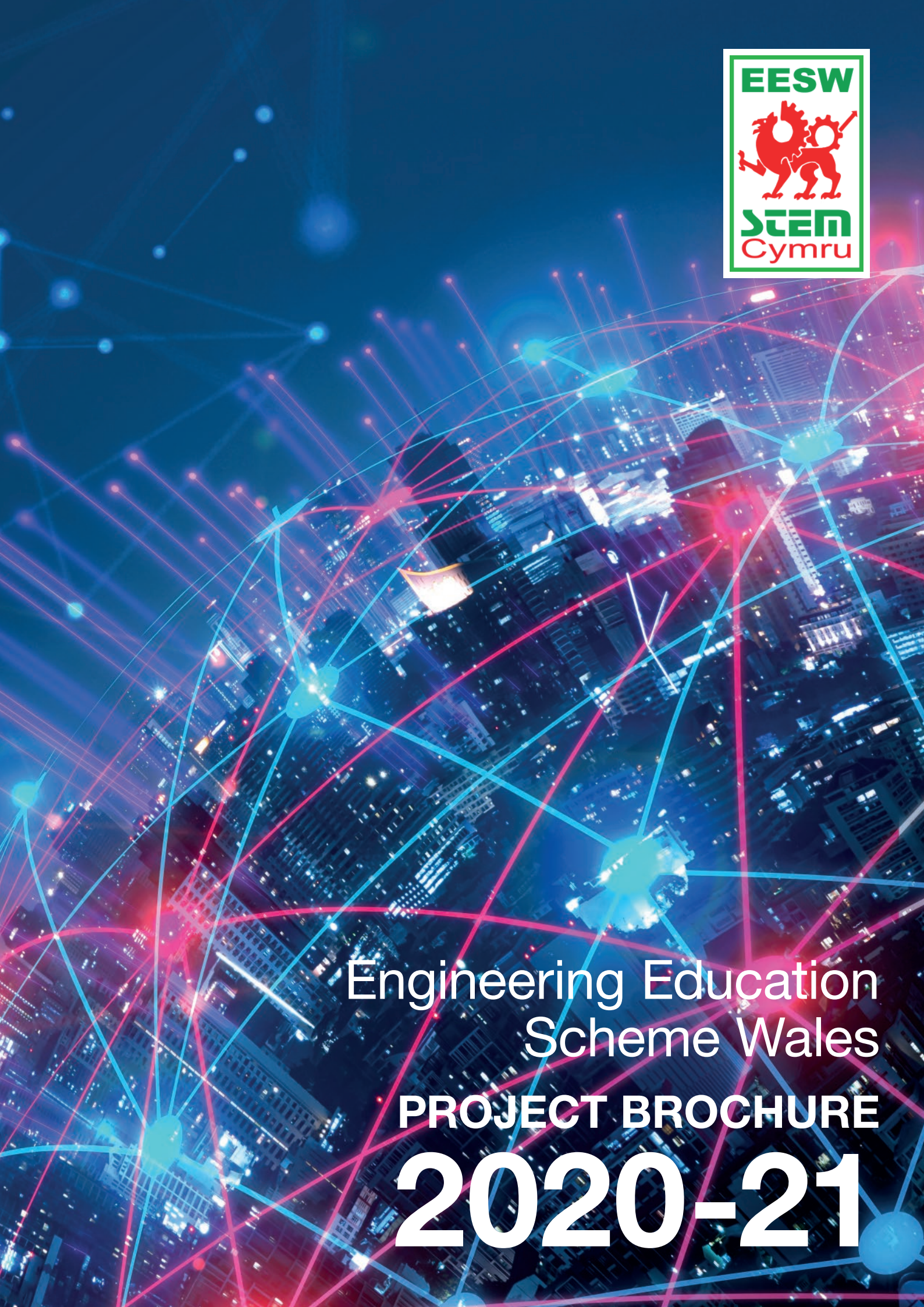

Engineering Education Scheme Wales

PROJECT BROCHURE

2020-21

Sponsorship of EESW Awards

IChemE South Wales Members Group

Best Chemical/Process Engineering Design

THE POWER TO SOAR · ADENYDD YR ERYR · PEIRIANYDD YFORY · ENGINEER TOMORROW · SWIEET 2007

Best Working Model or Prototype

IET The Institution of Engineering and Technology

Best Application of Engineering and Technology

(Two Awards)

THE WORSHIPFUL LIVERY COMPANY OF WALES · CWMNI ANRHYDEDDUS LIFRAI CYMRU · Nurturing Welsh Talent – Meithrin Dawn Cymru

Best Project for Sustainability or Environmental Protection

DIWYDIANT CYMRU · Hybu Busnesau Technoleg a Gweithgynhyrchu drwy'r Byd · INDUSTRY WALES · Growing Welsh Technology & Manufacturing Businesses Globally

Most Effective Presentation of the Chosen Solution

Llywodraeth Cymru Welsh Government

Best Application of Science

Institution of MECHANICAL ENGINEERS

Merseyside and North Wales Region

Ian Binning award for Best Use of Mechanical Engineering Principles

Llywodraeth Cymru Welsh Government

Most Innovative Solution to the Project Set

Institution of MECHANICAL ENGINEERS

South Wales Region

Best Appreciation of Safety Issues

wjec cbac

Best Overall Written Report

(Two Awards)

