

For more information go to
www.stemcymru.org.uk



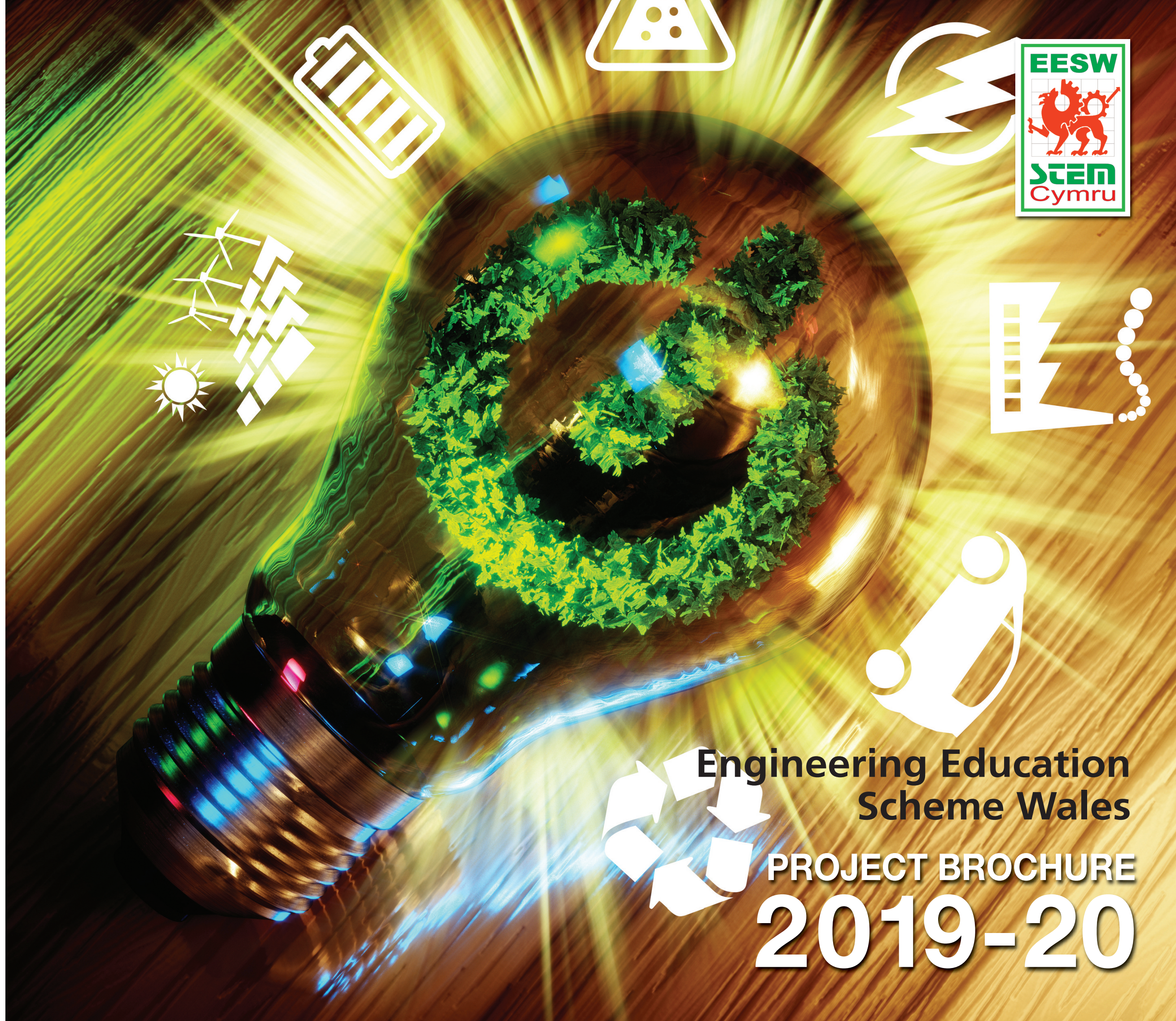
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Engineering Education Scheme
Wales is grateful for the EU funds
which have supported STEM Cymru
II and the continued support from
the Welsh Government.

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Engineering Education Scheme Wales

PROJECT BROCHURE 2019-20

Sponsorship of EESW Awards

Our Sponsors and Partners



Thursday 19th March 2020

	Best Use of Engineering Principles
	Best Overall Team Performance
	Best Chemical/Process Engineering Design
	Best Application of Engineering and Technology
	Best Appreciation of Safety Issues
	Most Effective Presentation of the Chosen Solution
	Most Innovative Application of an Existing Technology

	Best Working Model or Prototype
	Best Project for Sustainability/Environmental Protection
	Project with the Most Commercial Potential
	Best Energy Appreciation
	Most Innovative Solution to the Project Set
	Best Overall Written Report



Wednesday 1st April 2020

	Best Overall Team Performance
	Best Application of Engineering and Technology
	Best Use of Mechanical Engineering Principles

	Best Application of Science
	Project with the Most Commercial Potential
	Best Overall Written Report



Engineering Education Scheme Wales

We welcome you to the annual EESW Awards and Presentation Day at the Big Bang Near Me Wales. This year is particularly special as it marks our 30th anniversary.

The EESW 6th 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.

Over the years, thousands of sixth form students have enjoyed the benefits of working on our industry-linked projects. Here are some comments from past students:

"The skills I have gained throughout the Project are invaluable. This has further enhanced my desire and aspiration to be a design engineer when I am older."

"This EESW industry challenge was a chance for me to explore the world of engineering and helped me decide to study it at university."

"I am very grateful for the time and effort that the EESW dedicate in order to give opportunities such as this to students like myself across Wales and hope that pupils can continue to benefit in future. I think that the scheme is an excellent way to introduce engineering to school pupils, and an exciting way to spark an interest in innovation and creative thinking."

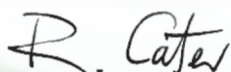
As part of the Big Bang competition, teams attending our events will be selected to represent Wales at The UK National Big Bang Fair in 2021. We are very pleased to be holding the Big Bang North Wales in Venue Cymru, Llandudno once again this year. The South Wales event is being held at MOD St. Athan for the second time and we are very grateful to Wing Commander Ben Trapnell and his staff, particularly FS Kevin Wilkin, for allowing us to use the facilities and for all their help in preparing for the event.

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 North, West Wales and the Valleys. 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 2019-20

Big Bang South Wales

Thursday 19th March 2020 – MOD St Athan, Barry

Team	School/College	Company	Page
Blaenau Gwent			
1	Coleg Gwent – Blaenau Gwent Learning Zone	National Museum of Wales - Big Pit	1
Bridgend			
2	Brynteg School	Capita - Redstart	1
3	Coleg Cymunedol Y Dderwen	Zimmer Biomet	2
4	Cynffig Comprehensive School	Zimmer Biomet	2
5	Ysgol Gyfun Gymraeg Llangynwyd 1	Sony UK Tec	3
6	Ysgol Gyfun Gymraeg Llangynwyd 2	Sony UK Tec	3
7	Bryntirion Comprehensive School	BBC Wales	4
Caerphilly			
8	Lewis Girls' School	University of South Wales	4
9	St Cenydd Community School 1	University of South Wales	5
10	St Cenydd Community School 2	University of South Wales	5
Cardiff			
11	Bishop of Llandaff CIW High School	Arup	6
12	Cardiff and Vale College 1	EESW	6
13	Cardiff and Vale College 2	EESW	7
14	Cardiff Sixth Form College 1	Network Rail	7
15	Cardiff Sixth Form College 2	Network Rail	8
16	Cardiff Sixth Form College 3	Network Rail	8
17	Fitzalan High School	Transport for Wales	9
18	Howell's College	Renishaw	9
19	Llanishen High School 1	Cardiff University - School of Computer Science	10
20	Llanishen High School 2	Cardiff University - School of Computer Science	10
21	St David's Catholic Sixth Form College 1	Cardiff University - School of Computer Science	11
22	St David's Catholic Sixth Form College 2	Cardiff University - School of Computer Science	11
23	St Teilo's CIW School	Eastman Chemical Company	12
24	Whitchurch High School 1	Associated British Ports	12
25	Whitchurch High School 2	Associated British Ports	13
26	Ysgol Gyfun Gymraeg Plasmawr 1	Cardiff Metropolitan University	13
27	Ysgol Gyfun Gymraeg Plasmawr 2	Cardiff Metropolitan University	14

Team	School/College	Company	Page
Carmarthenshire			
28	Queen Elizabeth High School	University of Wales Trinity St David - Computing	14
29	Ysgol Dyffryn Aman	TRJ	15
30	Ysgol Dyffryn Taf 1	GD Harries	15
31	Ysgol Dyffryn Taf 2	GD Harries	16
Monmouthshire			
32	Haberdashers' Monmouth Schools	General Dynamics UK	16
Neath Port Talbot			
33	St Joseph's School and Sixth Form Centre 1	Swansea University - Materials	17
34	St Joseph's School and Sixth Form Centre 2	TATA Steel	17
Newport			
35	Bassaleg School	Newport Wafer Fab	18
36	Caldicot School 1	Newport Wafer Fab / Microsemi, a Microchip Company	18
37	Caldicot School 2	Newport Wafer Fab / Microsemi, a Microchip Company	19
38	Rougemont School	Safran Seats	19
39	St Joseph's RC High School	CAF Rail	20
Pembrokeshire			
40	Ysgol y Preseli	Mainstay Marine	20

Team	School/College	Company	Page
Rhondda Cynon Taf			
41	Aberdare Community School	Dwr Cymru Welsh Water	21
42	Cardinal Newman Catholic School 1	Arup	21
43	Cardinal Newman Catholic School 2	Arup	22
44	Treorchy Comprehensive School 1	AECOM	22
45	Treorchy Comprehensive School 2	FSG Tool and Die Ltd	23
46	Ysgol Gyfun Rhydywaun	RCT County Borough Council	23
Swansea			
47	Bishop Gore School	University of Wales Trinity Saint David - Engineering	24
48	Bishop Vaughan Catholic School	Vale	24
49	Gower College Swansea - Gorseinon Campus	TATA Steel	25
50	Gower College Swansea - Tycoch, Computing 1	University of Wales Trinity Saint David - Computing	25
51	Gower College Swansea - Tycoch, Computing 2	University of Wales Trinity Saint David - Computing	26
52	Gowerton School 1	University of Wales Trinity Saint David - Engineering	26
53	Gowerton School 2	University of Wales Trinity Saint David - Engineering	27
54	Ysgol Gyfun Gwyr	Eddyfi Technologies	27
55	Ysgol Gyfun Gymraeg Bryntawe	Swansea University – Electrical Engineering	28
Vale of Glamorgan			
56	Whitmore High School	Morgan Sindall	28

