai Ho Chen  
Arsenii Gabov  
Xu Li  
Mohammad Akram Mughal  
Jiayu Qian  
Muhammad Shakir Shabbir

Teacher: Alex Kampas

Engineer: Tracey Dickinson & Dave Hewings

The railway in Wales has been a success story, with passenger numbers growing by almost 50 per cent in the last 10 years. To improve capacity, projects focus on modernising the railway, with electrification of the South Wales Mainline and resignalling a priority as part of the national Railway Upgrade Plan.

Design a system for measuring the current in a long conductor without contacting the conductor. This is required as the wire is the catenary, the overhead contact system, to be used in the electrification of trains in Wales. The system should be always online, and measurements of current should be readily available without further engagement or action from a third party. This will enable the monitoring of current in the catenary without distracting the standard operation of trains, which should be able to maintain their pantograph (contact apparatus) in contact to the catenary at all times and speeds. As a secondary objective, propose ideas of transferring the data collected by the designed sensor wirelessly to a control unit away from the sensing system. The project is an essential part of the electrification of trains in Wales, as further decisions in the design and operation of the train network will be made depending on the measurements obtained by this system.

## Team 12

### Cardiff Sixth Form College 2 & Network Rail

### Fitzalan High School 1 & Associated British Ports, Cardiff

#### *System for measuring current*

Team: Terence Chung  
Abdullahi Kalli Ja'afar  
Ching Wai Lam  
Alan Muriithi  
Andrei Postnov  
Zixuan Wang  
Hao Xiao  
Tingrun Zhou

Teacher: Alex Kampas

Engineer: Tracey Dickinson & Dave Hewings

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#### *Loss of Water in Barry Docks*

Team: Amitha Jha  
Owain Jones  
Thadshana Parameswaran  
Yousuf Shahzad

Teacher: Tony Cooke

Engineer: Robert Gray, Nathan Evans & Andy Dyer

ABP is the UK's leading port operator with 21 ports across the UK.

Barry docks relies solely on tidal water fill with no water pumping.

Determine the most cost-effective solution to offsetting water loss due to ship movements and leakage from the lock gates.

The team have decided to use angled water passageways to store water in a separate area which can be used to refill the docks if needed. They are also considering the use of a hydrophobic sealant to prevent water leakage from dock walls.

## Team 13

### **Fitzalan High School 2 & Associated British Ports, Cardiff**

#### *Loss of Water in Barry Docks*

Team: Mubin Amin  
Fatima Begum  
Fawaz Khan  
Munjia Rahman  
Melusi Sibanda

Teacher: Tony Cooke

Engineer: Robert Gray, Nathan Evans & Andy Dyer

ABP is the UK's leading port operator with 21 ports across the UK.

Barry docks relies solely on tidal water fill with no water pumping.

Determine the most cost-effective solution to offsetting water loss due to ship movements and leakage from the lock gates.

The team have decided to use solar and wind powered submersible water pumps to get water back into the docks.

## Team 14

### **Howell's School 1 & Renishaw**

#### *Parts Bin Quantity Monitoring System*

Team: Oliver Bluck  
Morgan Heselton  
Chris Lewis  
Joseph Newell  
Daisy Springer

Teacher: Dr Andrew Ford

Engineer: Simon Biggs

At Renishaw we manually assemble a large range of our products on benches, using parts bins to store components before assembly. This can sometimes lead to on-line parts shortages when starting a batch on the assembly line. We require a system to quickly visualise there is sufficient components for a build.

A system is required for production personnel to use that will provide a quick and easy confirmation of ample part quantities before starting a batch.

The design can be of a purely mechanical nature or feature some form of electronic measuring device / visual communication. The system should be easy to use with a clear representation of part quantities remaining.

## Team 15

### Howell's School 2 & Cardiff Metropolitan University

#### *Toxic Algae Bloom at Roath Park Lake*

Team: Ikuni Ebereonwu  
William Howkins  
William Hughes  
Ritika Khot

Teacher: Dr Andrew Ford

Engineer: Clara Watkins & Gareth Loudon

Cardiff Metropolitan is a global university rooted in Wales and with a history of practice focussed and professionally oriented education that dates back to 1865. Our origins in the Cardiff School of Art have established a rich environment in which creativity is highly prized.

Algae are one-celled organisms and are a natural part of water ecosystems. However, some types of algae such as blue-green algae possess bacterial cells, which are dangerous for humans and animals. When the conditions are in favour of their growth, they can bloom very fast making the lakes, streams or drinking water supplies poisonous. The algae are not always visible in water, and tests are required to distinguish different types. Many incidences have been reported previously around the world causing disruptions in drinking water supplies and quarantining lakes. During August, Roath Park Lake in Cardiff was closed due to toxic algae bloom. Authorities warned people to stay away from the lake and keep their dogs away.

Considering the problem described above, choose one of the following design tasks:

Prevent: Various methods are used to control algae bloom including chemicals, ultrasound, beneficial bacteria, planting barley straws and aeration. Design a product or system to prevent recurring bloom of toxic algae for Cardiff Roath Park Lake in the future.

## Team 16

### Llanishen High School 1 & GE Aviation

#### *A concept for a new automated coating application*

Team: Joel Chandler  
Alexander Fairhurst  
Liam Howells  
Mikael Hume Korotkov  
Alexander Minton  
Owen Morgan  
Hama Sharif  
Samuel Webber

Teacher: Philippa Wallington

Engineer: Ieuan Hennessey, Ben Capdeville  
& Andrea Ruan

GE Aviation Wales is a maintenance, repair and overhaul facility for 4 aircraft engine lines.

When the GE90 Fan Mid Shaft is being repaired, it has to be sprayed with coatings to prolong its serviceable life. The coatings have to be a very specific thickness. Currently, an operator manually sprays the FMS with the coating, but this is inefficient and inaccurate. If the coating is out of serviceable limits, the coating must be stripped and reapplied, which is expensive and time consuming.

Design a working concept for a new automated coating application which can be adapted to apply coatings to the GE90 FMS (engine gear shaft) evenly and to the correct thickness.

Create a working concept that can demonstrate through calculation the ability to apply coatings evenly and within the thickness tolerances provided to both flat plate & cylindrical coupons.