Ysgol Yr Esgob Gore
Bishop Gore School
Virtue and Good Literature

Caldicot
High School

CARDIFF
SIXTH FORM
COLLEGE

YSGOL GYFUN GATHOLIG
CARDINAL
NEWMAN
CATHOLIC COMPREHENSIVE

1872 PRIFYSGOL ABERYSTWYTH UNIVERSITY

ABP | ASSOCIATED BRITISH PORTS

AECOM

ARUP

COLEG CYMUNEDOL
Y DDERWEN

COLEG
CAMBRIA

Coleg Gwent

Coleg
Meirion
Dwyfor

PRIFYSGOL
BANGOR
UNIVERSITY

BBC | cymru
wales

CAF

Cardiff
Metropolitan
University
Prifysgol
Metropolitan
Caerdydd

Crickhowell
High School

Monmouth Schools
Sixth Form

HOWELL'S SCHOOL
Llandaff
GDST

Ysgol Uwchradd
Llanishen
High School

Dŵr Cymru
Welsh Water

EASTMAN
Eastman Chemical Company

FSG
TOOL & DIE LIMITED

Holyhead
Marine

Queen Elizabeth
High School

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

JCB

KnitMesh
Protecting People, Property and our Planet

Lubrizol

MERITOR

EESW

STEM Cymru

MMB
MOTT MACDONALD
BENTLEY

NetworkRail

NEWPORT
WAFER FAB

Raytheon
UK

St John's College

St Joseph's Catholic School
and Sixth Form Centre

St Teilo's
Church-in-Wales High School

Ysgol Gymunedol
TONYREFAIL
Community School

YSGOL GYFUN
TREORCHY
COMPREHENSIVE SCHOOL

Ysgol
BrynElian
High School

RHONDDA CYNON TAF

SAFRAN

SONY
UK Technology Centre

Swansea
University
Prifysgol
Abertawe

YSGOL
16 03
DAVID HUGHES

Ysgol
Dyffryn Aman

YSGOL
DYFFRYN
CONWY

Ysgol Friars

TATA STEEL

THALES

TRAFNIDIAETH CYMRU
TRANSPORT FOR WALES

University of
South Wales
Prifysgol
De Cymru

Ysgol Gyfun
GWYR

Ysgol Gyfun Gymraeg
Plasmawr

Ysgol Uwchradd
Caergybi

Ysgol Y Preseli

Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

VALE

virustatic
SHIELD

wsp

Engineering Education Scheme Wales

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. The Project is an approved WJEC Enterprise brief for the Skills Challenge Certificate of the Advanced Welsh Baccalaureate. Students are also able to gain a Gold CREST Award through participation in the scheme by developing a range of essential skills.

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

"This opportunity has been an outstanding way for us as both a team and individuals to practice, develop and create new skills. The project is unique, and not many students have an opportunity as useful as this during their school years."

"The project has allowed each of us to work alongside a professional company for the first time. Therefore, we have had a hands-on experience in understanding how a successful company is run, and how to communicate effectively in a professional manner…"

"It was interesting to focus on environmental aspects of engineering and it was a unique opportunity for me to take the role of team leader"

"Gave me great experience to improve key skills that are necessary for future careers as well as giving me a subject to talk about for university interviews."

This year, we have been in unprecedented circumstances, and all those involved have worked extremely hard to continue engaging with the EESW Project. We would like to thank students and their teachers for their perseverance to complete their Projects, despite the disruption in the academic year. We would also like to thank all professionals and academics from link companies and organisations for continuing to support us whilst working remotely.

To continue to celebrate the success of students' hard work, this year we have teamed up with Cazbah and Buffoon Media to bring you a virtual 'Awards & Presentation Day' on 8th July 2021, with both North and South Wales Projects combined. We are delighted that many organisations have kindly sponsored a variety of awards again this year. We gratefully acknowledge the support of all the schools, universities, companies and sponsors shown on the following pages, who have allowed us to continue offering this opportunity to young people across Wales.

Following the continued success of STEM Cymru 2, we are very pleased to announce that the Project has been extended to June 2023 thanks to the European Social Fund through the Welsh Government to operate in North, West Wales and the Valleys. We are also grateful to receive continued funding from the Welsh Government to undertake activities in other areas of Wales to March 2022.

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

R.F. Davies

Rebecca Davies
EESW Chief Operating Officer

EESW Teams 2020-21

South Wales

Team	School/College	Company	Page
Bridgend			
1	Coleg Cymunedol Y Dderwen	Sony UK Tec	1
Cardiff			
2	Cardiff Sixth Form College 1	AECOM	1
3	Cardiff Sixth Form College 2	AECOM	2
4	Howell's College 1	Transport for Wales Rail Services	2
5	Howell's College 2	Transport for Wales Rail Services	3
6	Llanishen High School 1	Thales NDEC / University of South Wales	3
7	Llanishen High School 2	Thales NDEC / University of South Wales	4
8	Llanishen High School 3	Thales NDEC / University of South Wales	4
9	St David's Catholic Sixth Form College 1	Network Rail	5
10	St David's Catholic Sixth Form College 2	Associated British Ports	5
11	St John's College	Dŵr Cymru Welsh Water	6
12	St Teilo's CIW High School	Eastman Chemical Company	6
13	Ysgol Gyfun Gymraeg Plasmawr	Arup	7
Carmarthenshire			
14	Queen Elizabeth High School 1	Aberystwyth University	7
15	Queen Elizabeth High School 2	Aberystwyth University	8
16	Ysgol Dyffryn Aman 1	University of Wales Trinity St David - Computing	8
17	Ysgol Dyffryn Aman 2	University of Wales Trinity St David - Computing	9
Monmouthshire			
18	Caldicot High School	Newport Wafer Fab	9
19	Haberdashers' Monmouth Schools	CAF Rail	10
Neath Port Talbot			
20	St Joseph's School and Sixth Form Centre	Vale Europe Limited	10
Pembrokeshire			
21	Ysgol Y Preseli	Aberystwyth University	11
Powys			
22	Crickhowell High School 1	University of South Wales	11
23	Crickhowell High School 2	University of South Wales	12