Big Bang North Wales

Wednesday 1st April 2020 – Venue Cymru, Llandudno

Team	School/College	Company	Page
Conwy			
1	Ysgol Bryn Eliau 1	Lubrizol Mostyn	29
2	Ysgol Bryn Eliau 2	KnitMesh	29
3	Ysgol Dyffryn Conwy 1	Airbus UK, Broughton	30
4	Ysgol Dyffryn Conwy 2	TATA Steel, Shotton	30
5	Ysgol Eirias	Bangor University	31
Denbighshire			
6	Ysgol Glan Clwyd	Qioptiq	31
7	Prestatyn High School	WSP UK	32
Flintshire			
8	Alun School 1	JCB Transmissions, Wrexham	32
9	Alun School 2	Bangor University - School of Medical Sciences	33
10	Coleg Cambria Deeside Sixth Form Centre	UPM, Shotton	33
11	Connah's Quay High School	Airbus UK	34
12	Hawarden High School	Raytheon	34
Gwynedd			
13	Coleg Meirion Dwyfor, Dolgellau 1	Dwr Cymru Welsh Water	35
14	Coleg Meirion Dwyfor, Dolgellau 2	Dwr Cymru Welsh Water	35
15	Coleg Meirion Dwyfor, Pwllheli 1	Dwr Cymru Welsh Water	36
16	Coleg Meirion Dwyfor, Pwllheli 2	Dwr Cymru Welsh Water	36
17	Coleg Meirion Dwyfor Pwllheli Sixth Form Hub	Mott MacDonald	37
18	Ysgol Friars 1	Coleg Llandrillo Marine Engineering	37
19	Ysgol Friars 2	WSP UK	38
Isle of Anglesey			
20	Ysgol David Hughes	Bangor University School of Medical Sciences	38
21	Ysgol Uwchradd Bodedern	Holyhead Marine Services	39
22	Ysgol Uwchradd Caergybi 1	BAE Systems	39
23	Ysgol Uwchradd Caergybi 2	BAE Systems	40

South Wales

Blaenau Gwent

Team 1

**Coleg Gwent – Blaenau Gwent
Learning Zone
& National Museum of Wales - Big
Pit**

Coal Mine Engineering

Team: Luke Mitchell
Tomos Savage-Taylor
Lewys Sherrat-Briggs
Luke Walden

Teacher: Dr Shaun Andrews

Company link: Sharon Ford

Big Pit is one of 7 Amgueddfa Cymru- National Museum Wales sites. It welcomes 150,000 visitors every year, including 50,000 formal learning visitors. The main attraction is the underground tour, which takes place 90m underground in the former coal mine.

Our aim is to enhance visitors understanding of Science, Technology, Engineering and Mathematics (STEM) and the important role these subjects played in Wales' industrial history and our modern world.

The project brief is to research, design and construct an exciting and engaging educational model, of a particular aspect of Coal Mine Engineering, that can be used to demonstrate the importance of the STEM subjects, to educate visitors of the Museum.

Bridgend

Team 2

**Brynteg School
& Capita - Redstart**

Off-Grid Classroom

Team: Megan Acaster
Tyler Edwards
Moustafa Fadel
Rhys Jenkins
Joseph Lee
Phillip Lomax
Matthew Ludlow
Shi Yan Xie

Teacher: Jon Catton

Company link: Ian Walsh & Stephanie Lewis

A local Welsh secondary school is looking to extend its existing building to accommodate 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.

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 3

Coleg Cymunedol Y Dderwen & Zimmer Biomet

Develop a tool to help insert an Advantage Acetabular Cup

Team: Karna Eagle
Joshua Floyd
Lloyd Griffiths
Connor Partridge
Lewis Sincock

Teacher: Sarah Sutor

Company link: Annabelle Boardman & Sian Williams

Zimmer Biomet is a global leader in musculoskeletal healthcare. We design, manufacture and market a wide range of orthopaedic reconstructive products.

The Advantage Acetabular Cup is an anatomically shaped Acetabular Hip Component which forms part of a total hip replacement. This cup is different to most because the articulating surface is built into the metal frame which is fixed in the Acetabulum. The surface must not be damaged while inserting it into the acetabulum and a force must be applied to ensure it does not move.

Design a reusable acetabular cup inserter instrument which does not mark the articulating surface of the cup but can be used for multiple sized components and must withstand the impaction forces required to fix the cup in the Acetabulum.

Additional things to consider would be- the instrument must be reusable and hence cleanable and sterilizable. It must also be able to be used with all sizes in the Advantage Acetabular Cup portfolio.

Team 4

Cynffig Comprehensive School & Zimmer Biomet

Develop a system with the ability to identify and locate batches throughout the plant

Team: George Llewelyn Buckley
Samuel Ingram
Joseph Lee Powell
Morgan Prime
Alex Ian Underhill
William Warrender-Vaughan

Teacher: Daniel Morrish & Christopher Berry

Company link: Scott Morris & Anthony Harrison

Zimmer Biomet is a global leader in musculoskeletal healthcare. We design, manufacture and market a wide range of orthopaedic reconstructive products.

At our Bridgend facility we process circa 21,000 parts through the plant per week. With batch size an average of 12 parts, we are processing approximately 1,750 batches weekly. We also deal with product that is non conforming, where batches are placed in hold locations. This means that we can have thousands of batches in the plant at any one time.

It can be problematic to identify where any of these batches are in the system, and it takes large amounts of man hours to physically locate the batches. This issue affects our ability to be able to react to customer demand, adhere to schedule and drive our inventory to target.

Develop a system to be able to identify and locate batches throughout the plant:

- Use an RFID method to tag the batches
- Ensure that the batches are identifiable by their unique batch number
- Be able to plot the location on a site map in order that locating the batch is simple and quick

Team 5

Ysgol Gyfun Gymraeg Llangynwyd 1 & Sony UK Tec

Insertion testing

Team: Charley Birch
Dewi Jones
Elis Richards

Teacher: Catrin Penry-Williams

Company link: Mezz Davies & Shreya Rijal

Sony UK Technology Centre (UKTEC) is an electronics factory based in Pencoed, Bridgend, South Wales that manufactures a variety of electronic products; from Broadcast Cameras that are frequently found in TV studios across Europe, to Raspberry Pi microcomputers that are sold to customers across the world.

Our Parts Quality Assurance (PQA) department must perform tests to ensure that the parts we use meet our high standards of quality. One of the tests performed on these connectors is an Insertion Test which is performed on the connectors fitted to the Raspberry Pi.

Performing this test manually can take days and is very difficult to perform accurately due to variations in factors such as insertion angle and insertion force.

Create a test method that will increase speed and/or accuracy of insertion tests. Your solution should consider factors such as test speed, insertion angle and insertion force and should allow users to track test progress.

Team 6

Ysgol Gyfun Gymraeg Llangynwyd 2 & Sony UK Tec

Insertion testing

Team: Rhodri Bayliss
Ioan Evans
Cameron Hughes
Iestyn James

Teacher: Catrin Penry-Williams

Company link: Mezz Davies & Shreya Rijal

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Caerphilly

Team 7

Bryntirion Comprehensive School & BBC Wales

Reducing the carbon footprint of Newsgathering at BBC Wales

Team: Alex Allen
Harry Chatham
Geraint David
Cian Ellis
Shay Pritchard
Shannan Servini
Rhys Walters

Teacher: Leighton James

Company link: Guto Thomas, Brian Davidge,
Fintan McNamara & Phil Stokes

The main BBC headquarters in Wales is Broadcasting House in Llandaff, Cardiff - although we are currently in the process of moving to the heart of our capital city, at Central Square.

Technology plays a big part in enabling effective newsgathering – many of which have changed dramatically in recent years. Newsgathering methods currently include the use of satellite trucks, self-operated broadcast vehicle, 3/4G mobile bonding backpacks, iPhones and Macbooks and SD cards. All of these have pros and cons when we consider their 'green' credentials.

Research greener ways of Newsgathering but still be true to the core requirement of being able to respond quickly. The brief can be split into two strands, there are the technologies used and also smarter ways of working.

Investigate ways of making the various Newsgathering methods greener and research other, newer methods that may be even greener. Find ways of improving the allocation of resources to news events.

Team 8

Lewis Girls' School & University of South Wales

Design a sustainable common room

Team: Martha Barry
Naomi Clements
Katie Moore
Bethan Nutt
Caitlin Payne
Megan Watkins

Teacher: Dr Steve Pole

Company link: Louise Pennell, Luan Al-Haddad
& Joanne Thomas

The climate is changing and we need to be more energy conscious and efficient. The University of South Wales wants to explore and research the use of sustainable construction materials, off grid living and encouraging wildlife in our lives.

Design a new sustainable sixth form common room at Lewis Girls School, considering the following features:

- Large enough to accommodate 100 pupils with small kitchen and toilet facilities. Only potable water (mains drinking water) is to be provided, all other water must be from renewable sources.
- Made from sustainable materials that will also help with energy usage.
- It is to be "off grid" and needs to generate its own power sources.
- To encourage wildlife, it must support a green roof to accommodate beehives.
- When choosing the site, think about the direction of the sun path and size of plot to accommodate the sustainable energy sources chosen.
- The Construction of the Building must take into consideration the surrounding area, H&S and the prevention of Risk during the Construction of the building must be discussed.

Team 9

St Cenydd Community School 1 & University of South Wales

First Responder Drone

Team: William Gasson
Laura Hartland
Jak Knowles
Connor McCarthy
Ryan Mote
Emily Willis

Teacher: Craig Hughes & Claire Duff

Company link: Louise Pennell & Leshan Uggalla

The University of South Wales was established in 2013 following the merger of the University of Glamorgan and the University of Wales, Newport.

Both the institutions that have come together to create the University of South Wales have a rich and varied history and can each trace their roots back more than 170 years.

USW's Treforest campus is a local university with an extensive Engineering department.

During mountain rescues it can take a long time for supplies/medical equipment to reach casualties.

Design a drone equipped to carry first aid equipment and/or AED for mountain rescue or difficult to reach areas.