Explain how GE could develop your concept into a real tool by:

- Suggesting manufacturing processes
- Material selection
- Design adaptability



trusted to deliver







Bedwas High School



Bishop Gore School



Cardiff and Vale College  
Coleg Caerdydd a'r Fro



Chepstow School  
Ysgol Cas-gwent



Penglais School



Pontypridd High School



Rougemont School



St Alban's RC High School



St David's  
Catholic Sixth Form College  
Coleg Catholig Dewi Sant  
Dorbarth Chwech



St John's College, Cardiff



Whitchurch High School



Ysgol Gyfun Gymraeg  
Bro Myrddin



Ysgol  
BrynElia  
High School



Ysgol Eirias



Ysgol Glan Clwyd



Croeso i  
Ysgol Gyfun  
Garth Olwg



Ysgol Maes Y Gwendraeth



Ysgol  
Morgan Llwyd



Ysgol Uwchradd Aberteifi



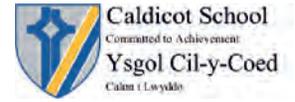
Bishop of Llandaff CIW High School



Bishop Vaughan School



Brynteg School



Caldicot School  
Committed to Achievement  
Ysgol Cil-y-Coed  
Calm i Lwyddo



COLEG CAMBRIA



COLEG CYMUNEDOL Y DDERWEN



Coleg Gwent



Grŵp Llandrillo Menai



Fitzalan High School



Gower College Swansea  
Coleg Gŵyr Abertawe



Ysgol Tregwyr  
Gowerton School



Heolddu Comprehensive School



Lewis Girls' School



Ysgol Uwchradd  
Llanishen High School

# STEM Cymru



MIDDELTON COLLEGE



Queen Elizabeth High School



Ysgol Uwchradd PRESTATYN High School



St Joseph's RC High School



St Joseph's School and Sixth Form Centre



St Teilo's CIW High School



Ysgol Gymunedol  
TONYREAIL Community School



YSGOL DAVID HUGHES



Ysgol Dyffryn Aman



Ysgol Dyffryn Conwy



Ysgol Dyffryn Taf



Ysgol Cyfun Gŵyr



YSGOL GYFUN GYMRAEG PLASMAWR



LLANGEFNI  
YSGOL  
CYNYDDO-CADW



Ysgol Maes Garmon



Ysgol Uwchradd Bodedern



Ysgol Uwchradd Caergybi



Ysgol Y Preseli

## Team 17

### Llanishen High School 2 & GE Aviation

#### *Concept to test whether the lubrication holes are blocked*

Team: Aala Nasser Al-Maskari  
Mohammed Nasir Boksh  
Joe Gage  
Alfie Gatenby  
Seethal Sasikumar  
Louis Sbienati  
Zoe Shapcott  
Fah Watthanamassakul

Teacher: Philippa Wallington

Engineer: David Hoare, David Sulley  
Mike Hall

GE Aviation Wales is a maintenance, repair and overhaul facility for 4 aircraft engine lines.

The oil flow holes in the transfer gearbox can become blocked by the rubber seal which could lead to failure and cause the engine to shut down.

Design and develop a working concept to test whether the lubrication holes are blocked while keeping the TGB at a fully built up level.

Create a working concept that can demonstrate how you can check whether the lubrication holes are blocked or not and if possible describe the method of clearing the holes without damaging the gearshafts and re-checking the lubrication holes to ensure they have been cleared.

Explain how GE could develop your concept into a real tool by:

- Suggesting manufacturing processes
- Material selection
- Design adaptability

## Team 18

### St David's Catholic College 1 & Arup

#### *Carbon Reduction on Government Services*

Team: Rhys Barkley  
Luca Contino  
Shandes Kafle  
Gurpreet Singh  
Ben Voss

Teacher: Matthew Miller

Engineer: Jason Prosser

Arup Cardiff is based in Pierhead Street in Cardiff Bay and has over 350 employees. Ranging from civil & structural engineers to ecology consultants and scientists.

Welsh Government are committed to contributing towards the reduction of carbon emissions in accordance with the Paris Agreement. One area of potential safety improvements, cost reductions and environmental benefits, is the need to grit roads in the winter period to allow people to make essential journeys safely. The cost are significant and climate experts are expecting winters in the UK to become more extreme due to climate change. The requirement for raw material extraction for the grit material is detrimental to the environment.

The aim is to investigate potential solutions to help reduce the requirement for road gritting in the winter months.

- Investigate and identify a solution to the problem that the Welsh Government are facing.
- Produce a functional/conceptual model of the solution
- Report on your investigation

## Team 19

### St David's Catholic College 2 & Arup

#### *Carbon Reduction on Government Services*

Team: Isaac Andal  
Oliver Brain  
Joseph Clarridge  
Abdullah Otri  
Rhys Pugh  
Mohammad Awais Saeed

Teacher: Matthew Miller

Engineer: Jason Prosser

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The aim is to investigate potential solutions to help reduce the requirement for road gritting in the winter months.

- Investigate and identify a solution to the problem that the Welsh Government are facing.
- Produce a functional/conceptual model of the solution
- Report on your investigation

## Team 20

### St John's College & Newport Waferfab

#### *Design an Educational Exhibit on Compound Semiconductor/ Photonics Manufacturing Production*

Team: Edward Camilleri  
Jin Dong  
Yue He  
Oliver Lau  
Ryan McAree  
Kaavya Sudheer  
Sam Thornton  
Kelly Yip

Teacher: Rhian Bate

Engineer: Joanne Daniels

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To increase:

- Understanding of compound semiconductors and photonics industry and their uses.
- Understanding of how microchips/wafers are produced.

Create an educational exhibit to explain compound semiconductor and photonics production, the environment – class 1 cleanroom, the processes and how compound semiconductors/photonics are used, pitched at an age range of 13-18 years.

Students will be required to understand the processes, complete a site induction and tour of the clean room to gain an understanding of the manufacturing procedures.

## Team 21

### St Teilo's CIW School & Eastman Chemical Company

#### *Production of Brine Water*

Team: Souza Abdi  
Yaseen Aldhahi  
Kian Cook  
Ewan Falcon  
Can Oran  
Oliver Smith

Teacher: Gareth Jenkins

Engineer: Sean Smith

Eastman is a global specialty chemical company that produces a wide range of advanced materials, functional products and fibres that are found in many different products. A world leader in the diverse market it serves, Eastman is focused on delivering innovative and technology-based solutions whilst maintaining its commitment to safety and sustainability.

Demineralised water plays an important role in many chemical processes worldwide. The water is demineralised so that it is absent of any solids and minerals. To produce demineralised water, brine water can be used as a feed. The brine removes organics.

Currently, we create brine by manually adding salt to water in a hotwell tank. This is transferred to a measuring tank before being processed by the Demin (Demineralised) plant.

The hotwell tank is very old and has suffered from heavy corrosion over the years of its usage. Therefore, Eastman requires an engineering solution that will allow us to continue brine water production whilst also reducing manual labour and taking into consideration of safety, cost and environmental impact.

## Team 22

### Whitchurch High School 1 & GE Aviation

#### *Variable Stator Vanes Tooling For a Jet Engine*

Team: Jack Furreedan  
Harry Hooper  
Linus Kirkwood  
William Lewis  
Joseph McCarthy  
Miguel Nieva-Galan  
Jacob Norton  
Molly Stone

Teacher: Mike Williams

Engineer: David Hoare, Abigail Snow, Lucy Elliott & Cameron Greenslade

GE Aviation Wales is Maintenance, Repair and Overhaul site for commercial jet engines.

Currently the Variable Stator Vanes (VSVs) fall out of the case when it is moved after the outer ring and the inner seals are removed.

Because of this, all the VSVs must be removed for transport. Removed VSVs must be inspected all over and so must the case allowing more problems to be found and costing more money.

Design a Piece of tooling to hold the Variable Stator Vanes (VSVs) in place during Transportation when the outer ring and the inner seals are removed| allowing for the inspection of the Blade edges, the threaded end and the bushed end of the VSV.