South Wales

Team	School/College	Company	Page
Rhondda Cynon Taf			
24	Cardinal Newman Catholic School and Sixth Form Centre	RCT County Borough Council	12
25	Tonyrefail Community School	FSG Tool & Die Ltd	13
26	Treorchy Comprehensive School	BBC	13
Swansea			
27	Bishop Gore School	University of Wales Trinity Saint David - Engineering	14
28	Ysgol Gyfun Gŵyr 1	Swansea University College of Engineering	14
29	Ysgol Gyfun Gŵyr 2	Swansea University College of Engineering	15
Torfaen			
30	Coleg Gwent- Torfaen Learning Zone 1	Meritor Heavy Vehicle Braking Systems	15
31	Coleg Gwent- Torfaen Learning Zone 2	Meritor Heavy Vehicle Braking Systems	16
32	Coleg Gwent- Torfaen Learning Zone 3	Meritor Heavy Vehicle Braking Systems	16
33	Coleg Gwent- Torfaen Learning Zone 4	Meritor Heavy Vehicle Braking Systems	17
34	Coleg Gwent- Torfaen Learning Zone 5	Meritor Heavy Vehicle Braking Systems	17

North Wales

South Wales

Bridgend

Team 1

Coleg Cymunedol Y Dderwen & Sony UK Tec

Develop a contactless workplace tracking system using industry 4.0

Team: Dafydd Roberts
Hollie Keeping
Kieran Pritchard
Samuel Gould

Teacher: Sarah Sutor, Hazel Deeming & Chloe Pritchard

Company link: Warren James

Sony UK Technology Centre in Pencoed is a division of Sony Europe B.V. At the site, Sony manufactures high technology Cameras and Systems, used globally, as well as a huge portfolio including the Raspberry Pi. It has a reputation for manufacturing excellence and benefits from a highly skilled and flexible workforce utilising the latest state of the art electronics manufacturing equipment and processes.

Sony's workers are centred around workstations and currently use swipe cards at these workstations giving some basic data that can be used by the company to monitor efficiency and other variables. Developing another method of recording data could be advantageously used to further improve efficiency, identify problems and the root issues of these, and perhaps improve wellbeing at the factory. It could also give scope for cross-referencing with other data from the factory.

The brief for this project was: Using an Industry 4.0 approach, develop a contactless way to record and analyse data about employees that are using work stations in a factory.

Cardiff

Team 2

Cardiff Sixth Form College 1 & AECOM

Off-Grid Classroom

Team: David Muriithi
Leung Tsun Hei
Jack Wang
Vincent Yeh
Jake Morgan
Timur Grigorev

Teacher: Gareth Jenkins

Company link: Sian Lewis

A local Welsh secondary school is looking to extend its existing building to supplement increasing pupil numbers. The site for the new school extension is located near the sea in an open and rural environment.

The challenge lies in how, as a building design engineer, you can capture enough renewable & sustainable energy to power the school and it's 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.

South Wales

Cardiff

Team 3

Cardiff Sixth Form College 2 & AECOM

Battery Power

Team: Parc Ki Tse
Anna Talantova
Samuel Atoma
Qianle Zhu
Petchpeera Meteekul
Ho Yeung Lam
Saltanat Kussainova
Lilyan Chow

Teacher: Gareth Jenkins

Company link: Sian Lewis

In today's climate, saving energy is essential. As building engineers, we are dedicated to providing energy efficient buildings. Although renewable technologies are becoming more efficient and producing more electricity to offset building consumption, we could make greater strides in efficiency if we could reduce the consumption within the buildings.

Office buildings consume a high percentage of the electricity produced in the UK. In most modern offices, employees are provided with laptops to carry out their day-to-day work. These laptops tend to be plugged in to the mains power for the entire time that staff are in the building, thereby drawing energy from the grid. Each laptop has a built-in battery. How much energy could be saved if the laptops were only drawing from the grid when they need charging?

The task is to determine a way to reduce the use of mains power by utilising the stored energy in a laptop battery. The team will need to measure the amount of charge in a 'laptop' battery in order to disconnect the 'mains' power once it is fully charged so that the stored power is then utilised. It is also important that the 'mains' power is restored when the battery reaches a preset level (e.g. 30%).

Cardiff

Team 4

Howell's College 1 & Transport for Wales Rail Services

Depot arrivals alert system

Team: Havana Ide
Grace Eddy
Bernard Lo
Linus Lo
Libby Roberts
Angela Ng

Teacher: Andrew Ford

Company link: Sean Cadogan, Tom Parker & Chloe Thomas

Transport for Wales maintenance depots operate 24 hours a day, with much of the work being undertaken at night when trains are out of service. Maintenance and cleaning must be completed, and trains moved into the correct positions, ready for the morning service which leads to time pressure on everyone involved.

Canton is a large depot which undertakes a variety of work. Particularly at night, technicians may find themselves waiting for units to be berthed in the shed ready for work. With no way of knowing when their next unit has arrived, time may be wasted as staff rely on periodic checks or word of mouth.

The brief is to Design and test a concept system to identify which train has entered the maintenance shed and give an audible/ visual alert.

The system should:

- Initially monitor one or two maintenance roads, but be scalable
- Work throughout the site over a distance of up to 200 m
- Not interfere with the safe movement of trains

South Wales

Cardiff

Team 5

Howell's College 2 & Transport for Wales Rail Services

Depot Arrivals Alert System

Team: Auvni Patel
Jennifer Emezie
Maite Klocke –Mancisidor
Alexia Vaghela
Rhianne Henderson
Abbie Griffiths

Teacher: Andrew Ford

Company link: Sean Cadogan, Tom Parker & Chloe Thomas

Transport for Wales maintenance depots operate 24 hours a day, with much of the work being undertaken at night when trains are out of service. Maintenance and cleaning must be completed, and trains moved into the correct positions, ready for the morning service which leads to time pressure on everyone involved.

Canton is a large depot which undertakes a variety of work. Particularly at night, technicians may find themselves waiting for units to be berthed in the shed ready for work. With no way of knowing when their next unit has arrived, time may be wasted as staff rely on periodic checks or word of mouth.