Team 10

St Cenydd Community School 2 & University of South Wales

Dynamo Suitcase

Team: Phoebe Barrow-Jones
Mackenzie Barry
Adam Davies
Megan Paynter
Mackenzie Selway
Owain Thomas

Teacher: Craig Hughes & Claire Duff

Company link: Louise Pennell & Leshan Uggalla

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Charging stations at airports can be busy/not working.

The project is to find a greener option for individuals who frequently find themselves at charging points in airports.

Our aim is to conserve the kinetic energy produced by the wheels on suitcases and convert it to electrical energy.

Cardiff

Team 11

Bishop of Llandaff CIW High School & Arup

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

Team: Ewan Chadwell
Ammar Osman
Shi Qi Lin
Ella Turner
Hannah Whitfield

Teacher: Ben Hughes & James Bull

Company link: Dan West, Patricia Fenia, Joe Essen
& Jonathan Reynolds

Ove Arup & Partners is a global firm of independent engineers, designers, planners and consultants offering a broad range of professional services.

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.

Conduct a LZC (Low & Zero Carbon) 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 R's of Sustainability" Reduce, Recycle, Reuse. You should:

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

Team 12

Cardiff and Vale College 1 & EESW

Develop a STEM Workshop for KS3

Team: Shaan Jalil
Jack Mead
Ethan Rogers
Xavier Toppar

Teacher: Marc Tothill & Andrew Picton

Company link: Vincent Keating

Develop an in-school workshop for 11-14-year-old students (Key Stage 3) aimed developing pupils understanding of STEM through practical activity.

The workshop should make pupils aware of the importance of their STEM subjects through hands on use of the resources developed.

The team should produce an engaging lesson plan for the workshop as well as the resources and equipment to be used. The equipment should be developed to be cost effective, re-usable, and robust for packing, transporting and use in a school setting.

The workshop developed should be aligned to the national curriculum and illustrate how the skills used relate to industry.

Team 13

Cardiff and Vale College 2 & EESW

Develop a STEM Workshop for KS3

Team: Sepideh Azizi
Jake Butler
Luc Kibblewhite
Jack Whiting

Teacher: Marc Tothill & Andrew Picton

Company link: Vincent Keating

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Team 14

Cardiff Sixth Form College 1 & Network Rail

System for measuring current

Team: Ariel Andhika
William He
Jiani Li
Oliver Liu
Mithun Padmanabhan
Yicheng Shen
Kyle Tang
Taksaporn Tangwanchai

Teacher: Alex Kampas & Gareth Jenkins

Company link: David Hewings

Passenger numbers using the railway in Wales has grown 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 re-signalling a priority as part of the national Railway Upgrade Plan.

Design a system for measuring 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 with 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 in Wales, as further decisions in the design and operation of the train network will be made depending on the measurements obtained by the system.

Team 15

Cardiff Sixth Form College 2 & Network Rail

System for measuring current

Team: Megan Blethyn
Isobell Khan
Ziying Lin
Guillame Macniel
Anlan Qiu
Murat Shafigullin
Wilson Wong

Teacher: Alex Kampas & Gareth Jenkins

Company link: David Hewings

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Team 16

Cardiff Sixth Form College 3 & Network Rail

System for measuring current

Team: Alexandr Andreyev
Ji Dong
Stephanie Jackson
Myles Ng
Kevin Qin
Siyuan Ren
Ozil Zhang

Teacher: Alex Kampas & Gareth Jenkins

Company link: David Hewings

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Team 17

Fitzalan High School & Transport for Wales

Train Door Diagnostics

Team: Osama Abdulamousha
Mahmoud Ajaj
Habib Ali
Mahamed Ibrahim
Hanfa Khan
Zobair Lahmoudi
Sajid Raz

Teacher: Tony Cooke

Company link: Sean Cadogan & Tom Parker

Transport for Wales operates and maintains a fleet of trains across Wales and the borders. New trains are on the horizon but maintaining our ageing fleet of diesel trains presents several challenges.

Train doors remain a significant source of unreliability - many mechanical, pneumatic and electrical components can develop faults. Once a door fails to close at a station, the driver cannot release the brakes. At the maintenance depot, fault finding can be very time consuming and a high number of no fault found incidents are reported, leaving problematic doors at risk of failing again in future.

Design and build a prototype of a system to monitor the health of a Class 150 door by logging the following parameters against time:

- Drive cylinder pressure (analogue)
- Door close control (digital) signal
- Door interlock obtained (digital) signal

This test unit would be fitted temporarily to a train either on depot or during a trial-run. It must therefore be portable and intuitive for a trained technician to use. The unit must interface with the local door controls without interfering with normal operation. Data recorded should be presented in an easily readable format.

Team 18

Howell's College & Renishaw

Tool Tracking System

Team: Asa Cleaver
Sacha Hopkins
Bethan Leeke
Tawhid Murad
Jamie Owen

Teacher: Dr Andrew Ford

Company link: Simon Biggs, Erik Danielsen,
Ben Wallace & Stephen Pickles

At Renishaw we use hand tools to assemble and maintain our products and machines. These are often stored in toolboxes or in shared drawer units between several technicians and operators. Downtime could be incurred if tools cannot be located quickly to complete essential tasks or could even lead to lost or mis-placed tooling having to be replaced.

A solution is required to identify where each tool is, or who is using the tool at any given time. It must be visibly easy to identify and link tools to specific jobs. The system should be able to be used by any operator who requires a specific tool.

The design can be of a purely mechanical nature or feature some form of electronic device / visual communication. The system should be easy to use with a clear representation of missing or unidentified tools.

Team 19

Llanishen High School 1 & Cardiff University - School of Computer Science

Portable Automated External Defibrillator (AED)

Team: Thomas Barclay
Ewan Green
Dylan Jenkins Knowles
Alfred Sewell
Hudhaifa Sulaiman
Charles Tsang
Lewis Vaughan

Teacher: Philippa Wallington

Company link: Matthew Turner, Catherine Teehan
& Kruthi Rajashekar

AEDs are used to help those experiencing sudden cardiac arrest. They are easy to use yet sophisticated machines. For a person suffering Sudden Cardiac Arrest (SCA), every minute without the intervention of a defibrillator can reduce the chances of survival by up to 10%. If a defibrillator is used and effective CPR performed within 3-5 minute of a cardiac arrest, chances of survival increase from 6% to 74%.

Reducing the cost of AEDs would mean more Public Access Defibrillators (PAD)s available for use and significantly increase survival rates. The average cost of an AED is around £1,000 but with the advances in IoT (Internet of Things) technology, we believe this cost can be significantly reduced.

Develop a prototype utilising IoT technology (such as Pis, Arduinos, etc) that is portable and easy to use. Factors to consider would be:

- ensuring full automation
- accurately monitoring patient condition
- ensuring the correct charge is applied
- ensuring the main components are suitably housed to prevent damage

Team 20

Llanishen High School 2 & Cardiff University - School of Computer Science

Portable Automated External Defibrillator (AED)

Team: Salmaan Abdillahi
Sam Bryce
Benjamin Davies
Matthew Hill
Caleb Morris
Scott Owen
Caitlin Preece
Samantha Wallington

Teacher: Philippa Wallington

Company link: Matthew Turner, Catherine Teehan
& Kruthi Rajashekar

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Team 21

**St David's Catholic Sixth Form
College 1
& Cardiff University - School of
Computer Science**

Portable Automated External Defibrillator (AED)

Team: Melanie Benedict
Lucy Edwards
Ffion Hutchings
Joshua James

Lilli Loukisas

Teacher: Matthew Miller

Company link: Matthew Turner, Catherine Teehan
& Kruthi Rajashekar

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Team 22

**St David's Catholic Sixth Form
College 2
& Cardiff University - School of
Computer Science**

Portable Automated External Defibrillator (AED)

Team: Ella Denton
Kashiv Naker-Khawaja
Louis Sbienati
Iona Scott
Zac Shortall

Teacher: Matthew Miller

Company link: Matthew Turner, Catherine Teehan
& Kruthi Rajashekar

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- ensuring the correct charge is applied
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Team 23

St Teilo's CIW School & Eastman Chemical Company

Track and fix air leaks around the site

Team: Kelis Huntley
Jordan Lee Thompson
Josie Turner
Mason Turner
James Wilkes

Teacher: Natalie Neill & Samantha Barry

Company link: Sean Smith, Thet Su Aye Chan,
Euan Abercromby & Hannah Mohsen

Eastman is a global speciality chemical company that produces a wide range of advanced materials, functional products and fibres that are found in many 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.

Air is a key utility required for the running of the plants on site – whether it is for the instruments, purging a vessel, or running a pump. Without it the plant simply cannot run. However air leaks are difficult to track due to the fact that we can't see it, smell it, or often times even hear it. This means compressors will begin to work harder, and so cost the company more to continue running the process. On some plants we are currently losing around 2.5 bar a week. Eastman requires an engineering solution that will eliminate air leaks, before the problem grows.

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 consideration of safety, cost and environmental impact.

Team 24

Whitchurch High School 1 & Associated British Ports

Hydraulic Press

Team: Theo Grima
Clíodhna Higgins
Gregory Rhys Johnson
Emilia Matthews
Elliot Rankmore

Teacher: Mike Williams

Company link: Robert Gray & Tom Toughig

ABP is the UK's leading and best-connected port owner and operator. Our network of 21 ports around Britain offer unparalleled marine, road and rail access to domestic and international markets. ABP also owns the UK's busiest rail freight terminal at Hams Hall located in the heart of the country.

The problem: We need to press a slew shaft of a quayside crane into a slew gear.

For the task you will need to build a frame that will allow you to align the shaft and the gear that has an interference fit, the gear itself needs to be heated to allow the shaft to press through, once cooled the gear shrinks onto the shaft.

The frame must be strong but be able to move it, you must be able to lower the shaft and gear into the frame and remove once coupled, there must be guarding around the sides but able to see how if it has gone correctly, must have a way to align the shaft and the gear but allow to move with the shaft to stop any damage.