## Team 23

### Whitchurch High School 2 & GE Aviation

#### *Combuster Case Mask*

Team: Ieuan Burgess  
Evan Clark  
Owen Pearce  
Charlie Wilkins  
Ben Williams

Teacher: Mike Williams

Engineer: David Hoare, Abigail Snow, Lucy Elliott  
& Cameron Greenslade

GE Aviation Wales is Maintenance, Repair and Overhaul site for commercial jet engines.

Masking tape is currently used to cover areas of a Combustor Case that do not need repairing.

This process is expensive and takes a lot of time. Pupils are required to research and develop a new method of masking that will save time and materials.

## Team 24

### Whitchurch High School 3 & AECOM

#### *Off-Grid Education*

Team: Daniel Cosslett  
Divya Joshi  
Freya Luscombe  
Saed Mahamed  
Logan Pettersen  
Ahmed Suliman  
Maya Williams  
Ben Wiltshire

Teacher: Mike Williams

Engineer: Sian Lewis

A local Welsh secondary school is looking to extend its existing building to supplement increasing pupil numbers.

The site for the new school extension is located near the sea in an open and rural environment. The challenge lies in how, as a building design engineer, you can capture enough renewable & sustainable energy to power the school and its mechanical and electrical building services equipment.

The Equipment has been chosen and designed to ensure a suitable and comfortable teaching environment for the occupants but requires a method of power by which this equipment is not drawing upon the mains electricity network.

The aim of this project is to come up with a concept design for a small-scale educational building that generates, stores and releases its own energy.

## Team 25

### Whitchurch High School 4 & AECOM

#### *Off-Grid Education*

Team: Hannah Drury  
Georgia King  
Praveena Pemmasani  
Sarah Thomas  
Shannon Yu

Teacher: Mike Williams

Engineer: Sian Lewis

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## Team 26

### Ysgol Gyfun Gymraeg Plasmawr 1 & Cardiff University, School of Computer Science and Informatics

#### *To accurately measure student engagement during careers events and other exhibitions*

Team: Eleri Davies  
James Hartland  
Dario Mavilia  
Huw Owen  
Aled Robins  
Dewi Townley  
Anna Watt

Teacher: Gareth Hall Williams

Engineer: Matthew Turner & Catherine Teehan

Cardiff is a stimulating, cosmopolitan and compact city of around 350,000 people. In recent years major developments have attracted a growing business community, including an increasing number of technology companies.

The School of Computer Science and Informatics is located in the Queen's Buildings at the southern end of the University campus in the centre of Cardiff.

We are a research-led school in one of the UK's premier universities with a reputation for excellent teaching and internationally accomplished research activities.

We are looking for a solution using sensors to accurately measure how long a person is engaging with a stand at a careers fair. Although we can collect names at each stand, we are keen to see what attracts a student to engage with a stand and how long on average they spend at each stand. We would also like to know how many students are walking by a stand without engaging compared to how many stop and engage at a stand. We would like to be able to advise employers on how to best set up their stands to encourage students to engage.

## Carmarthenshire

### Team 27

#### **Ysgol Gyfun Gymraeg Plasmawr 2 & Cardiff University, School of Computer Science and Informatics**

*To accurately measure student engagement during careers events and other exhibitions*

Team: Anellie Beare  
Isobel Flynn  
Jac Lingard  
Luc Lloyd  
Christopher Lowes  
Rhys Morgan  
Cameron Thomas

Teacher: Gareth Hall Williams

Engineer: Matthew Turner & Catherine Teehan

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### Team 28

#### **Queen Elizabeth High School & GD Harries**

#### *Reducing CO2 Emissions*

Team: Mia Evans  
Kate Hill  
Chris Chang  
Dylan Hughes  
Anthony Jenkins  
Zuzanna Milewska  
Danni Payne  
Lucas Steadman

Teacher: Sharon Magill

Engineer: Garry Batte

GD Harries is one of Wales's largest independent suppliers of aggregates and a civil engineering company delivering multimillion pound infrastructure projects.

The task that the team were given was to research and consider methods G.D. Harries could follow in order to reduce their carbon dioxide emissions.

Solutions could range from finding alternative fuels and changing their vehicles for more efficient ones to finding new locations to obtain the raw materials they need. The metaphorical sky was the literal limit.

The intention is for an overall reduction of approximately 5% carbon dioxide emissions after the solution is implemented with a payback time of 5 years.

## Team 29

### Ysgol Dyffryn Aman & CR Clarke

*Explore the viability of recycling PET/rPET using the C R Clarke Schred Recycling System*

Team: Dewi Wyn Evans  
David Jacob Isaac  
Tomos Ellis Rees  
Cian Lloyd Roberts  
Alex Shufflebotham  
Christopher White

Teacher: James Thomas

Engineer: Maurice Clarke

C R Clarke & Co are designers and manufacturers of equipment for thermoforming and plastic fabrication. They sell to educational and industrial customers around the world. More recently they have developed their Schred plastic recycling system, to granulate and reconstitute waste plastic.

While the Schred system works with a wide variety of materials, PET and rPET have not been successfully processed. It is believed that this is down to a small number of factors:

- Moisture Content of the granulated material.
- Heating Temperature (to ensure that the granules fuse but don't overheat)
- Cooling Rate (it is understood that the heated material must be cooled very quickly to avoid it crystallising, which makes it brittle and impossible to work)

Develop a process to successfully create items from PET/rPET using the C R Clarke Schred recycling system. The solution may include modifications/improvements/additions to the existing range of equipment.

## Team 30

### Ysgol Dyffryn Taf & Whitland Engineering

*Hand rail fabrication system*

Team: Max Holland  
Lloyd Mammatt  
Alastair Shepherd

Teacher: Richard James

Engineer: Eurig Jones

Whitland Engineering is a specialist company delivering engineering and project management services throughout the UK.

The business covers all the main disciplines of mechanical fabrication and installation, electrical engineering, process logic control systems, civil engineering and project management.

Design a two-stage operational process that enables engineers to initially assemble and tack weld a range of standard handrails.

Following this a rotational system is required to enable engineers to finally MAG weld the fitment with ease.

## Ceredigion

### Team 31

#### **Ysgol Gyfun Emlyn & Aberystwyth University**

##### *Designing an Interactive Alarm Clock*

Team: Ben Crees  
Elian Evans  
Gruffydd Evans  
Eleanor Jenkins  
Hannah Morris  
Heather Platten  
Noah Smith  
Isabelle Williams

Teacher: Charles Gale

Engineer: Martin Nelmes

Aberystwyth University Computer Science Department has one of the largest and best-known robotics groups in the UK. It specialises in research into areas of robotic control, cognition and vision. In cooperation with the Department of Physics it is also involved in space robotics, for example the ExoMars 2020 mission.

The Intelligent Robotics Group is interested in real world applications for everyday problems.

The team has been asked to develop a design for a mobile alarm clock that moves away from the user, forcing them to get out of bed in order to turn it off. The 'clock' will need to include motors, sensors and a speaker, together with a programable controller. It is important that the design is robust and reliable.