The brief is to Design and test a concept system to identify which train has entered the maintenance shed and give an audible/ visual alert.

The system should:

- Initially monitor one or two maintenance roads, but be scalable
- Work throughout the site over a distance of up to 200 m
- Not interfere with the safe movement of trains

Cardiff

Team 6

Llanishen High School 1 & Thales NDEC / University of South Wales

Controlling acid temperature in battery filling

Team: Asa Abdulrazzaq
Mohammed Alquraishi
Ellis Ashley
Gabby Dickinson
Matthew James

Teacher: Philippa Wallington

Company link: Clare Johnson & Dene Yandle

Thales UK is a team of over 6,500 experts, including 4,500 highly skilled engineers, across nine key UK sites. They have unrivalled experience across every major industry they serve. From their National Digital Exploitation Centre (NDEC), a co-funded project between Thales and Welsh Government, run from Thales Ebbw Vale Campus, they are supporting the EESW initiative with their engineering expertise. The project is in association with the University of South Wales who are providing academic guidance to the students.

Yuasa batteries are used in many different industry sectors. As part of the manufacturing process, the assembled battery is filled with Sulphuric acid which acts as the conductor to transport electrical ions between the positive and negative plates when the battery is charged or discharged. This battery is filled with the correct volume of acid for the battery type currently manufactured. This volume is determined by the increase in weight of the battery as the acid is loaded. Since the weight of the acid is variable with temperature changes the operator has to constantly adjust the fill volume according to the acid temperature. The engineering challenge is to redesign a reliable system to maintain the acid temperature for delivery into the battery.

South Wales

Cardiff

Team 7

Llanishen High School 2 & Thales NDEC / University of South Wales

Improving the efficiency of acid battery filling

Team: Lottie Jones
Aeddan Chinnick-Ross
Thomas Lynham
Amjed Naser
Lucas Simin

Teacher: Philippa Wallington

Company link: Clare Johnson & Dene Yandle

Thales UK is a team of over 6,500 experts, including 4,500 highly skilled engineers, across nine key UK sites. They have unrivalled experience across every major industry they serve. From their National Digital Exploitation Centre (NDEC), a co-funded project between Thales and Welsh Government, run from Thales Ebbw Vale Campus, they are supporting the EESW initiative with their engineering expertise. The project is in association with the University of South Wales who are providing academic guidance to the students.

Yuasa batteries are used in many different industry sectors. As part of the manufacturing process, the assembled battery is filled with Sulphuric acid which acts as the conductor to transport electrical ions between the positive and negative plates when the battery is charged or discharged. This battery is accurately filled with the correct volume of acid for the battery type currently manufactured on the line. This volume is determined by the increase in weight of the battery as the acid is loaded. The current system in use is a gravity-fed acid system where a set volume of acid is stored in an overhead tank ready to be gravity-fed into the battery when the battery is in position. The engineering challenge is to redesign a reliable system to improve the speed of acid delivery into the battery.

Cardiff

Team 8

Llanishen High School 3 & Thales NDEC / University of South Wales

Creating a method of humidifying or adding moisture to a sealed controlled environment

Team: Seren Carson
Dre Day
Thomas Hurley
Jack Irwin
Iggy Jacob
Joseph Lynn
Dayyan Sheikh

Teacher: Philippa Wallington

Company link: Clare Johnson & Dene Yandle

Thales UK is a team of over 6,500 experts, including 4,500 highly skilled engineers, across nine key UK sites. They have unrivalled experience across every major industry they serve. From their National Digital Exploitation Centre (NDEC), a co-funded project between Thales and Welsh Government, run from Thales Ebbw Vale Campus, they are supporting the EESW initiative with their engineering expertise. The project is in association with the University of South Wales who are providing academic guidance to the students.

Environmental test equipment consists of a sealed controlled environment where products are tested on their resilience in extremes of operating conditions. As part of the design of the environmental test chambers, humidity levels are set by the operator and have to be accurately maintained. The engineering challenge is to create a method of humidifying or adding moisture to the environment of the test space. Many methods of adding moisture to an environment already exist such as evaporative and ultrasonic systems. Can you design or develop a new system which will create moisture?

South Wales

Cardiff

Team 9

St David's Catholic College 1 & Network Rail

Severn Tunnel Resilience Planning

Team: Ryan Hellings
George Cawser-Pritchard
Alexander Balinsky
Tom Borley
Joe Burton

Teacher: Matthew Miller

Company link: Dave Hewings & Thomas Garner

The Severn Tunnel has been running since 1886. There are various issues that result in the tunnel being expensive to operate;

- Water ingress from the estuary causes metallic components to corrode faster, particularly the rails and electrification equipment
- Regular brickwork inspections and repairs are required to maintain the structure
- A huge volume of water is continually pumped from the tunnel. This consumes a lot of energy.

What could Network Rail do to reduce operating costs over the next 100 years?

The project team shall identify engineering solutions to reduce life cycle costs for the maintenance and operation of the Severn Estuary Rail crossing. The team may take a holistic approach looking across engineering disciplines or instead focus on a specific area.

Cardiff

Team 10

St David's Catholic College 2 & Associated British Ports

Cardiff Docks Feeder Measurement / Monitoring

Team: Daisy Davis
Maria Fernanda Da Sousa Trad
Theo Judd
Nikolas Harrhoff-Nargi
Alex Heard
Marshall Saunders

Teacher: Matthew Miller

Company link: Robert Gray & Steve Roderick

The task is to monitor water flow in docks feeder taken out of the River Taff at Black Weir and compare with water flow at Celerity Drive (Docks Feeder Canal) in order to:

1. Quantify water flow in docks feeder
2. Control water flow in docks feeder
3. Remote reading of water flow
4. Remote operation of system

This will allow us the company to measure and control the water used in the operation of the dock more efficiently and accurately and use the measurements to calculate cost savings of pumping water from the sea to maintain the level in the dock. It will also enable various maintenance tasks to be carried out more efficiently.