Team 25

Whitchurch High School 2 & Associated British Ports

Hydraulic Press

Team: Hannah Agius
Cara Erasmus
Rifath Hamid
Zubair Harari
David Woodcraft

Teacher: Michael Williams

Company link: Robert Gray & Tom Toughig

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Team 26

Ysgol Gyfun Gymraeg Plasmawr 1 & Cardiff Metropolitan University

A Sustainable Transport System for Cardiff

Team: Anwen Dyban-Sully
Cadi Hicks-Jones
Aidan Richards
Mia Townshend
Owen Wade
Cai Walsh

Teacher: Gareth Hall Williams

Company link: Clara Watkins & Joe Venables

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. The University is made up of five schools, including the Cardiff School of Art & Design.

Our University's purpose is to deliver high quality and high impact practice-focused and professionally recognised education, research and innovation in partnership with our students and industry.

Cardiff is the second fastest growing city in the UK, and like all cities, transport is crucial for its operation. Currently, our roads are congested, our cycle paths inadequate, and the use of fossil fuels destined for transition. The waste we leave behind and its effect on our climate are becoming increasingly visible. Welsh government are making plans to implement large changes to the way the people of Cardiff will travel in the future.

Cardiff Metropolitan University has set the task of creating a transport system for the future - one built with sustainability, the environment and cost effectiveness in mind. The brief is open ended and can be set in present Cardiff or the Cardiff of the future.

Carmarthenshire

Team 27

Ysgol Gyfun Gymraeg Plasmawr 2 & Cardiff Metropolitan University

A Sustainable Transport System for Cardiff

Team: Luchia Cook
Beca Davies
Thomas Gallimore
Daniel Howes
Ffion Humphreys
Dyfan Lloyd-Owen
Ioan Llywelyn

Teacher: Gareth Hall Williams

Company link: Clara Watkins & Joe Venables

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Team 28

Queen Elizabeth High School & University of Wales Trinity St David - Computing

Find my Bicycle

Team: Amy Louise Bond
Arthur Evans
Jack Foxton
Joel Griffiths
Jayanth Mummidi
Olivia Sharif
Mia Squires
Nandika Teeluck

Teacher: Sharon Magill

Company link: Dr Kapilan Radhakrishnan
& Dr Carlene Campbell

The University of Wales Trinity Saint David (UWTSD) was formed on 18 November 2010 through the merger of the University of Wales Lampeter and Trinity University College Carmarthen, under Lampeter's Royal Charter of 1828. In 2011 HRH the Prince of Wales became its Royal Patron.

Every year thousands of cycles are stolen in the UK. Bike security is a serious issue faced by Cyclists. Technology could help tackle the issue.

Design and develop a device using wireless sensors that could be fitted on cycles to track its geographical position.

- 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 onto cycles.
- Gather data from sensors to track its geographical position.

Team 29

Ysgol Dyffryn Aman & TRJ

Wellbeing and Sustainability are the fundamentals of a 21st Century Classroom

Team: Helen Dimmer
Louise Flynn-Phillips
Tomas Waterson

Teacher: James Thomas

Company link: Kristy Tillman, Julie Jones
& Nathan Rees

T Richard Jones (Betws) Ltd have been established in Ammanford since 1935, with diverse operations to include; Construction, Demolition, Recycling and Civil Engineering. They are keen to seek opportunities and innovation to allow their operations to be sustainable. Clients to include developers and local authorities endeavour to procure schemes to enhance the environment and provide sustainable futures. Local authorities continue to invest in their schools as part of the 21st Century Schools Programme.

The team should examine their existing teaching environment, with a proposal to improve the 21st Century classroom to promote wellbeing and sustainability through an authentic learning environment. It is envisaged that the psychology and social interaction will be enhanced as a result, with positive impact on attainment and wellbeing.

Design a classroom with elements and components that enhance wellbeing and sustainability of features, with the enhancement of smart technology to include augmented reality. Research similar existing projects such as the SPECIFIC Active Buildings concept at Swansea University to assist with the design.

Team 30

Ysgol Dyffryn Taf 1 & GD Harries

Communications in haulage with difficult signal areas

Team: Edward Carpenter
Sasha James
Teagan Mason
Philip Mead

Teacher: Richard James

Company link: Simon Dorken

GDH are the primary suppliers of crushed stone, asphalt and concrete products in west wales, with 6 quarries, 3 asphalt plant and 7 concrete plants.

Communication between our fixed and mobile assets can be hindered by poor reception due to the topography and range.

Review and identify the most efficient methods of communication between our assets.

There is potential for the use of third-party equipment, to extend the range of communication within our operating area.

Consider the cost and ease of use, alongside the legal constraints associated with using communications whilst on the move.

Monmouthshire

Team 31

Ysgol Dyffryn Taf 2 & GD Harries

Communications in haulage with difficult signal areas

Team: Rhys Goymer
Iolo Morgan Rees
Jack Thomas

Teacher: Richard James

Company link: Simon Dorken

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Team 32

Haberdashers' Monmouth Schools & General Dynamics UK

Brand

Team: Sam Day
Jonah Harrison
Matthew Hotston
Rose Li
Ben Morgan
Sabrina Pun
Rowan Saxton
Dan Taylor

Teacher: Keiran Chaplin

Company link: James Butler

General Dynamics UK (GDUK)'s Oakdale site is home to one of GD Mission Systems' EDGE Innovation Sourcing Network (ISN) centres. The centre contains several stands that have been specially designed to display new technologies which are of heavy single piece wooden construction and don't meet the business' current needs for a flexible, reconfigurable solution that can be quickly and easily relocated.

Design and prototype a new portable EDGE ISN stand that can be quickly disassembled, packaged for transport and reassembled. It must be strong and robust enough to support several flat panels displays on its upper front elevation alongside smaller pieces of portable technology (e.g. tablets, smartphones). Evaluate alternative construction materials, select preferred materials and propose a design that leverages the benefits of the selected materials.

Create working scale models of the design and consider alternative solutions for housing additional hidden equipment required to support the equipment on display (laptop PCs, power supplies, small network equipment) and the routing of cables. Propose alternative methods of providing reconfigurable signage and branding for the stand.

Neath Port Talbot

Team 33

**St Joseph's School and Sixth Form
Centre 1 & Swansea University –
M2A**

Corrosion of nickel-plated steel

Team: Phoebe Davies
Lauren Dougan
Eseobong Essien
Angel Gigi
Charlotte Humphries
Erin Jones
Anastasia Lynch

Teacher: Sam Williams

Company link: Rhiannon Kingsley, Dr Mark Coleman
& Rebecca Waldram

The Materials and Manufacturing Academy (M2A) runs funded postgraduate projects in the Materials Science and Engineering department within Swansea University, based on the Bay Campus.

Localised corrosion can occur on nickel-plated objects such as keys, tools and jewellery when porosity in the plating means electrolyte can reach the substrate.

Look into the effect this porosity could have on products, by creating model defects in nickel plated steel samples. Use a range of techniques to study the effect of porosity and subsequent substrate exposure on the integrity and longevity of everyday products. Investigate how contact with different electrolytes (DI water, saltwater and detergent) effects the samples provided.

Design a test set-up for monitoring the onset of corrosion caused by a droplet placed over a defect in the surface of a sample with a digital camera. Use data analysis information to work out which environments cause the greatest issue for nickel plated steel products.

Team 34

**St Joseph's School and Sixth Form
Centre 2 & TATA Steel**

Coke Breeze Build Up in Clean Water Basin

Team: Ryan Hacker
Iqra Hassan
Alex Hussell
Rory James-Deane
Evan Jenkins
Joshua Price
Vincenzo Rabito
Lewis Thomas

Teacher: Sam Williams

Company link: Carys Chambers

At Port Talbot, the Coke Ovens produces Coking Coal which supplies the Blast Furnace, where in turn it gets used as a part of the burden whilst making liquid iron. When the coking coal is quenched large quantities of coke dust, coke breeze and coke fines are washed into our settling ponds. The purpose of the settling ponds is to separate the coke dust, coke breeze and coke fines from the quench water so this water can then be re-used in a Quench operation again. These coke fines, dust and breeze build up in the clean water basin, where the Quench pump draws the water from to fill the tanks up. The level of the coke breeze rises to above the pumps' suction legs and therefore the pumps begin to deteriorate and the coke breeze settles in the distribution pipework and tanks. These pumps are critical within Coke Making and without them production must stop, costing an estimated £15,000 per hour.

- Identify a method of determining the level of Coke Breeze in the Clean water Basin without manual intervention
- Generate some concepts on alternative filter baskets to prevent the coke breeze entering the clean water basin.

Newport

Team 35

Bassaleg School & Newport Wafer Fab

Designing Educational Workshops for STEM Subjects for primary school

Team: Zainab Bashir
Luke Goodwin
Harvey Lee
Joshua Legg
Jack Patey
Anna Ross
Scott Williams

Teacher: Steph Snellgrove

Company link: Joanne Daniels, Adam Bil
& Raymond James

To actively support increased understanding for 9-11 year olds (primary level) of STEM subjects by how STEM fits with qualifications and career opportunities in the local area.

Create a 45-60 minute- activity workshop at KS2 level for primary education. Focus of the Workshop should be a STEM related and where possible to have a flow through link to Semiconductor industry. Create a circuit where a microchip could be used.

Align the activity to the national curriculum and design how these skills are used by industry. Design two mascots/logos - in the shape of Microchips.

Workshop designs must use items that are sustainably sourced, recyclable and be cost-effective. You should consider Health & Safety and class size for the Workshop will be on average 30 students.

Team 36

Caldicot School 1 & Newport Wafer Fab / Microsemi, a Microchip Company

Designing Educational Workshops for STEM Subjects for primary school

Team: Holly Butler-Smith
Jack Clifford
Adam Grenyer
Callum Jones
Kieron Leahy
Adam Policarpou
Ethan Silcox
Michael Wall

Teacher: Richard Scott & Mark Sheridan

Company link: Joanne Daniels, Michelle Taylor,
Felix Campano Casado, Rob Bowen,
Adam Bil & Raymond James

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Team 37

Caldicot School 2 & Newport Wafer Fab / Microsemi, a Microchip Company

Designing Educational Workshops for STEM Subjects for primary school

Team: Joshua Finch
Alex Kartal
Morgan Voaden
Finlay Williams
Casey Wilson

Teacher: Richard Scott & Mark Sheridan

Company link: Joanne Daniels, Michelle Taylor,
Felix Campano Casado, Rob Bowen,
Adam Bil & Raymond James

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Team 38

Rougemont School & Safran Seats

Develop a design concept to close the dynamic gaps between a double seat

Team: Harry Bagwell
Ben Edwards
Joel Evans
Destina Yaman
Josie Young

Teacher: Jane Goodwin

Company link: Peter Carr

Safran Seats GB designs and manufactures premium aircraft seating. We produce a wide range of 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 give passengers a great experience every time.