### Team 32

#### **Penglais School & Aber Instruments**

##### *Automated Probe Calibration Stand*

Team: Lee Herbert  
Min-Young Kim  
Penny Lewis  
Orin Lole Durbin  
Gregor Macmillan  
Trey Moffat  
Abigail Shipman  
Oliver Walsh

Teacher: Dr Mark Lewis

Engineer: Emma Thomas & Chris Milner

Aber Instruments have developed a method of detecting how much yeast cells in fermentation are viable. They achieve this by creating probes that are able to generate an electrical field in the solution that then polarizes the living yeast cells.

By making them behave like capacitors, the probe can then calculate the capacitance of the cells and is able to use this information to calculate the number of cells that are living and therefore, the amount of yeast that needs adding to the solution. To polarize all the test solution the probe is held 1cm deep in the centre of the solution. Currently, Aber Instruments are clamping the probes into a retort stand and manually adjusting the width and height of it into the solution. This is not the most efficient or accurate method as with every individual calibration the probe is lowered approximately 1cm into the centre of the solution resulting in less accurate and precise calibration.

Design a mechanism that would improve the calibration efficiency and accuracy for cell polarization.

## Monmouthshire

### Team 33

#### Ysgol Uwchradd Aberteifi & Statkraft

##### *Automated Turbine Cleaning System*

Team: William Bright  
Molly Clarke  
Dafydd Davies  
Rhys Godfrey  
Chris Saji  
Oliver Sibley

Teacher: Natasha Sharman

Engineer: Gareth Jones

Create and implement an automated mechanism to clean leaves, objects and other debris from a water inlet at Cwm Rheidiol Dam. Currently the water inlet requires cleaning weekly for a total of 3 hours which is unsustainable for the company and the workers at the dam. The turbine must be stopped and lifted to clean. This wasted time of production is inefficient for the company and costs hundreds of pounds every week.

Health and safety is another major issue for the current situation. Cleaning the bristles of the turbines is an inefficient and rudimentary way of maintaining a turbine. Also, employees could be injured standing by the bristles which need to be cleaned.

It is essential for the turbines to remain clean and the working solution should result in less risk of damage to the turbine. Moreover, a practical and sustainable solution must be found to ensure the safety and care of the environment and conservation of the indigenous species of fish and plants in the dam.

### Team 34

#### Caldicot High School 1 & Newport Waferfab

##### *Design an Educational Exhibit on Compound Semiconductor/Photonics Manufacturing Production*

Team: Elliott Davies  
Euan Dobel  
Thomas Dobel  
Tom Nicholson  
Joseph Williams  
Connor Winstone  
Joseff Young

Teacher: Richard Scott, Mark Sheridan  
& Emma Baker

Engineer: Joanne Daniels & Dennis Knight

Newport Waferfab delivers a manufacturing service, providing fast and agile “semiconductor production” for the CS cluster, which enables customers to succeed in their fields of expertise.

To increase:

- Understanding of compound semiconductors and photonics industry and their uses.
- Understanding of how microchips/wafers are produced.

Create an educational exhibit to explain compound semiconductor and photonics production, the environment – class 1 cleanroom, the processes and how compound semiconductors/photonics are used, pitched at an age range of 13-18 years.

Students will be required to understand the processes, complete a site induction and tour of the clean room to gain an understanding of the manufacturing procedures.

## Team 35

### **Caldicot High School 2 & Newport Waferfab**

#### ***Design an Educational Exhibit on Compound Semiconductor/Photonics Manufacturing Production***

Team: Jordan Higham  
Nicole Jeremiah  
Ewan Maund  
Charlotte Nee  
Jacob Nesling  
Rhys Probert

Teacher: Richard Scott, Mark Sheridan  
& Emma Baker

Engineer: Joanne Daniels & Dennis Knight

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## Team 36

### **Chepstow School & Royal Navy**

#### ***Sustainable Power Source for a Radio Relay in Disaster Relief operations***

Team: Joseph Bell  
Hannah Lidgett

Teacher: Rachel Tiller

Engineer: James Tuhey

The Royal Navy is one of the longest established Armed Forces in the world, and operates Ships, Submarines and Aircraft globally, 24 hours a day, 7 days a week.

HMS DEFENDER has deployed to a remote island recently hit by a devastating hurricane. The teams providing disaster relief support to restore the local infrastructure reported significant problems in communicating back to the co-ordinating ship from ashore. A radio relay device could bridge the gap, which is already available from the NATO stores system, however it requires a sustainable power source that would offer sufficient electrical energy 24/7 to support effective communications with no down time.

Research, design and build a working prototype power supply system, that scavenges energy from its surroundings to power a communications bridge device (Wireless Router) that will form the communications link. The power supply requirement specification is as per the wireless router. Your requirement for sustainability and long term deployability without maintenance or intervention by an operator will be briefed in detail by your project officer.

## Team 37

### King Henry VIII CIW High School & Alun Griffiths Contractors

#### *Oldtown Bypass*

Team: Clarke James  
Imogen Ruth Lambert  
Christie-May Neal Thrupp

Teacher: Richard Thomas

Engineer: Elizabeth Bland & Steve Saunders

Alun Griffiths (Contractors) Ltd is a leading regional civil engineering and construction contractor based in Abergavenny, Monmouthshire. Established in 1968, Griffiths employs over 750 people and has an extensive plant fleet.

Oldtown has suffered from traffic congestion in the town centre for many years and the existing route, which is unsuitable for large vehicles, has experienced high numbers of road traffic accidents. The Client requires a new dual-carriageway bypass to be designed and built to remove traffic from the town centre and provide better journey time reliability for road users. The new route must be safe, sustainable - with consideration of environmental, social and economic impacts - and affordable.

The project objectives which you must consider are:

- Remove traffic from local roads
- Contribute to the seven goals of Welsh Government's Wellbeing of Future Generations Act 2015
- Increase the level of usage for non-car forms of transport
- Increase the use of public transport by providing a fully-integrated network
- Improve journey time consistency
- Reduce accidents on the route

Your team must provide a solution for the Client.

## Team 38

### Monmouth School for Boys & General Dynamics

#### *The Guide*

Team: Iwan Briggs  
Dylan Chang  
Oliver Harrison  
Dominic Kwong  
James Whitehead

Teacher: Kieran Chaplin

Engineer: Delwyn Morgan & James Butler

The Guide is a warning device that works by receiving signals from the 'Scout project' and alerts the user of possible danger in the vicinity (gas leak| chemical spill) rather than having multiple alarm systems and designated fire assemblies.

The Guide allows the user to continue with his/her work safely, whilst allowing the company to monitor those that access the site (site pass) and only shut down certain areas of the plant to maintain efficiency of production.

The user will be made aware of any possible risks whether to evacuate that area if needed and where to report to.

## Neath Port Talbot

### Team 39

#### Monmouth School for Girls & General Dynamics

##### *Pod Booking System*

Team: Eva Barry  
Lauren-Anya Hurlle  
Megan Payne  
Kelly Tang

Teacher: Gareth Dunn

Engineer: Delwyn Morgan & James Butler

General Dynamics UK currently faces an issue where private meeting spaces are difficult to find for unplanned meetings. GDUK has two main types of spaces: bookable meeting rooms and unbookable 'pods'. For the bookable meeting rooms, it is possible to know when a room is free or engaged on an existing system. For the non-bookable 'pods' however, in order to know if they are free or not, methods of detecting room occupancy must be used and the information sent to a system.