South Wales

Cardiff

Team 11

St John's College & Dŵr Cymru Welsh Water

Energy Neutral Water & Waste Water treatment

Team: Estee Chen
Emily Davies
Ella Phillips
Anais Fisher
Rhys Taylor
Yuto Yim
Qingyi Meng
Xingyue Luo

Teacher: Rhian Bate

Company link: Stephne Puddy & Ben Burggraaf

Welsh Water's energy use is fully dependant on how much water their customers are using. Imagine what a typical day of a Welsh Water customer would look like, how they use water and how water & energy services are supplied to their homes.

The team must figure out how much water the 2050 customer uses by 2050 and design the following plants in four different groups:

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

The four groups need to work together to design the most optimal water cycle, from an energy efficiency point of view.

Cardiff

Team 12

St Teilo's Church in Wales High School & Eastman Chemical Company

Reduce Rate of Lime Deposition in Effluent Lagoons

Team: Benjamin Sweetland
Benjamin Whelan
Edward Gwilliam
Iphieroho Oneyibo
Iveroghene Oneyibo
James Thomas
Joseph Elguezabal
William Mahoney

Teacher: Samantha Barry

Company link: Sean Smith & Luke Northover

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

The wastewater produced by the production plants are acidic and require neutralisation before it is pumped off site. If neutralisation is not carried out, the acidic wastewater could be harmful to the environment, so it is essential that the wastewater is treated to an acceptable pH before release. The neutralising agent used is Lime, it is used in a slurry form.

The slurry is made up of water and 12% lime. Lime is not very soluble in water and so when it reaches the lagoons, it tends to settle into large deposits which require regular dredging.

Eastman require an engineering solution that will prevent the deposition of lime, reducing maintenance on lagoons.

South Wales

Cardiff

Team 13

Ysgol Gyfun Gymraeg Plasmawr & Arup

Reducing the environmental effect and carbon footprint of the new BBC headquarters in Central Cardiff

Team: Katy Knoyle
Owain Griffiths
Mari Boundy
Carwyn Hammett
Haydn Allen
Dafydd Jones

Teacher: Gareth Hall Williams

Company link: David Emm, Ashleigh Davies & Joe Esseen

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

The brief is to conduct a LZC (Low and Zero Carbon) study, looking at it from a holistic point of view on sustainability, that is to think about not just the environmental impact, but how your choices will effect society and the economy as well . The team should;

Identify some technologies that are available to meet 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.

Carmarthenshire

Team 14

Queen Elizabeth High School 1 & Aberystwyth University

Free-standing Tennis Ball Towers

Team: Kyle Verzosa
Jacob Morse
Evan Bunyan
Grzegorz Skowronski
Arwen Skinner
Nia Williams
Milly Pocknell

Teacher: Sharon Magill

Company link: Natalie Roberts & Adil Mughal

“Mathematics by the Sea” has been practised at Aberystwyth since the University first opened. In fact, Aberystwyth was the first University to teach Mathematics in Wales. Today, one of the research areas being investigated by the department, is the mathematical modelling of structures.

Is it possible to predict which structures can be built using tennis balls and which are going to be unstable - and why?

Andria Rogava, a physicist from Ilia State University in Georgia, demonstrated that simple friction can be used to create free-standing towers, by stacking tennis balls on top of each other. Such tennis ball structures are held together by mutual friction between contacting balls and the balance of torques between them.

An open question then is: is it possible to build towers where each layer consists of four spheres arranged into a square arrangement, or where each layer is a pentagon of spheres? What about towers with a base of six or seven spheres? If it is not possible to create towers with a base of four or five spheres, then what makes the tower with a base of three spheres so special?

South Wales

Carmarthenshire

Team 15

Queen Elizabeth High School 2 & Aberystwyth University

Free-standing Tennis Ball Towers

Team: Camille Sotes
Sed Fernandez
Ruby Webley
Kevin Zhou
Angharad Thomas
Ryan Hughes
James Culf

Teacher: Sharon Magill

Company link: Natalie Roberts & Adil Mughal

“Mathematics by the Sea” has been practised at Aberystwyth since the University first opened. In fact, Aberystwyth was the first University to teach Mathematics in Wales. Today, one of the research areas being investigated by the department, is the mathematical modelling of structures.

Is it possible to predict which structures can be built using tennis balls and which are going to be unstable - and why?

Andria Rogava, a physicist from Ilia State University in Georgia, demonstrated that simple friction can be used to create free-standing towers, by stacking tennis balls on top of each other. Such tennis ball structures are held together by mutual friction between contacting balls and the balance of torques between them.

An open question then is: is it possible to build towers where each layer consists of four spheres arranged into a square arrangement, or where each layer is a pentagon of spheres? What about towers with a base of six or seven spheres? If it is not possible to create towers with a base of four or five spheres, then what makes the tower with a base of three spheres so special?

Carmarthenshire

Team 16

Ysgol Dyffryn Aman 1 & University of Wales Trinity St David, Computing

SMART Monitor – A Health Monitoring System

Team: Sion Griffiths
Ruella Jones
Ragulan Pulanthian
Jac Thomas
Jake Wigley

Teacher: James Thomas

Company link: Dr Kapilan Radhakrishnan & Dr Nitheesh Kaliyamurthy

Personal Health always remains a high priority. Monitoring health conditions is a very important task for every individual. Due to our busy day to day commitments and schedules, monitoring our health becomes a challenge. The challenge also extends from our health to monitoring the health conditions of elderly people in our households.

The main aim of this project is to design and develop a SMART Health Monitoring device (not limited to wrist bands, sunglasses, mobile applications, etc.) using the IoT platform to monitor the health and to alert the registered General Practitioner if needs attention. The SMART Health Monitoring System could extend its service from monitoring to booking appointments, prescribing medication, and further to deliver automatically with/ without user intervention in a secure mode of communication.