All seating products offer a range of seating positions, from a partial recline to a fully flat sleeping surface. As seats move gaps can often appear and pose potential safety hazards to passengers. A normal double seat is typically supplied with a central console which 'seals' against each seat, but Zodiac wish to investigate the possibility of providing two seats together with no dividing feature. But how do we prevent hazardous gaps and openings occurring during a full range of motion?

Develop a concept and investigate opportunities to close the gaps during all phases of seat motion from upright to a fully flat position. The team should determine the basic geometry of a seat, the potential motion and should consider the basic requirements of a closeout feature on a premium product, provide a range of concepts and provide their recommended solution.

AECOM

AIRBUS

ARUP



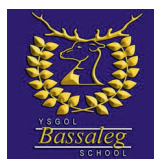
GENERAL DYNAMICS
United Kingdom Limited







Aberdare Community School



Ysgol Yr Esgob Gore
Bishop Gore School
Virtue and Good Literature



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



Cardiff and Vale College
Coleg Caerdydd a'r Fro



Connah's Quay High School



Cynffig Comprehensive School



Fitzalan High Sch



Gower College Swansea
Coleg Gŵyr Abertawe



Monmouth Schools Sixth Form



Queen Elizabeth High School



Rougemont School



St Joseph's RC High School



St Joseph's Catholic School and Sixth Form Centre



St Teilo's
Church-in-Wales High School



Ysgol Dyffryn Taf



Ysgol Eirias



Ysgol Gyfun Gymraeg Llangynwyd



Ysgol Gyfun Rhydywaun



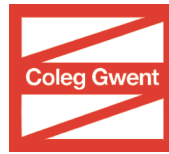
Bishop of Llandaff CIW
High School



Bishop Vaughan School



Bryntirion Comprehensive
School



Lewis Girls' School

STEIN Cymru



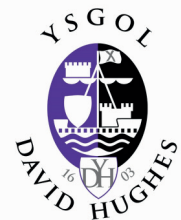
Ysgol Uwchradd Prestatyn High School



Whitchurch High School



Whitmore High School



Ysgol Friars



Ysgol Glan Clwyd



Ysgol Uwchradd Bodedern



Ysgol Uwchradd
Caergybi



Ysgol Y Preseli

Pembrokeshire

Team 39

St Joseph's RC High School & CAF Rail

Crab Visibility

Team: Hans Arellano
Ethan Barnes
Hannah Garcia
Elena Kingston
VJ Salongcong

Teacher: Cerys Corbett

Company Adric Marsh & James Walker
link:

CAF manufacture trains in their brand new £32M facility in Newport. They have a shunting machine called the "Crab". This machine is designed to move around finished and unfinished trains around site as required and can operate on road and rail modes. Care is required when coupling up to trains - they weigh in excess of 40T and cost over £2M each. Extreme care is required when going from road to rail modes. If the Crab is not correctly positioned above the rails, then it will not engage into them correctly. As some rails are support 1m above floor level on columns, the machine could easily topple over.

There are two problems that require solving:

1. Improve visibility when coupling up to trains
2. Improve visibility when going between road and rail mode

The system must be:

- Reliable. It must not provide a "false positive", that is state that the rails are correctly engaged when they are not.
- Easy to use. At present, the Crab operator gets out of the Crab to confirm coupling
- Relatively simple in operation. Minimal training should be required
- Relatively inexpensive

Team 40

Ysgol y Preseli & Mainstay Marine

Sea Power

Team: Cerys Chadwick
Archie Dworakowski
Thomas Elliott
Joe Emberson-Marl
Rhys Griffiths
Ioan Roberts
David Varney

Teacher: Duncan Richmond

Company Ellen Rowell & Nigel Sims
link:

Mainstay Marine Solutions Ltd build maintain and repair rugged reliable workboats and marine renewable energy devices at our deep-water facilities in Pembroke Dock, on the Milford Haven waterway in South West Wales.

Fossil fuels are not environmentally sustainable. Green energy technology is needed to provide the world's energy without further damaging the environment.

Design a device for generating electricity from the sea.

There have been many commercial projects to harness the energy from the sea to generate electricity. Try and think of a new way to create the electricity.

Rhondda Cynon Taf

Team 41

Aberdare Community School & Dwr Cymru Welsh Water

Welsh Water 2050

Team: Michael Bayes
Minh Cao
Brandon Houston
Will Hughes
Callum Hutchinson
Jack Jones
Biran Sumbul

Teacher: Darren Jones

Company link: Stephne Puddy & Ben Burggraaf

Welsh Water is owned by Glas Cymru a single purpose company with no shareholders and is run solely for the benefit of customers.

The Glas Cymru business model aims to reduce Welsh Water's asset financing cost, the water industry's single biggest cost. Under Glas Cymru's ownership, Welsh Water's assets and capital investment are financed by bonds and retained financial surpluses.

Financing efficiency savings to date have largely been used to build up reserves to insulate Welsh Water and its customers from any unexpected costs and also to improve credit quality so that Welsh Water's cost of finance can be kept as low as possible in the years ahead.

To reduce the consumption of water by consumers.

We are looking at trying to reduce the water usage during the average shower; and how the water used can be recycled into the toilet system.

We will look at trying to reduce the water flow in the shower by using a rotating bevel, this will make the water supply intermittent (pulse) thus reducing the water used.

Team 42

Cardinal Newman Catholic School 1 & Arup

Reducing micro plastics

Team: Neave Davies
Matthew Evans
Leah Howard
Dylan Williams

Teacher: Richard Lawson

Company link: Jason Prosser, Vera Ngosi
& Patrick Barry

Arup is a multinational professional services firm headquartered in London which provides engineering, design, planning, project management and consulting services for all aspects of the built environment.

To design a solution to remove fibre micro plastics from the waste water produced by washing machines.

Design an active filter/pump that is able to remove particulate pollutants at a micron scale thus improving the quality of water output to the waste water system.

Team 43

Cardinal Newman Catholic School 2 & Arup

Functional safety boot providing shielding from EM Induction sensors

Team: Devan Amin
Jack Bailey
Olaf Kolasa
Gerwyn Lowe
Joseph Mantle
Valentino Sidoli-Williams

Teacher: Richard Lawson

Company link: Jason Prosser, Vera Ngosi
& Patrick Barry

Arup is a multinational professional services firm headquartered in London which provides engineering, design, planning, project management and consulting services for all aspects of the built environment.

To design a solution steel reinforced work boots triggering train sensors while working on or near the rail network.

Design a work boot or modification which can be applied to existing work boots that will enable steel reinforced boots to be worn and used around electromagnetic induction sensors without triggering false detections. This must be safe enough to be worn on site and provide PPE.

Team 44

Treorchy Comprehensive School 1 & AECOM

Off-Grid Education

Team: Evan Bromfield
Rowan Forsyth
Lauren Godfray
Fynley Jones
Libby Pritchard

Teacher: Owen Nelson

Company link: Sian Lewis

AECOM has grown to become the world's No. 1-ranked engineering design firm - delivering integrated, sustainable solutions that help clients and communities in every region of the world create and unlock new opportunities. AECOM Cardiff is a multidisciplinary office based near the city centre railway station.

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 45

Treorchy Comprehensive School 2 & FSG Tool and Die Ltd

Quality Control of FSG001 Test Buttons

Team: Solomon Barrett
William Conway
Daniel Palmer
Ethan Parsons
Alfie Williams

Teacher: Owen Nelson

Company link: Steve Cope

As a company FSG are leaders in their field of high precision and quality components. As such, we work for some of the leading manufactures in the medical, automotive and food packing industries. To satisfy ever changing markets we are constantly evolving to keep up with new technology and customer demands.

Investigate and gather data on our existing process, then analyse and come up with a new and improved procedure. This could mean purchasing new equipment/software or manufacturing custom solutions.

For FSG to regard the project as a viable option you would need to:

- Work to the schedule and meet deadlines.
- Stick within an agreed budget.
- Produce reliable results.
- Report findings and financial payback.

The components are for the medical industry and a critical part used to manufacture replacement Hip and Knee joints. They are used as test pieces to evaluate the adhesion of artificial bone to the parent metal. FSG produce 4000 FSG001 components per month and each goes through a quality assurance procedure (QA) to be signed off before shipping to the customer. For this check we need to control the Diameter and Thickness of the components.

Team 46

Ysgol Gyfun Rhydywaun & RCT County Borough Council

Sustainable Highways

Team: James Davies
Kaitlyn Davies
Kayleigh Davies
Taylor Jones
Abigail Morris
Chloe Richards
Maddison Williams
Sam Williams

Teacher: Kevin Davies

Company link: Roger Waters, Rebecca Smith;
Dylan Kelleher & Adam Griffiths

The A465 Head of the Valleys road is proposed to be dualled between Merthyr and Hirwaun by 2025. There are two routes that provide access into the north of the Cynon Valley, the A4059 (Hirwaun Road) and the B4276 (Merthyr Road).

At peak times, these routes are over capacity and lead to congestion and delays daily. A highway link between Harriet Street roundabout and the Croesbychan junction with the A465 Heads of the Valleys Road is proposed, being a single carriageway two-lane road.

The proposed bypass must be designed in line with "Schedule 3 of the Flood and Water Management Act 2010" and be sufficient to deal with a 1:100 storm plus an additional 30% for climate change. The proposal will also utilise the use of Sustainable Urban Drainage (SuDs) to store and manage the flow of water from the proposed road.

Consider the carbon footprint both during the construction and operation of the bypass. Therefore, consideration will be given to the use of sustainable materials and construction methods to reduce the scheme's carbon footprint.

Swansea

Team 47

Bishop Gore School & University of Wales Trinity Saint David - Engineering

Recycled Carbon Fibre Waste

Team: Tamam Alshekh
Michael Bould
Giorgio Diana
Connor Molloy

Teacher: Joanna Lane

Company link: Andrew Tibbott

The University of Wales Trinity Saint David (UWTSD) was formed on 18 November 2010 through the merger of the University of Wales Lampeter and Trinity University College Carmarthen, under Lampeter's Royal Charter of 1828. The University's Royal Charter is the oldest in Wales and England after the universities of Oxford and Cambridge. In 2011 HRH the Prince of Wales became its Royal Patron.