Design a solution where a user can look at a site floorplan to see availability and location of rooms. This information should be supplied by some form of sensor/detector. The solution should be easily deployed, have a relatively low cost and be low maintenance. It must be suitable for all types and sizes of rooms (not dependant on the infrastructure of certain buildings) and should not be too intrusive (e.g. sensors should not be covering the entire room).

It is also vital that the software is safe from cyber-attacks and must conform to the cyber protection requirements an information assurance policy of the company. The application should run on Microsoft Windows but be easily transferred to portable devices (i.e. mobile phones) and for it to be flexible to different buildings, the application could allow for floorplans to be imported.

### Team 40

#### St Joseph's School and 6th Form Centre 1 & TATA Steel, Port Talbot

##### *Torpedo Automated Lubrication System*

Team: Luke Davies  
Aron Finnemore  
Luke Jones  
Mathew Lane  
Craig McLaughlin  
Kristian O'Leary  
Jonathan Shallis

Teacher: Sam Williams

Engineer: Kelly Coombs & Rob Thomas

Tata Steel is one of the world's most geographically diversified steel producers, with operations in 26 countries. At Port Talbot site we can produce 4.8 million tonnes of steel every year with approximately 4900 employees and an annual turnover of £1.7 billion.

Iron is poured into Torpedo Vessels and transported via our rail network. Approximately 18–20 Torpedo Vessels are in service at any one time and able to transport molten iron via 4 different types of Torpedoes with different capacities. They are periodically removed from service for maintenance and to help prolong the time periods in between maintenance, lubrication to specific points is required. Currently, this process is carried out manually, which means the Torpedo is temporarily removed from service and a person comes into contact with the item of plant.

Design an automated lubrication system that will feed all bogie and bolster pivot points, bearing faces, axle bearings etc. The design must take into account:

- How the system is powered
- (Electrically, mechanically driven?)
- Size of the pump and lubricant reservoir
- Position of the system on the Torpedo

## Newport

### Team 41

**St Joseph's School and 6th Form  
Centre 2  
& Weartech**

#### *Thinking inside the box*

Team: Selvinur Dilki  
Jess Engledow  
Grace Heery  
Hannah James  
Lucy Robathan  
Iman Shakeel  
Seren Wonklyn

Teacher: Sam Williams

Engineer: Lee Derrick, Lewis Hayward  
& Geo Joseph

Founded in 1990, Weartech International is a producer of cobalt-based hardfacing and wear-resistant welding consumables. For over 25 years, Weartech has supplied products to customers facing significant wear problems. Headquartered in Anaheim, CA with an additional manufacturing facility in Port Talbot, Wales, Weartech is a global leader in the manufacturing of wear-resistant Cobalt, Nickel, and Iron-based alloy coatings, castings or machined components.

Weartech has wanted to reduce their plastic consumption through their packaging system.

Design a suitable packaging system for their products that will not only be durable but also environmentally and economically sustainable.

The team will also need to make sure that the "boxes" will be suitable for any size of product as well as being cost effective.

### Team 42

**Bassaleg School 1  
& Newport Waferfab**

#### *Design an Educational Exhibit on Compound on Silicon and Silicon Semiconductor/ Photonics Manufacturing Production*

Team: Tamim Ahmed  
William Ballard  
Tayeeb Islam  
Rhys Jones  
Alexander Lewis  
Jack Underwood-Gibbs

Teacher: Kim Chesher

Engineer: Joanne Daniels

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Increase their:

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Create an educational exhibit to explain compound semiconductor and photonics production, the environment – class 1 cleanroom, the processes and how compound semiconductors/photonics are used, pitched at an age range of 13-18 years.

Various forms of technology can be used to deliver this project, e.g.: 3D modelling, virtual reality and video physical models. Exhibit dimensions: 3 metres by 2.5 metres.

## Team 43

### Bassaleg School 2 & Newport Waferfab

#### *Design an Educational Exhibit on Compound on Silicon and Silicon Semiconductor/ Photonics Manufacturing Production*

Team: Megan Broadwell  
Jack Davies  
Amy Evans  
Kaitlin Field  
Jakub Jagiello  
Anisa Tufail  
Erin Vicary

Teacher: Angus Ferraro

Engineer: Joanne Daniels

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## Team 44

### Rougemont School & Safran Seats

#### *19 Hour flight activities*

Team: Laura Cushing  
Edward Darlington  
Ben Marshall  
Lydia Medhurst  
Lauren Pohl  
Austeja Stasiuleviciute  
Jai Tandon

Teacher: Jane Goodwin

Engineer: Peter Carr, Alexis Salter  
& leuan Delaney-James

Safran Seats UK designs and manufactures premium aircraft seating and cabin furniture. We produce a wide range of seating products including customer specified projects from scratch, known as ‘blue sky’ products. The word ‘premium’ is a big part of the company’s philosophy and we take great pride in products which are high quality and give passengers a great experience every time.

The increase in aircraft capabilities and range has led to Quantas completing a direct 19hr flight. Aside from eating, sleeping and watching videos, the brief here is to identify and create seat features that will offer alternative activities to occupy passengers.

It should be acknowledged that this concept is for placement in a luxury aircraft seat and appropriate considerations should be made.

## Pembrokeshire

### Team 45

#### St Joseph's RC High School & Orb Electrical Steels

*Identify and develop a method that can be used by Orb Steel works Newport to measure the tension of electrical steel coating*

Team: Molly Baria  
Wiktor Blaszczyński  
Caitlin Bridge  
Gainmore Daka  
Yianni Giallelis  
Aine McDonald  
Joseph Thompson

Teacher: Cerys Corbett

Engineer: Kelly Coombs & Richard Fellowes

Cogent comprises of its electrical steel manufacturing operations, Orb Electrical Steels, Surahammars Bruks AB and its downstream manufacturer of transformer cores and components, Cogent Power Inc.

Orb Steel Works in Newport have asked the St Joseph's team to develop a method that will allow the optimum tension of an electrical steel coating to be identified.

All electrical steel produced by Orb steelworks is coated, this coating must be placed on the steel at an optimum tension to ensure optimum domain direction and steel quality.

### Team 46

#### Pembrokeshire College & Magstim Company

*Coil Monitoring for Magstim Ltd*

Team: Tomm Aucote  
Josie Gabel Mcevoy  
Callum Harries  
Samuel Rummery  
Jack Rushby  
Tom Sheppard

Teacher: Jason Pointer & Lisa O'Connor

Engineer: David Hawkins

Magstim is a leading supplier of Transcranial Magnetic Stimulation (TMS) stimulators and packages used for Magstim TMS therapy and neuromodulation research.

Magstim stimulators and coils are designed and manufactured by our dedicated team in West Wales, UK. Our pioneering team includes engineers, manufacturing operatives as well as supporting functions. Magstim employs over 100 people, the majority of which work at our head offices in West Wales, UK and Minnesota, USA.

The objective of this project is to develop a temperature-controlled environment. Magstim currently perform sound testing on some of the accessories it sells using a modified plastic storage shed in which the accessory hangs with two microphones (one for recording and the other for peak detect) which sit directly under the coil head. Below is a picture of one of the accessories that is tested. The project brief is to take current setup and extend the testing that can be performed in there by developing a control system for the air temperature within the enclosure to allow functional testing to also be performed.