South Wales

Carmarthenshire

Team 17

Ysgol Dyffryn Aman 2
& University of Wales Trinity St David, Computing

SMART Monitor – A Health Monitoring System

Team: Ioan Jones
Owen Mayes
Connor Fairhurst
Morgan Coombe

Teacher: James Thomas

Company link: Dr Kapilan Radhakrishnan & Dr Nitheesh Kaliyamurthy

Personal Health always remains a high priority. Monitoring health conditions is a very important task for every individual. Due to our busy day to day commitments and schedules, monitoring our health becomes a challenge. The challenge also extends from our health to monitoring the health conditions of elderly people in our households.

The main aim of this project is to design and develop a SMART Health Monitoring device (not limited to wrist bands, sunglasses, mobile applications, etc.) using the IoT platform to monitor the health and to alert the registered General Practitioner if needs attention. The SMART Health Monitoring System could extend its service from monitoring to booking appointments, prescribing medication, and further to deliver automatically with/ without user intervention in a secure mode of communication.

Monmouthshire

Team 18

Caldicot High School
& Newport Wafer Fab

Engineering & Career Logic Game

Team: Edward Goodings
James Fox
Alex Wills

Teacher: Mark Sheridan

Company link: Joanne Daniels

Students find it hard to understand the many different types of engineering jobs/positions available in the Semiconductor Sector and the industry as a whole.

The task is to design an activity, game or quiz -that help individuals consider “Is Engineering a Career for them?” The activity will provide a result that links to engineering career options. (primarily aimed at the semiconductor sector and supply chain, however, engineering roles in a broad sense would also be acceptable).

This activity should support identifying skills required in engineering for example:

- Problem Solving
- Decision making
- Mechanical / Electrical Awareness
- Maths and English
- Following instructions

The game/activity should be fun, engaging, interactive and inclusive of diversity.

South Wales

Monmouthshire

Team 19

Haberdashers’ Monmouth Schools
& CAF Rail

Water Test Facility Time and Motion Study

Team: Maeve Barratt
Finn Gahan
Will Collis- Smith
James Ogborne
Seth Butler

Teacher: Kieran Chaplin & Gareth Dunn

Company link: Adric Marsh & James Walker

CAF is a Spanish company that has been manufacturing rolling stock for over 100 years. The companies first UK based facility was opened in 2018.

As part of the train manufacturing process, the completed units must be tested for water tightness. As the site has three production lines feeding into one Water Test Facility (WTF), the WTF has become a bottleneck for site operations. The WTF operations must therefore be analysed to understand how the process can have additional capacity for a justifiable outlay.

The team have been asked to:

1. Assess the “as is” operation of the WTF, for instance, timing how long each aspect of the test takes

2. Compare the time for the WTF against the TAKT for the production lines to understand the required improvements

3. Propose options for delivering the improvements for the WTF

4. Deliver the improvements for the WTF

5. Evaluate the effectiveness of the WTF improvements

Neath Port Talbot

Team 20

St Joseph’s Catholic School and Sixth Form Centre
& Vale Europe Limited

Redesign of Reduction Circuit Hydrogen Heater

Team: Ffion James
Rebecca Carey
Ben Condon
Lewis Dare

Teacher: Samantha Williams

Company link: Peter Martin, Will Pugh & Jack Davies

Hydrogen gas is used in Vale’s process to reduce the nickel oxide feed they receive to nickel metal so that it can be extracted. This hydrogen gas is heated from 20°c up to 550°c in a gas fired heater. This is the original design from when the plant was first built in 1967.

Due to the age of the equipment, it is becoming more difficult to meet strict emission limits set on the flue gas. Vale have also suffered several blockages within the process lines due to a build-up of solids contained within the hydrogen gas. The heaters are now coming to the end of their useful life and need to be replaced.

The company are looking for a design of a heater that will not only give lower emissions (preferably zero) but will also be either less likely to block or quicker/easier to clean. The current heater is located on the roof of the Kiln Plant so alternative locations should also be considered to make access easier. Consideration of maintenance access provisions (ladders and platforms) should also be made.

South Wales

Pembrokeshire

Team 21

Ysgol Y Preseli
& Aberystwyth University

Mobile Sterilisation Unit for Schools

Team: Branwen Vaughan
Eve Mathias
Taran Parker
Gruffydd Green
Rhys Davies
Ieuan Francis
Katey-Anne Othen
Tamzin Husband

Teacher: Duncan Richmond

Company link: Natalie Roberts & Stephen Fearn

Aberystwyth University's Physics and Computer Science departments have worked together to develop robotic applications for many years, including being involved in rovers sent to Mars. Expertise range from robot design and construction through to autonomous navigation and robots that can learn like children.

With the current situation regarding keeping educational facilities open amidst the covid-19 pandemic, is it possible to design and develop a sterilisation vehicle for this purpose?

During the current pandemic, the importance of ensuring environments are kept clean has been particularly highlighted. To aid with the maintenance of a clean environment for regular use, this task involves designing a solution that can be used with schools to safely and efficiently clean an area either during break times or overnight. The team are encouraged, although not limited to, considering a design that involves a vehicle that can safely navigate around and between rooms in educational environments (i.e. schools/colleges/universities) and efficiently sterilise various workspaces (classrooms/laboratories/computer rooms/corridors).

Powys

Team 22

Crickhowell High School 1
& University of South Wales

Sustainable bridge design in an LEDC

Team: Patrick Edwards
Toby Park
Owain Draisey
Alex Holmes
Robin Flower

Teacher: Carron Goold

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

Due to a severe weather event, an African village has lost the river crossing which connects it to the nearest school and hospital.