UWTSD has a core value of operating sustainable and environmentally friendly initiatives. Methods of getting rid of CFRP are costly and not environmentally friendly.

Devise an environmentally friendly method of recycling, re-using or upcycling carbon fibre plastics.

Prove that it is useful and could re-use a significant proportion of CFRP waste.

Team 48

Bishop Vaughan Catholic School & Vale

ASPIRE (Alternative, Smart Platform for Integrated Refinery Energy)

Team: Cameron Andrews
Caitlin Duggan
Corey-Jay Evans
Sadie Ford
Dylan Robinson
Ben Sears
Cameron Wilshire

Teacher: Andrew Smith

Company link: Peter Martin, Jack Davies & Will Pugh

Vale is the largest nickel producer in the world and supplies a wide range of customers from large steel manufactures. At Clydach around 200 people are employed on site which produces approximately 40,000 tonnes of nickel per year. The site is over 117 years old and uses the Mond nickel carbonyl process to refine an impure feed into high purity nickel pellets and powders.

The site has a high CO₂ emission rate – 12 tons per hr. and with the introduction of new laws regarding environmental implications of carbon emissions, there is a pressure to reduce this amount, working towards zero emissions.

The refinery is currently working on a project to reduce its CO₂ emissions, entering the atmosphere from burnt fuel, in line with new government regulations 2030. As part of this project there are two elements that require further investigation: to use existing low-grade H₂O which is at 80°C, which is currently surplus, and a suitable CO₂ capture, usage or sequestration system.

Look into each element and propose a method to use and recommend the most cost and energy effective solution.

Team 49

Gower College Swansea - Gorseinon Campus & TATA Steel

Blast Furnace Stoves Asset Integrity

Team: Reuben Allen
Ziqing Liao
Aidan Nicholas
Shitao Qu
Lucy Roberts
Qiang Wang
Yanfeng Wang

Teacher: Ceri Davies

Company link: Bethany Carnegie

At Port Talbot the Blast Furnace stoves are lined with refractory. The stoves are used to increase and maintain the temperature of hot blast air to the furnace tuyeres. The refractory lining is used for insulating the hot blast air and prevents heat from reaching the carbon steel outer shell.

The blast furnaces have ongoing issues with hot spots on the stove shell where the refractory lining has failed or gas tracking has occurred behind the refractory (more typical). Currently the hand-held thermal imaging camera inspections are not able to identify all hot spots due to limited access and frequency of inspections. These hot spots after a period effect the metallurgy of the shell and leads to premature failure of the shell.

The aim of the project is to;

- Map historic locations of identified hot spots by reviewing Thermography reports for stoves 9,10,11,12,13,14 & 15
- Develop a permanent technique for continuous monitoring of the stoves for hot spots and how this equipment will be maintained. Taking into consideration limitations of equipment, required maintenance and skills required of personnel to operate.

Team 50

Gower College Swansea - Tycoch, Computing 1 & University of Wales Trinity Saint David - Computing

Automated Pollution Detection using IOT/WSN Technology

Team: Denon Berry
Kai Davis
Kelan Hinder
Charlie Keirl
Jake Rosser
Connor Thomas

Teacher: Geoff Dawkins

Company link: Dr Kapilan Radhakrishnan
& Dr Carlene Campbell

Monitoring pollution levels is an essential element of protecting the environment. Undertaking this manually can be time-consuming and often the monitoring cannot be done as often as is needed to gather meaningful data. The growth of the Internet of Things (IoT) and technologies such as Wireless Sensor Networks (WSNs) has great potential for the development of automated solutions, which can be deployed for extended periods and provide data in real-time.

Design and implement a wireless sensor network (WSN) based monitoring system that can measure physical parameters related to pollution levels and displaying the collected data in real-time. Monitoring pollution is a broad area and therefore there is some flexibility for the focus of the project. Two suggestions are a WSN for monitoring air quality or WSN for monitoring pollution levels in water.

These two applications require different approaches and equipment. Research the feasibility of each project and determine which best matches the skillset of the group.

Team 51

Gower College Swansea - Tycoch, Computing 2 & University of Wales Trinity Saint David - Computing

Automated Pollution Detection using IOT/WSN Technology

Team: Shalik Nazeem
Jack Pasquantonio
Peter Siow
Connor Tomkins

Teacher: Geoff Dawkins
Mentor: Jacob James-Machin

Company link: Dr Kapilan Radhakrishnan
& Dr Carlene Campbell

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These two applications require different approaches and equipment. Research the feasibility of each project and determine which best matches the skillset of the group.

Team 52

Gowerton School 1 & University of Wales Trinity Saint David - Engineering

Using Technology to Help Humanity

Team: Isaac Clark
Seren Howells
Chay McCrickard
Owen Parry
Ryan Stagg
Casey Williams

Teacher: Vicky James

Company link: Dr Rachel Alexander
& Andrew Tibbott

The University of Wales Trinity Saint David (UWTSD) was formed on 18 November 2010 through the merger of the University of Wales Lampeter and Trinity University College Carmarthen, under Lampeter's Royal Charter of 1828. The University's Royal Charter is the oldest in Wales and England after the universities of Oxford and Cambridge. In 2011 HRH the Prince of Wales became its Royal Patron.

We need to show how existing technology can be used to solve current problems. Existing technology can be used to help with climate change and to make life easier for the disabled, but the manufacturers do not always know about new technologies.

Design and build a demonstrator that is portable and a working model, that can be taken to events to showcase developments in engineering technology.

Examples could include a model house powered by sun/wind, or a gadget to make life easier for a disabled person.

Team 53

Gowerton School 2 & University of Wales Trinity Saint David - Engineering

Using Technology to Help Humanity

Team: Poppy Ace
Isis Estell-Gibson
Callum Evans
Ella Macey
Ashley Morgan
Ben Smith

Teacher: Vicky James

Company link: Dr Rachel Alexander

The University of Wales Trinity Saint David (UWTSD) was formed on 18 November 2010 through the merger of the University of Wales Lampeter and Trinity University College Carmarthen, under Lampeter's Royal Charter of 1828. The University's Royal Charter is the oldest in Wales and England after the universities of Oxford and Cambridge. In 2011 HRH the Prince of Wales became its Royal Patron.

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Examples could include a model house powered by sun/wind, or a gadget to make life easier for a disabled person.

Team 54

Ysgol Gyfun Gwyr & Eddyfi Technologies

Recycling Water System for our Ultrasonic Probe System

Team: Molly Anderson-Thomas
Matthew Brown
George Cawsey
Lewis Jones
Mirian Lloyd
Dafydd Mills
William Morris
Finlay Richards

Teacher: Alun Rennolf

Company link: Neil Pearson

Eddyfi UK Ltd (EFI) has over 30 years of experience in the design, development, manufacture, and sales of advanced NDT inspection equipment focusing on detecting, locating, and characterizing defect mechanism occurring in all kind of metallic structures.

Ultrasonic (UT) inspection is a well-established method to locate structural flaws in structures such as pipelines and on aircraft and marine vessels. For inspection, ultrasonic sound waves are used to determine the state of the structure and are passed through a contact medium such as water or gel to force as much of the sound energy into the material under inspection. Water is continuously supplied under the probe to fill the varying surface gap between the probe face and the surface, requiring substantial volumes of water when inspecting large objects such as storage tanks or pipeline. To reduce water usage 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 to be used on the Rapid Motion Scanner (RMS) product developed by Eddyfi Technologies.

Vale of Glamorgan

Team 55

Ysgol Gyfun Gymraeg Bryntawe & Swansea University – Electrical Engineering

A Custom Electronic Equestrian Scoreboard

Team: Elisha Davies
Jacob Davies-Hannen
Ruari Gunnenberg
Aaliyah Jaynes
Cameron Jenkins
Ben Lumber
Aled Miller
Luke Willett

Teacher: Rhys Havard

Company link: Rhiannon Kingsley, Dr Timothy Davies & David Moody

The university has been asked by an equestrian centre in Llandeilo, Carmarthenshire to design an equestrian scoreboard. The centre requires a daylight readable screen which can ideally be connected to a computer or other interface for the user to input the score information which is projected onto the screen.

We recommend investigating the use of large 32 by 64 pixel LED matrix panels which can be side and end stacked to create larger displays. Starting with one panel, the display will need to be controlled by a microcontroller, such as a Raspberry Pi or Arduino, depending on the team's expertise.

There will need to be an interface to enter the information, which might be a pad with buttons, or ideally get the micro to "talk" to a PC.

Firstly, carry out a "requirements capture", where you speak to the customer to ascertain their needs.

Once you have agreed the requirements, plan an outline solution researching current panels available on the market and any similar example projects.

Team 56

Whitmore High School & Morgan Sindall

Reduction of Carbon Footprint and General Energy Reduction of Temporary Site Accommodation

Team: Thomas Froud
Reuben Hopkin
Caitlin Meadows
Owen Smith
Bethan Thomas
Ellis Young

Teacher: Dale Gamble

Company link: Steve Langford, Steven Birchenough & Michael Little

Morgan Sindall are a large construction company with projects all over the UK. We are heavily involved in the 21st Century Schools Programme in Wales.

We need to find a way to improve the overall performance of temporary site accommodation in relation to environmental impact and energy performance of these buildings.

Look at all aspects of the building like water usage, storage, heating, lighting, insulation building materials.

When project has been decided upon we will then engage with the specialist architects and engineers so that they can have input on the scheme.

North Wales

Conwy

Team 1

Ysgol Bryn Elia 1 & Lubrizol Mostyn

Road Tanker Off-loading Pump Replacement

Team: Aaron Jones
Owen Jones
Troy Kettle
Finn O'Sullivan
Katie Roberts

Teacher: Neil Humphreys

Company Kevin Hirst
link:

Lubrizol Mostyn leads the world in TAED manufacture and supply for the detergent and biocides industries.

Two of our raw materials are delivered to site by bulk road tanker and transferred from them into bulk tanks. Historically two pumps were installed, one as a duty pump, the other as a standby pump. The pumps are to be replaced as they are now 25+ years old, we experience reliability issues with them and Tank Farm Operators report that they need to run both pumps to offload a tanker in a reasonable time and would also like to be able to pump the pipework dry to minimise spillage when the tanker is disconnected.