## Team 47

### Ysgol y Preseli & Mainstay Marine

#### *Wave Energy Platform*

Team: Lewis Vaughan  
Rhys James  
Rachael Morgan  
Charlie Richards  
William Lloyd  
Morgan Williams

Teacher: Duncan Richmond

Engineer: Charlotte Wood & Norbert Rumpfer

Mainstay Marine Solutions Ltd are boat builders who have been manufacturing and maintaining large, heavy and complex semi-submersibles for over 30 years. Our comprehensive facilities are based in Pembroke Dock, Pembrokeshire on the Milford Haven Waterway in South West Wales.

Previous examples of our work include: Pilot Boats, RIBS, Patrol Boats, Wind Farm Support Vessels, Workboats, Passenger Vessels and Renewable Energy Devices.

Our team consists of 80 employees which includes our own in-house design team of naval architects and engineers, a core management team and skilled craftsmen.

Due to environmental concerns there is a growing need to generate electricity from renewable sources. South West Wales has an abundance of resources to fulfil this, particularly marine, e.g. wave and tidal, however a lot of the technologies are still not fully developed.

Design a platform to harvest wave energy to be deployed off the coast, considering durability and ease of maintenance of any designs.

## Powys

## Team 48

### Ysgol Maesydderwen & Vale

#### *Developing an Integrated and Sustainable Heating System at Clydach Refinery*

Team: Harrison Darshan  
Carwyn Dugay  
Caitlin Edwards  
Emily Gannon  
Athul Johnson  
Albert Jones  
Jaden Maskell-Beynon  
Tom Swindley

Teacher: Hefin Davies

Engineer: Peter Martin, William Pugh  
& Jack Davies

Vale is a global mining company that is based in Brazil and employs around 75,000 people worldwide. Vale is the largest nickel producer in the world, with the Clydach Refinery employing 200 people on site, producing 40,000 tonnes of nickel per year. Site operates 24/365 with feed materials coming from mines in Canada and Indonesia.

The site has high fixed energy costs related to the heating processes of gas and solids. With the cost of energy increasing year on year and the environmental implications of carbon emissions there is pressure to reduce this cost/usage.

The task is to design an integrated system to provide the heating requirements in the most efficient manner. Consideration should be made as to how to achieve the heating in terms of design and type of equipment. Consideration should also be made as to how any waste heat could be captured and used within the integrated system. Look at sustainable options for sourcing the energy requirements as well as options that remove the need to import energy sources from the external national grids.

# Rhondda Cynon Taf

## Team 49

### Cardinal Newman School & Capita

#### *Automatic pollution monitoring and speed limit adjustment system to improve air quality and congestion on the A470*

Team: Charlotte Elliott  
Jac Fernandez-John  
Abbie Hooper  
Elliot Jenkins  
Morgan Kelly  
Joseph Wells

Teacher: Richard Lawson

Engineer: Ian Walsh & Stephanie Lewis

Capita has a diverse set of roles in transport, health, education and local governments, as well as consulting roles within other large-scale companies. A wide range of expertise enables Capita to streamline many processes increasing effectivity, efficiency, public satisfaction, and profitability.

Air pollution is becoming a health concern as well as an environmental issue. As a result, traffic along the A470 is controlled to reduce emissions. Currently, the pollution levels along the A470 dual carriageway are controlled by static and permanent speed restrictions (50MPH). This impacts and impedes the flow of traffic at peak times, even when pollution levels are low so is therefore flawed. To facilitate more efficient monitoring and use of speed restrictions to benefit the environment and reduce congestion issues.

Design a system of small, low cost with an automatic sensors which will monitor air pollution along the A470 corridor and inform automated variable speed limits to reduce congestion as well as pollution levels in a sustainable efficient manner.

## Team 50

### Pontypridd High School & Rhondda Cynon Taf County Borough Council

#### *Safe Routes in Communities*

Team: Liam Hooper  
Seren Hopkins  
Tom Penikett  
Trudy Pounder  
Isobelle Preston

Teacher: Sian Brayford & Carl Williams

Engineer: Roger Waters, Adam Griffiths  
& Rebecca Smith

Every year, each Local Authority in Wales has the opportunity to bid for funds set aside by the Welsh Government for Safe Routes in Community schemes.

Safe Routes in Communities schemes are a package of practical measures for improving accessibility and safety within communities, in particular to schools.

Safe Routes in Communities measures will vary from community to community, but could include the provision of:

- New walking and cycling routes to the community facilities, including schools
- Improvements to existing walking and cycling routes to the community facilities
- e.g. better lighting, improved footpath surfaces and widened footways
- New or improved access to your community facilities, or other measures in the
- area to encourage walking and/or cycling
- Traffic management features, such as 20mph zones; and
- Cycle storage facilities at the school, leisure centre, community hall etc

## Team 51

### Tonyrefail Community School & Sony UK Tec

#### *Correction of orientation for use in robotic construction*

Team: James Evans  
Abby Lawless  
Toby Morgan  
Nia Phillips  
Caitlin Rees  
Kai Williams-Price

Teacher: Matthew Jones

Engineer: Louise John & Warren James

The Sony UK Technology Centre based in Pencoed - South Wales, manufactures cameras and camera systems for worldwide distribution and an essential part of these systems is the individual remote control each camera comes with.

This means they must produce a large number of remote controls and are in need of an effective way of constructing them. The task that has been assigned to the team is to ensure that the buttons are prepared prior to being placed into the remote by a robotic 'arm'.

Sony receives the buttons inside of a "loose tray". The robotic arms that Sony possess for this job are not yet capable of differentiating between buttons of different orientations, hence why the team must create a method of re-orientation for the buttons so that the robotic arm may place the buttons into the remote control correctly.

## Team 52

### Treorchy Comprehensive School & Dŵr Cymru Welsh Water

#### *Developing solutions for Welsh Water's target to become energy neutral by 2050*

Team: Abigail Barnes  
Ursula Harrison  
Emily Searle  
Jacob Treasure  
Tom Rees

Teacher: Owen Nelson & Tom Summers

Engineer: Stephne Puddy & Ben Burggraaf

The UK energy market has dramatically changed in the last 5 years, transitioning to a low carbon electricity market. As a large energy user, Welsh Water has the ambition to become energy neutral by 2050, meaning energy consumption is equal to the energy generated by the company. Energy use is fully dependant on how much water our customers are using.

Look at a typical day of a Welsh Water customer and calculate how much water on average customers will use in 2050. Design the following plants considering the most optimal water cycle from an energy efficiency point of view:

- A drinking water treatment plant that doesn't use power from the electricity grid
- A sewage treatment process plant that doesn't use power from the electricity grid
- A pumping station that transports drinking water in the most energy efficient way to customers
- A pumping station that transports sewage from customers' homes to waste water treatment plants.