The team need to design a bridge for the river crossing (approx. 15 m width) that will provide access for the village and will have resilience against future severe weather, caused by climate change. The team will need to create a model of their chosen design, that can be used at events to raise funds for the construction of the bridge.

The bridge design should consider the use of locally available construction materials, due to the poor site access.

The design should consider the buildability of the bridge, given that there will be limited opportunity to employed skilled and experienced labour or sophisticated machinery and the model should be sufficiently portable to take to fund raising events.

South Wales

Powys

Team 23

Crickhowell High School 2
& University of South Wales

Sustainable bridge design in an LEDC

Team: Will Vaughan
Mason Heal
Mali Whittle
Emilia Stott
Youbab Khan
Jeferson Beliber

Teacher: Carron Goold

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

Due to a severe weather event, an African village has lost the river crossing which connects it to the nearest school and hospital.

The team need to design a bridge for the river crossing (approx. 15 m width) that will provide access for the village and will have resilience against future severe weather, caused by climate change. The team will need to create a model of their chosen design, that can be used at events to raise funds for the construction of the bridge.

The bridge design should consider the use of locally available construction materials, due to the poor site access.

The design should consider the buildability of the bridge, given that there will be limited opportunity to employed skilled and experienced labour or sophisticated machinery and the model should be sufficiently portable to take to fund raising events.

Rhondda Cynon Taf

Team 24

Cardinal Newman Catholic School and Sixth Form Centre
& RCT County Borough Council

Upper Boat Roundabout – The Development of an Active Travel Interchange

Team: Alex Lee
Harvey Bull
Harry Evans

Teacher: Richard Lawson

Company link: Roger Waters, Rebecca Smith & Dafydd Morgan

Rhondda Cynon Taf CBC was formed in 1996 following the abolition of the county of Mid Glamorgan. Rhondda Cynon Taf County Borough Council was formed by the merger of the former Mid Glamorgan districts of Rhondda, Cynon Valley and Taff Ely (with the exceptions of Creigiau and Pentyrch).

Upper Boat roundabout is a busy multi arm junction that includes slip roads to and from the A470 and provides access to the largest industrial estate in Rhondda Cynon Taf. Whilst it is a heavily trafficked interchange, it is a major barrier to walking and cycling. For people who work or want to visit the industrial estate and live to the north west have to cross this roundabout, which is currently very difficult to do by means of walking and cycling. There is also no designated 'available' route across the roundabout for children who live in the Tonteg area and attend the high schools in Rhydyfelin.

The team's task is to develop an active travel route/network across Upper Boat roundabout to provide a safe and accessible walking and cycling link in order to connect the nearby communities and users to the industrial estate.

South Wales

Rhondda Cynon Taf

Team 25

Tonyrefail Community School & FSG Tool and Die Ltd

Metal Cutting Fluid Control

Team: Nell Downie
Rhys Edwards
Sam Jones
Amelia Minty
Ethan Roberts
Tristan Thorngate
Keegan Wasley
George Wilson

Teacher: Gareth Lloyd Davies

Company link: Steve Cope

At FSG, a lot of cooling fluids are used during the production of their high precision metal components. This coolant is oil based and bad for the environment as well as expensive to buy and costly to dispose of.

The company would like a solution to either reduce the amount they use, recycle their waste or reuse what they have already got.

The team will be required to analyse current procedures and usage, investigate what can be done to solve the problem whilst also looking at the legal, environmental and safety aspects of the problem before coming up with a few solutions and evaluating the best one.

Rhondda Cynon Taf

Team 26

Treorchy Comprehensive School & BBC

Design of a Portable Weatherproof Broadcasting Kit

Team: Ethem Geyik
Max Broughton
Charlotte Cule
Jac Simmonds
Adam Daley
Noah Pugh

Teacher: Owen Nelson

Company link: Brian Davidge & Guto Thomas

We're all broadcasters now. Zoom, Facetime and Skype are among the many apps that we all use to speak to friends and family. During the Covid pandemic, broadcasters such as the BBC have also used these for radio and television contributions. But we also need access to more specialist apps, with greater resilience and guarantees over the quality of the audio and video, as well as good core connectivity.

This project is to work on building a portable, practical and cheap solution for a pop-up Radio kit. Using standard Raspberry Pi components and a basic sound mixer, the challenge will be to build a station in a box which has its own power source to enable a basic live broadcast into BBC Radio Wales.

Whilst exceptionally challenging during a pandemic, the overall target is to see whether a solution can be developed that works, and which could be used to broadcast from Treorchy Comprehensive to BBC Wales at Central Square.

South Wales

Swansea

Team 27

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

Swansea bay micro generation

Team: Nayim Ali
Kit Armstrong
Thomas Clarkson
Ethan Faulkner
Casey Ky
Sarah Masters
Ewan Stratford

Teacher: Jessica Gibson

Company link: Andy Tibbott

As our reliance on fossil fuels comes to an end, we will need to invest in clean sustainable energy sources. There are a number of renewable energy projects in the local area and most have been very successful. One of the most notable plans of recent years has been the creation of a tidal lagoon in the Swansea bay. It is hoped that this project will still go ahead despite the Westminster government removing its support.

Considering the Swansea bay area, the team must analyse the feasibility of a large-scale micro-generation project. Their considerations should include multiple types of generation equipment to make the most out of the local landscape, climate and population distribution.

The aim of this project is to propose a series of measures that would provide the maximum amount of reliable renewable energy generated from small scale generation equipment across the bay area. The proposed lagoon project was to produce 520 million watts of electricity annually over a period of 60 years. The total project cost would be £1.3 billion. If the same £1.3 billion were offered as grant funding for multiple small scale (domestic) projects how much energy could reliably be produced?