Develop a project document considering the options available and proposing, in detail, the pump type, specification including size, materials of construction, pump sealing arrangements, installation details, electrical requirements, maintenance requirements and any protection feature to ensure that the pump is installed to best practice and will deliver reliable operation for a minimum of 10 years.

Consider only using Acetic Anhydride pumps. The team should consider safety, reliability and cost. The pumps are scheduled to be replaced next year and this information will be used to assist us in our decision-making process.

Team 2

Ysgol Bryn Elia 2 & KnitMesh

Mesh Counting System

Team: Adam Arshad
Chloe Newton
Adrian Scarsbrook-Roberts
Jaiden Thomas

Teacher: Neil Humphreys

Company Peter Evans & Aled Williams
link:

KnitMesh Technologies is a leading UK manufacturer of knitted mesh products designed and developed for a wide range of sectors such as automotive, aerospace, telecoms and the military.

Knitted mesh is produced from various metals or mineral and synthetic materials processed into a structure of interlocking loops.

Wire mesh washers currently need to be checked manually as they need to be a specific size. Accurate dimensions only are acceptable. A fast, reliable system is required to improve efficiency.

Team 3

Ysgol Dyffryn Conwy 1 & Airbus UK, Broughton

Dowel Removal Method

Team: Jack Carus-Davies
Iolyn Chennell
Jacob Griffiths
Toby Laurie
James Martin
Sion Sullivan
Elgan Williams

Teacher: Penri Jones

Company link: Joanne Murray, Emily Merrison, Richard Williams, Amani Kausar & Oliver Aldridge

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.

When removing the dowels used to hold the skin of the wing to the ribs (frame) the hammer used can damage the aluminium skin and the countersink hole. This needs to be repaired at extra time and cost. The lifetime service of the aeroplane can also be reduced.

Design and build (if able to do so) equipment that would allow the removal of the dowels without the risk of damage to the aluminium countersunk holes.

Any idea/solution can be presented, so long as decisions for doing so are fully justified. There is a cost limitation for the potential design proposal.

Team 4

Ysgol Dyffryn Conwy 2 & TATA Steel, Shotton

Leveller Cassette Rig

Team: Matthew Cawley
Mali Evans
Jack Hardy
Nellija Pelite
Mari Roberts
Susam Tezgel
Lochlan Watson

Teacher: Penri Jones

Company link: Julie Baddock & Hamza Abbas

TATA Steel manufactures sheet steel for companies at the Shotton plant.

The production line consists of tension levellers, with their purpose to level and improve the flatness of the steel strip. The project will focus on the tension leveller on our galvanising line which incorporates an anti-curve section where, as the name suggests, the purpose is to keep the strip flat and free from deformations.

With new people coming into the business and working on the process of the line, they have raised concerns regarding one of the four cassettes which has to be put on the stand inverted making it difficult to carry out maintenance.

Currently the cassettes are turned when changing work rolls or carrying out maintenance by the use of slings and planks of wood, leaving workers open to potential hazards (trapping fingers, crushing).

Design and build a rig for this work to be done with much lower risk factor. There are no limitations as to what materials you use to build the rig. But there is a cost limitation for your potential design proposal.

Denbighshire

Team 5

Ysgol Eirias & Bangor University

Visualising Student Attendance Data

Team: Matthew Browne
Joshua Hall
George Houghton-Mari
Aedan Jones

Teacher: Mike Hodges

Company link: Cameron Gray

The School of Computer Science and Electronic Engineering at Bangor University would like to begin analysis on student attendance data generated an electronic registration system.

The brief/task and design requirements:

The project team should investigate the possible analyses that could be conducted, and then design a method to visually communicate the results of the analysis.

We would like to receive as outputs:

- the set of descriptions of the data used.
- the data-driven question you've decided to answer.
- details of the methods used to process and/or summarise the data.
- the design process arriving at your final visualisation.
- the code for the visualisation.

Team 6

Ysgol Glan Clwyd & Qioptiq

Automatic system to align and affix a precision lens to a casing

Team: Jay Almond
Dewi Davies
Owain Jones
Daniel Mason-Jones
Rhydian Roberts
Owen Tadgell
Robert White
Matthew Yeomans

Teacher: David Williams

Company link: Erin Cooper & James Alexander

Qioptiq designs and manufactures photonic products and solutions that serve a wide range of markets and applications in the areas of medicine, life science, industrial manufacturing, defense and aerospace, and research and development.

Produce an automatic and reliable system that will repetitively align and affix a precision lens to a casing. This is a production line process so must be highly accurate and done within the shortest time possible.

A reference lens will project the image of an illuminated crosshair graticule into a camera. The camera will measure the position and rotation of the crosshair. A second new lens will then be placed in front of the camera but its graticule will be adjustable. The aim is to create a mechanism to adjust the position and rotation of this graticule to equal that of the reference lens. Once adjusted, the graticule shall be firmly secured to the lens without disturbing its position.

The process represents the ability to assemble many lenses from a batch of parts and each should be set the same as the reference lens.

Flintshire

Team 7

Prestatyn High School & WSP UK

Reducing CO2 Emissions from Concrete

Team: Jac Armstrong
Jamie Barson
Amelia Buckley-Scott
Mashiat Manzoor
Daniel North
Celyn Sammons

Teacher: Penny North

Company link: Mike Wellington

WSP is a global engineering company with over 60 offices in UK with the office in Wrexham North Wales supporting Prestatyn High School in this EESW challenge. 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 2000 years old is still standing today. However, the production, transportation and curing of concrete produces a huge amount of carbon dioxide, which of course is a harmful greenhouse gas, contributing to climate change and other anthropogenic effects on the environment.

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

Team 8

Alun School 1 & Bangor University - School of Medical Sciences

How safe are the bagged prewashed salad and vegetables in our supermarkets?

Team: Hannah Barnard
Lucy Brennan
Megan Griffiths
Will Lorenz
Alice Tilley

Teacher: Sarah Davies

Company link: Gwyndaf Roberts, Helena Robinson
& Alyson Moyes

The School of Medical Sciences is the focus for medical education and research at Bangor University. The School of Medical Sciences has close links with the local biomedical science laboratories.

Bagged pre-washed produce are a popular choice for busy amateur cooks. But the image of fresh salad leaves being cleansed in sparkling running spring water is far from the reality of industrial baths containing a chlorine solution, replaced maybe once a day. In July 2016 an E. coli outbreak, thought to be linked to contaminated salad, killed two people and hospitalised 62 others.

Antibiotic resistant E. coli can take up residence amongst a person's healthy gut flora. The elderly are susceptible to urinary tract infections (UTI) that are caused by their own gut flora. Treatment usually involves a broad-spectrum antibiotic, but as a consequence the antibiotic resistant bacteria can populate more of the intestinal tract. Any subsequent UTI will most likely be caused by the resistant bacteria and be much more difficult to treat. Failure to do so can lead to the life-threatening sepsis. Investigate the scale of this problem using common microbiological techniques.

Team 9

Alun School 2 & JCB Transmissions, Wrexham

JCB Transmissions: Assembly of Transmission Boxes

Team: Celyn Bodey
Daniel Eames
Will Ellis
Callum Hallworth
Kavan Heppenstall
Lily Ruffer

Teacher: Alison McLellan & Neil McBain

Company link: Julie Jones, Cameron Pemberton, Harry Wheeler & Ben Williams

JCB was founded by in 1945, who started operations in Uttoxeter Staffordshire in a in a rented 12"x15" lock-up garage and with a second-hand welding set and surplus military stock began to make tipping trailers for the new generation of petrol tractors. Now JCB is an international company, employing 12,000 people worldwide, making 300+ different products.

In 2019 so far, an average of 1.2 'Bevel Boxes' have been scrapped per week due to assembly failures. This costs the company in production of parts, as well as slowing down the production line. It also has an environmental impact, as the parts take energy to be produced and transported.

JCB Transmissions would like to make it as easy as possible for the fitters to assemble the task gears and to try to remove human error from the build. The company requires an automated and design system that will include all of the parts required for the build, and the sequence.

Design requirements include: secure storage of all parts needed, a system for informing the fitter of order of installation, ease of use and a system for detecting the wrong part being selected.

Team 10

Coleg Cambria Deeside Sixth Form Centre & UPM, Shotton

Design a VHP Shower Bar

Team: Rhys Bowen
Tea Bullock
Rowan Davidson
Joshua Gardiner
Jeswin George
Morgan Lee
Larissa Martin

Teacher: Faye Wallace

Company link: Gez Williams, Dave Clancy & Jan Ellis

UPM Shotton is a paper mill based in North Wales, UK. UPM Shotton produces newsprint based on 100% recycled fibre (all UK sourced) and uses up to 80% renewable energy.

The current VHP shower bar is hard to service, as it cannot be removed, and access is extremely difficult.

Design a VHP shower bar for the inner wire loop that can be easily removed in the shortest possible time to allow the bar to be maintained off the machine. This is to replace the original shower beam that is currently in the machine which is difficult to access and maintain.

Team 11

Connah's Quay High School & Airbus UK

The Slave Extractor

Team: Marika Habrat
Hana Kalivodova
Olivia O'Kane
Faith Ruby Randles
Olivia Smith
Hanna Szakacs

Teacher: Chris Jennings

Company link: Joanne Murray, Emily Merrison,
Richard Williams, Amani Kausar &
Oliver Aldridge

Airbus produces mainly commercial aircraft. In Broughton they manufacture the wing. On average Airbus produce around 1000 wings per year. Even though Airbus Broughton is so efficient they have an approximate 8 year back log of orders. Airbus produce aircraft for AirFrance, Lufthansa, Easy Jet and many more.

The problem deals with removing specific components without causing extensive damage to the fuselage. Airbus were extracting the slaves from the fuselage outer skin panel with a dowel removal (which is produced from unprotected steel). As a result, when steel and aluminium are in contact when removed it causes dentation marks and scratches. The tool was damaging the countersink holes and left them with a half-moon shape, this damage then affected how the rivets fit securely into the panel, so this problem is costly damage to Airbus which needs to be addressed.

Create a solution to reduce and prevent damage occurring during the extraction of shanks from the countersink hole within the fuselage outer skin. The team's solution is based on four options for safe removal of the shank utilising a range of inexpensive but effective materials.