## Team 53

### Ysgol Gyfun Garth Olwg 1 & FSG Tool & Die

#### *Billet Crane*

Team: William Gray  
James Hobbs  
Erin Hughes  
Tammy Humphreys  
Tia Rees

Teacher: Gareth Humphreys

Engineer: Steve Cope & Dafydd Keene

FSG Tool & Die is a toolmaking company based in Llantrisant, that produces parts for a number of industries including medical, automotive and automotive sectors.

Create a machine to help lift pieces of heavy metal which we currently find difficult to pick up without help.

It is necessary to use a type of claw which would be capable of holding the pieces of metal (billets) and turning them at a 90-degree angle to push them into machines. Three billets may be placed at 120 degrees to each other and could weigh up to 200kg each.

You will need to consider the size of the pieces (between 200mm-400mm) due to the diverse size of our products, and your design will need to cope with this changing size and thickness. It will also be necessary to ensure that the pieces of metal are not damaged by using tight grip which may cause scratches or any other over-use that could create marks on the metal pieces.

## Team 54

### Ysgol Gyfun Garth Olwg 2 & FSG Tool & Die

#### *Billet Crane*

Team: Iestyn Davies  
Isobel Henson  
Sion Russell  
Rhianne Williams

Teacher: Gareth Humphreys

Engineer: Steve Cope & Dafydd Keene

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## Team 55

### **Bishop Gore School & University of Wales Trinity Saint David, School of Engineering**

#### ***Automated Transportation for SA1 Campus***

Team: Wharith Alkarim  
Tom Charles  
Arthur Gravenor  
Tom Henderson  
Ellis Penn-Thomas  
Jamie Quin  
Dylan Sykes  
Cameron Williams

Teacher: Robert Young

Engineer: Richard Morgan & Andrew Tibbott

The University of Wales Trinity Saint David has recently moved into a new £60 million campus based in the SA1 waterfront area of Swansea. Staff office spaces are a 10-15-minute walk away and there is limited parking at the main site. Public transport regularly serves the site with bus stops on Fabian Way and outside Sainsburys supermarket. Transport around the site and between buildings can be difficult for staff required to transport documents/equipment or those with mobility issues.

Design and produce a prototype autonomous transport solution to serve the SA1 campus. The chosen solution should comply with any local, national and international laws/by-laws for powered transport and should be accessible by persons with a broad range of mobility issues and be capable of making pre-programmed journeys between the 5 main sites around the SA1 campus.

You cannot install or alter infrastructure on any land without obtaining the relevant consents from all interested parties.

The vehicle should use sustainable energy sources and require minimal maintenance.

## Team 56

### **Bishop Vaughan School & University of Wales Trinity Saint David, School of Engineering**

#### ***Marina Kleaner 1 (MK1)***

Team: Gracjan Golebiewski  
Nathan John  
Matthew Jones  
Romeo Kpakio  
Alex Lewis  
Ben Steward

Teacher: Andrew Smith

Engineer: Richard Morgan & Andrew Tibbott

The University of Wales Trinity Saint David has recently moved into a new £60 million campus based in the SA1 waterfront area of Swansea. The new campus is currently home to over 1500 staff and students and will continue to grow. Of particular concern is our potential to release plastic waste into nearby waterways. Recent news coverage has shown the devastating impact that plastic waste can have on the marine environment, and we are keen to minimise our effect on the local natural resources.

Design and produce a prototype autonomous waterborne plastic waste collection system. The chosen solution should be capable of collecting the "average" plastic litter in the waterways of the Yacht club, Swansea Marina and Prince of Wales Dock.

The solution should require minimal maintenance or intervention from people to function properly and should not be detrimental to the environment or wildlife in the area. The chosen solution should be capable of operating safely in a heavily used waterway with careful consideration how to best address sustainability and renewable energy in design.

## Team 57

**Gower College Swansea, Gorseinon  
1  
& TATA Steel, Port Talbot**

### *Steam Pipe Insulation*

Team: Katherine Fung  
Bilal Husain  
Jason Liu  
Jack Spiller  
Ioan Webber

Teacher: Ceri Davies & Denise Thomas

Engineer: Kelly Coombs, Bethany Carnegie  
& Alan Hughes

Tata Steel is one of the world's most geographically diversified steel producers, with operations in 26 countries. At Port Talbot site we can produce 4.8 million tonnes of steel every year with approximately 4900 employees and an annual turnover of £1.7 billion.

Tata suffer from a loss of energy due to the natural cooling of steam pipes carrying steam to the electricity generating plant. This is mainly due to old or damaged insulation on steam pipes.

Look into methods of improving insulation, taking into account that the pipes need to be inspected regularly and are outdoors.

## Team 58

**Gower College Swansea, Gorseinon  
2  
& Swansea University**

### *Sports Prosthetic*

Team: Ajay Bater  
William Hines  
Ryan Mattick  
Mari Potter  
Holly Robertson  
Vrishank Shrivastava  
Ciaran Sullivan

Teacher: Ceri Davies & Denise Thomas

Engineer: Rhiannon Kingsley, Dr. Hari Arora  
& Sarah Rowland

Medical Engineering is the application of engineering principles to both the human body and to a broad range of instrumentation used in modern medicine. The engineering degree courses at Swansea University draw on the exciting medical research that is taking place within the College of Engineering and the Swansea University Medical School. The research success in the two colleges led to the creation of the £22 million Centre for NanoHealth (CNH), a unique facility linking engineering and medicine.

The quality of life for an amputee can be greatly improved through provision of a prosthetic. However, creating a prosthesis that adequately captures the ability and control of the original limb is a challenge. Certain markets for prosthesis receive a great deal of attention, whereas others are lacking. This project aimed to design an upper limb prosthetic for use in a sporting/active environment, where significant impact can be made. Detailed biomechanics, design and manufacturing methods were to be explored to create a prototype prosthesis. Material selection is one important factor but consideration to the end-user requirements is key.

## Team 59

**Gower College Swansea, Tycoch  
& University of Wales Trinity Saint  
David, School of Applied Computing**

### *Where is my pet?*

Team: Joshua Brudenell  
Jack Croft  
Joshua James  
Lauren Jones

Teacher: Geoff Dawkins & Leigh Rees

Engineer: Dr Kapilan Radhakrishnan

Missing pets are a global problem, and statistics show that there are currently more than 70,000 pets missing in the UK. One in three pets are lost during its lifetime. Microchipping by Petlog is the UK's largest lost and found database that help pet owners to find their beloved pets.

According to the Petlog database around 75% of dogs and 45% of cats are reunited with their owners with use of microchip. The main aim of this project is to develop a tracking device that is cost effective and easy to use by the owners. The device will allow pet owners to see real time information of location and send alerts when necessary.

Develop a thorough understanding of sensors and wireless sensors networks by conducting in depth research. Identify suitable technology to implement a real-time tracking system. Design and develop a device using sensors to fit. Gather data from sensors to track its geographical position.

## Team 60

**Gowerton School  
& Calsonic Kansei**

### *Electronic Kanban System to support Manufacturing at Calsonic Kansei*

Team: William Arnold  
Kori Barton  
Josie Eales-Davies  
Robert Frew  
Mabon Lloyd-Kaniewski  
Amy Chloe Tomkins

Teacher: Vicky James & Amy John

Engineer: Hugh John

Based in Llanelli, Wales, our Technology Centre is primarily engaged in the design and development of products for our European customers. Our European Technology Centre maintains close links with the advanced research and development centre of Calsonic Kansei Corporation in Japan.

Committed to delivering the needs of our customers, we also provide on-site technical services at key customer locations.

Introduce an Electronic Kanban system to support the manufacturing team between Furnace Off-load and Final Assembly WIP Areas.

- Review the manufacturing process and understand the type of data being captured
- Develop a process for the electronic capture of this data between Furnace Off-load and Final Assembly WIP Areas
- Develop a process to manipulate this data into a format that can aide day decision making

Similar paper-based systems are used at Calsonic currently.

The Kanban system must be aligned to both the manufacturing process and the PMC work scheduling system.

## Team 61

### Ysgol Maes y Gwendraeth & National Botanic Gardens of Wales

#### *Off road transporter*

Team: Ethan Bale  
Celyn Clement  
Rhys Davies  
Jessica Ennis  
Toby Price

Teacher: Jonathan Williams

Engineer: Helen John & Peter Lee-Thompson

The National Botanic Garden of Wales opened in May 2000. This made us the first national botanic garden to be created in the new millennium.

Our mission to inspire, educate and conserve has not only made us a beautiful place to visit but a fascinating and relevant one too. We have an amazing collection of over 8000 different plant varieties, spread across 560 acres of beautiful countryside.

Volunteers of the gardens need to carry heavy materials and tools around the botanic gardens over large distances.

Build a product that can transport heavy equipment and materials over large distances, that is strong enough but also safe to use.

The gardens have a lot of voluntary workers, so it must be suitable and easy to use by people of all ages. It should also be environmentally friendly to preserve all wildlife and landscapes.

The gardens include a large area of land of different terrain, which the product must be able to travel across.

## Team 62

### Ysgol Gyfun Gwyr & Eddyfi Technologies

#### *Recycling Water System for our Ultrasonic Probe System.*

Team: Ella Davies  
Oscar Healy  
Marcus Hopkin  
Elliot Hunt  
Luke Matthey  
William Rees  
Amy Southall  
Daniel Williams

Teacher: Gemma Pugh & Alun Rennolf

Engineer: Neil Pearson & Stuart Kenny

Eddyfi UK Ltd (EFI) is a global leader in the supply of NOE equipment across a wide range of industries including aerospace, petrochemical and nuclear.

Eddyfi have steerable robotic systems that can climb steel structures to deploy all kinds of probes to perform measurements. This remote inspection approach allows inspections of areas either difficult or too dangerous to inspect manually.

For typical ultrasonic (UT) inspection, sound is passed through a contact medium such as water or gel to force as much of the sound energy into the material under inspection. To obtain a consistent UT signal when automating these scans, water is continuously supplied requiring substantial volumes of water when inspecting large objects. To reduce water usage, help the environment and assist inspections in remote locations such as deserts, the ability to recycle the water would be hugely beneficial.

Engineer a working prototype of a water recycling system that can be used on the Rapid Motion Scanner (RMS) product developed by Eddyfi Technologies.

# Torfaen

## Team 63

### Croesyceiliog School 1 & Kier

#### *Plastics*

Team: Alex Courtney  
Lucas Evans  
Anna Mingulova  
Gabriel Mulcahy  
Charlotte Wilkinson

Teacher: Nizar Richi & Geraldine Tarr

Engineer: Amanda Swoboda & Nick Hamersley

Kier Group plc is a UK construction, services and property group active in building and civil engineering, support services, public and private housebuilding, land development and the Private Finance Initiative.

There is a current problem around the recycling of plastics and making something that will benefit the construction industry.

The task is to think of something that will benefit the construction industry which will be made from recycled plastic. Take into consideration the sustainability of the product.

There will need to be ongoing site visits.

## Team 64

### Croesyceiliog School 2 & Kier

#### *Plastics*

Team: Katie Brooking  
Iwan Davies  
Jordan Maynard  
Jamie Metcalfe  
Keira Winter  
Joseph Young

Teacher: Nizar Richi & Geraldine Tarr

Engineer: Amanda Swoboda & Nick Hamersley

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The task is to think of something that will benefit the construction industry which will be made from recycled plastic. Take into consideration the sustainability of the product.

There will need to be ongoing site visits.

## Team 65

### Croesyceiliog School 3 & Kier

#### *Plastics*

Team: Orren Berry  
Liam Boycott  
Amelia Davies  
Aimee Hunter  
Tom O'Donnell  
Taylor Roberts

Teacher: Nizar Richi & Geraldine Tarr

Engineer: Amanda Swoboda & Nick Hamersley

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The task is to think of something that will benefit the construction industry which will be made from recycled plastic. Take into consideration the sustainability of the product.

There will need to be ongoing site visits.

## Team 66

### Croesyceiliog School 4 & Irvin GQ

#### *Airdrop Sequencing Mechanism for a Ballistic Payload*

Team: Joseph Messoro  
Leah Owen  
Harvey Sparrow  
Ella Williams  
Ethan Williams  
Preeti Yongya

Teacher: Nizar Richi & Geraldine Tarr

Engineer: Martyn Jones & Michael Fieldhouse

IrvinGQ is the world leader in specialist Aerial Delivery Systems. Originally founded in 1919, the company has led military parachuting for the past 100 years.

The problem is how to restrain a 1.5m diameter 'ball' weighing ~12,000kg on an Aerial Delivery (AD) platform during flight before it is extracted from the aircraft. Once extracted the ball is to be released so that it can freefall to earth, before parachutes are deployed stabilising the platform for controlled descent.

IrvinGQ has designed a new AD platform called ATAX. There is a requirement to transport and release into freefall a heavy spherical mass. This project explores the potential methods of separating the mass from the platform immediately following aircraft extraction.

The mass must be properly restrained whilst in the aircraft to appropriate military standards, and then released once clear of the aircraft post extraction. The platform must be recoverable. The team must gain a deep understanding of the AD sequence of operation and devise a reliable method of achieving this objective.

## Team 67

### St Alban's RC High School 1 & Meritor

#### *Pad Profile Measurement System*

Team: Alex Davies  
Thomas Harvey  
Cameron Haywood  
Thomas O'Brien  
Sian Phillips

Teacher: Chris Powell

Engineer: Mark Norman, Cerys John  
& Rhys Watkins

Meritor is a leading global supplier of drivetrain, mobility, braking and aftermarket solutions for commercial vehicle and industrial markets.

Meritor HVBS Cwmbran specialises in air disc brakes, which are designed, tested and manufactured for various suppliers and applications.

The problem is with regards to measuring the different modes of deflection on brake pads.

Design a suitable measuring system to record the profile of a brake pad after test. 8 set locations need measuring, but all positions vary with different types of pads. The fixture needs to be adjustable.

Consider the cost of the method and how quickly it can be performed.

## Team 68

### St Alban's RC High School 2 & Meritor

#### *Pad Profile Measurement System*

Team: Ffion Adams  
Timothy Bela  
Charlotte Chipper  
Anna Davey  
Anastasiya Gwinnell  
Ben Morris

Teacher: Chris Powell

Engineer: Mark Norman, Cerys John  
& Rhys Watkins

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