Team 12

Hawarden High School & Raytheon

Aircraft Protective Slippers

Team: Daniel Astbury
Keely Burns
Charlie Ellis
Abby Latham
Abigail Richards
Macey Taylor

Teacher: Mark Kenny & Julie Parry

Company link: Laurence Baron

Raytheon UK is a subsidiary of Raytheon Company. We are 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. Raytheon UK also designs, develops and manufactures a range of high-technology electronic systems and software solutions at its facilities. Broughton is the home of Special Mission Aircraft modifications.

Aircraft have many sharp edges and protuberances on the outside and sometimes inside. When on the ground, especially during maintenance and when being modified, workers can catch themselves on these features causing harm to the worker and damage to the aeroplane.

Design protective 'slippers' that can be placed over the various protuberances, to be easily installed and removed, to be of a distinctive colour (usually red) to be conspicuous so they do not get left behind. Must be made from soft materials that are environmentally friendly, durable, long lasting, fire proof (for internal use) and weather resistant.

Gwynedd

Team 13

Coleg Meirion Dwyfor, Dolgellau 1 & Dwr Cymru Welsh Water

Table-top Demonstration of a Hydro Turbine and Generator

Team: Cai Jennings
Daniel Owen
Tomos Roberts
Amber Lillian Selby

Teacher: Suzi Slaney

Company link: Andrew Dixon & Huw Scourfield

By installing turbines on dams and water treatment works inlets, Dwr Cymru Welsh Water have in recent times made huge strides in installing embedded generation within their water supply network. The basic principles of mechanical energy and electrical generation output have been understood for some time, but suitable visualization models are few and far between.

Design, from first principles, a table-top model of a hydro turbine and generator, suitable for connecting to a domestic water supply, to have the following attributes:

- A time dependant, push button inlet valve
- Be suitable for water pressures of 3 BarG, with a flow of around 5l a minute maximum
- Turbine to be an impulse type with jet and rotating buckets, largely constructed of plastic or Perspex
- Be connected to a low voltage DC generator with suitable load (lamp or similar). It is permissible to use an off the shelf generator, or to utilise a DC type motor for this.
- Have a free-flowing outlet for the water suitable for allowing the volume to be captured and measured.

Team 14

Coleg Meirion Dwyfor, Dolgellau 2 & Dwr Cymru Welsh Water

Table-top Demonstration of a Hydro Turbine and Generator

Team: Owain Evans
Oliver Redman
Robat Rees
Cai Roberts
Tommy Wilkes

Teacher: Suzi Slaney

Company link: Andrew Dixon & Huw Scourfield

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Team 15

Coleg Meirion Dwyfor, Pwllheli 1 & Dwr Cymru Welsh Water

Table-top Demonstration of a Hydro Turbine and Generator

Team: Dylan Lloyd Jones
Aaron Lancelay
Tom Wyn Lewis
Osian Morgan
Tomos Williams

Teacher: Suzi Slaney

Company link: Andrew Dixon & Huw Scourfield

By installing turbines on dams and water treatment works inlets, Dwr Cymru Welsh Water have in recent times made huge strides in installing embedded generation within their water supply network. The basic principles of mechanical energy and electrical generation output have been understood for some time, but suitable visualization models are few and far between.

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- Have a free-flowing outlet for the water suitable for allowing the volume to be captured and measured.

Team 16

Coleg Meirion Dwyfor, Pwllheli 2 & Dwr Cymru Welsh Water

Table-top Demonstration of a Hydro Turbine and Generator

Team: Kia Hughes
Alex Key
Lewis Thompson
Liam Watkin

Teacher: Suzi Slaney

Company link: Andrew Dixon & Huw Scourfield

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Team 17

Coleg Meirion Dwyfor Pwllheli Sixth Form Hub & Mott MacDonald

Effective and Efficient Mixing of Chemicals for Water Treatment Process

Team: Taliesin Griffith
Ella Harris
Celt Jones
Megan Haf Owen-Jones
Huw Evan Watson
Heledd Williams

Teacher: Rhodri Llwyd

Company link: Prys Roberts, Laker Wong
& Prithula Roy Choudhury

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 5 years and so far has been commended for its performance.

To protect the environment, there is a minimum quality standard that the final effluent from a waste water treatment plant must achieve. One aspect of the treatment process is to add chemicals to facilitate the removal of solids.

To ensure that a chemical is used to its full potential, it must be mixed effectively with the flow through the treatment works. This doesn't only ensure solids are removed effectively, but 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 dosing fluid with a bulk stream that may be present at a treatment works. The solution must be able to adjust the amount of chemical to be added and handle fluids of varying viscosities to simulate the variation in flow and composition at a treatment works.

Team 18

Ysgol Friars 1 & Coleg Llandrillo Marine Engineering

Adapting a Sail Training Boat for Disabled Sailors

Team: Jacob Alexandrou
Cameron Dalton
Cai La Trobe-Roberts
Kateryn Reid
Max Rizzuto

Teacher: Shaun Holdsworth

Company link: Andy White

The award-winning SEAS project (Supporting Enabling Accessible Sailing) was set up at the Conway Centre in beginning of 2018 and enables disabled people from across North Wales the opportunity to get out on the water, socialise, learn to sail and most importantly have fun. SEAS has taken more than 120 disabled people sailing in the last year with many more wanting to take part.

One of the main barriers that limits disabled people taking part in sport is the availability of suitably adapted equipment. We have been donated a SARO Scimitar keelboat. This is a locally built type of 'Keelboat' that has a very heavy ballasted lead keel that prevents the boat from capsizing.

Design a seating and steering system that will enable our sailors to be as independent as possible. The system will need to support a disabled sailor when the boat leans over and allow them to steer. Some of our sailors have very limited mobility and physical strength, most can move their arms.

Basing the solution on the provided 1/2 scale model of the back of the boat/existing rudder system, design and adapt the steering system to create a working prototype.

Isle of Anglesey

Team 19

Ysgol Friars 2 & WSP UK

Tidal Energy Solutions

Team: Arnav Agarwal
Meical Cook
Llew Davies
Tyler Green

Teacher: Shaun Holdsworth

Company link: Neil Garton-Jones & Owen Duncan

WSP is one of the world's leading professional services firms. We provide technical expertise and strategic advice to clients in the Transportation & Infrastructure, Property & Buildings, Environment, Industry, Resources and Energy sectors.

Develop an options report that identifies a preferred tidal energy solution off the Welsh coast by appraising existing technologies and potential alternatives that can include your own design to promote potential public funding from Welsh Government (WG) and for inclusion as part of their future green energy policy.

Appraise an existing tidal barrage and two tidal generators and explain the factors that are advantageous for tidal generation and the factors that are less so against alternative energy solutions and for the 3 or 4 systems to be compared. Identify any opportunities that would allow WG to promote Wales as a development site.

Produce a matrix analysis that compares the considered options. Build a scale working model to demonstrating your concept option and energy transfers or alternatively develop a 30 visualisation of an existing appraised option.

Team 20

Ysgol David Hughes & Bangor University School of Medical Sciences

How safe are the bagged prewashed salad and vegetables in our supermarkets?

Team: Jasmine Blight
Stephen Cowley
Carys Doran-Jones
Megan Elias
Emily Evans
Arwyn Foulkes
Samuel Hughes
Lowri Roberts

Teacher: Geraint Llyn

Company link: Gwyndaf Roberts, Helena Robinson
& Alyson Moyes

The School of Medical Sciences is the focus for medical education and research at Bangor University. The School of Medical Sciences has close links with the local biomedical science laboratories.

Bagged pre-washed produce are a popular choice for busy amateur cooks. But the image of fresh salad leaves being cleansed in sparkling running spring water is far from the reality of industrial baths containing a chlorine solution, replaced maybe once a day. In July 2016 an E. coli outbreak, thought to be linked to contaminated salad, killed two people and hospitalised 62 others.

Antibiotic resistant E coli can take up residence amongst a person's healthy gut flora. The elderly are susceptible to urinary tract infections (UTI), and treatment usually involves a broad-spectrum antibiotic, but subsequent UTI will most likely be caused by bacteria resistant to antibiotics and is much more difficult to treat. Failure to do so can lead to the life-threatening sepsis. Investigate the scale of this problem using common microbiological techniques.

Team 21

Ysgol Uwchradd Bodedern & Holyhead Marine Services

Test Rig for Boat Suspension Seating

Team: Harvey Bentley
Cai Hughes
Elis Thomas
Keane Webster
Tomos Williams

Teacher: Eurwyn Hughes

Company Nick York & Daniel Firth
link:

Whole body vibrations are an issue for small fast boats, Long hours of exposure to the shocks associated with operating these vessels can cause long term injuries to personnel.

Shock mitigating seating is available, however the wide range of designs available, it's very hard to work out which seats are most effective at reducing shock.

We need a test rig to compare how much shock is reduced by various seat designs. The seats of particular interest are:

- Shox 5900
- Ullman Biscaya (compact)
- Shark Jockey Seat
- Scot Seats SJ2

The requirements for the rig are as follows:

- The rig should have the flexibility to test other seats as they become available
- We are only worried about shocks in a vertical plane and single impacts
- The rig should control and equalize all variables apart from the seat being tested
- The rig should have the capability to subject the seat to different levels of shock
- The rig must be safe to use and designed to be as cost effective as possible

Team 22

Ysgol Uwchradd Caergybi 1 & BAE Systems

Self sufficient water recovery system

Team: Sarah Goodsir
Casey Hughes
Samuel Jenkins
Anna Jones
Adam Vallely

Teacher: Steffan Taylor & Chloe Taylor

Company June Strydhorst, Gerallt Owen
link: & Adam Waterhouse

The T1 hangar in the RAF Valley base is being upgraded and a more environmentally friendly system for water will need to be put in place to contribute to improving the environment.

The task is to come up with a solution to improve the T1 hangar water system so that rainfall is utilised therefore using less water.

Provide an environmentally friendly self-recovery water system from the hangar roof that will provide water to the urinals and toilets. Once calculations of water recovery are known and usage is evaluated, if excess water available consider other uses. This will also require a self-sufficient pump to pump the water. As a design requirement we would require a model version of the system.

The solution should consider rain catchment area, rain water prediction and sunlight direction and hours and include expected usage graphs.

Team 23

Ysgol Uwchradd Caergybi 2 & BAE Systems

Self sufficient water recovery system

Team: Courtney Turner

Teacher: Steffan Taylor & Chloe Taylor

Company link: June Strydhorst, Gerallt Owen
& Adam Waterhouse

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