Swansea

Team 28

Ysgol Gyfun Gwyr 1 & Swansea University College of Engineering

Composites 3D printing of a device that adapts door handles for handsfree opening

Team: Dylan Allen
Tomos Besley
Matthew Lewis
Gruff Robinson

Teacher: Alun Rennolf

Company link: Dr Mark Coleman
& Dr Feras Korkees

Swansea is one of the UK's leading centres for materials teaching and research. The internationally leading materials research conducted at Swansea is funded by prestigious organisations such as Rolls Royce, Airbus, The European Space Agency, and Tata Steel.

The Materials Research Centre (MRC) has pioneered postgraduate degrees that are tailored to the needs of industry and produce top quality research. This successful approach is demonstrated by a research grant portfolio in excess of £40 million.

With reports that coronavirus pathogens can live on surfaces for up to 72 hours, minimizing the frequency with which we touch things is paramount but very hard to do. You can't exactly avoid doorknobs and punching your PIN into card readers. Therefore, it is important to design and make new devices so that you don't have to come into contact with anything at all. 3D printing is a new technology that can produce customised parts and save labour and cost.

The task is to use 3D printed composites to design a hand device that can hook onto round handles and features a loop to slip a finger into for leverage.

South Wales

Swansea

Team 29

Ysgol Gyfun Gwyr 2 & Swansea University College of Engineering

Composites 3D printing of a device that adapts door handles for handsfree opening

Team: Dylan Brannigan
Grace Gormley
Christian Morton
Millie Phillips
Kian Richards
Lily Williams

Teacher: Alun Rennolf

Company link: Dr Mark Coleman
& Dr Feras Korkees

Swansea is one of the UK's leading centres for materials teaching and research. The internationally leading materials research conducted at Swansea is funded by prestigious organisations such as Rolls Royce & Airbus.

The Materials Research Centre (MRC) has pioneered postgraduate degrees that are tailored to the needs of industry and produce top quality research. This successful approach is demonstrated by a research grant portfolio in excess of £40 million.

With reports that coronavirus pathogens can live on surfaces for up to 72 hours, minimizing the frequency with which we touch things is paramount but very hard to do. You can't exactly avoid doorknobs and punching your PIN into card readers. Therefore, it is important to design and make new devices so that you don't have to come into contact with anything at all. 3D printing is a new technology that can produce customised parts and save labour and cost.

The task is to use 3D printed composites to design a hand device that can hook onto round handles and features a loop to slip a finger into for leverage.

Torfaen

Team 30

Coleg Gwent- Torfaen Learning Zone 1 & Meritor Heavy Vehicle Braking Systems

Friction Pad analytic system

Team: Ben Williams
Dominic Williams
Guy Sutton
Elliott Watkiss-Leek
Evan Morgan

Teacher: Patrick Seale, Huw Phillips
& Christopher Garrett

Company link: Mark Norman & Alexander Mat

Meritor is a global business that designs and manufactures many products (axles, suspensions, disc brakes etc.) Meritor HVBS specifically focus on the braking system. The company have a variety of different types of test rigs on site such as structural fatigue, performance and durability.

One of our most important test rigs in Meritor HVBS is the Dynamometer, this machine measures torque and rotational speed simultaneously - giving the performance of the brake. Some of the tests that are performed on the Dynamometer include, mechanical strength, thermal aging, wear test, and taper wear test. During these tests, interim checks are completed routinely where a technician hand measures the brake pad friction material's thickness. This data is recorded by hand and then typed into Excel to compare to previous checks. The task is to come up with a solution where the data can be more efficiently recorded as well as more visually representative. Possibly come up with system that can identify and provide a classification on what type of wear is present and how severe it is.

South Wales

Torfaen

Team 31

Coleg Gwent- Torfaen Learning Zone 2 & Meritor Heavy Vehicle Braking Systems

Friction Pad analytic system

Team: Alice Evans-Smith
Tawheed Ahmed
Matthew Bousie
Owen Mason

Teacher: Patrick Seale, Huw Phillips
& Christopher Garrett

Company link: Mark Norman & Alexander Mat

Meritor is a global business that designs and manufactures many products (axles, suspensions, disc brakes etc.) Meritor HVBS specifically focus on the braking system. The company have a variety of different types of test rigs on site such as structural fatigue, performance and durability.

One of our most important test rigs in Meritor HVBS is the Dynamometer, this machine measures torque and rotational speed simultaneously - giving the performance of the brake. Some of the tests that are performed on the Dynamometer include, mechanical strength, thermal aging, wear test, and taper wear test. During these tests, interim checks are completed routinely where a technician hand measures the brake pad friction material's thickness. This data is recorded by hand and then typed into Excel to compare to previous checks. The task is to come up with a solution where the data can be more efficiently recorded as well as more visually representative. Possibly come up with system that can identify and provide a classification on what type of wear is present and how severe it is.

Torfaen

Team 32

Coleg Gwent- Torfaen Learning Zone 3 & Meritor Heavy Vehicle Braking Systems

Friction Pad analytic system

Team: Joseph Lightfoot
Sam Thackray
Tobias Jeffries
Luca Tudesco
Harri Morgan

Teacher: Patrick Seale, Huw Phillips
& Christopher Garrett

Company link: Mark Norman & Alexander Mat

Meritor is a global business that designs and manufactures many products (axles, suspensions, disc brakes etc.) Meritor HVBS specifically focus on the braking system. The company have a variety of different types of test rigs on site such as structural fatigue, performance and durability.

One of our most important test rigs in Meritor HVBS is the Dynamometer, this machine measures torque and rotational speed simultaneously - giving the performance of the brake. Some of the tests that are performed on the Dynamometer include, mechanical strength, thermal aging, wear test, and taper wear test. During these tests, interim checks are completed routinely where a technician hand measures the brake pad friction material's thickness. This data is recorded by hand and then typed into Excel to compare to previous checks. The task is to come up with a solution where the data can be more efficiently recorded as well as more visually representative. Possibly come up with system that can identify and provide a classification on what type of wear is present and how severe it is.

South Wales

Torfaen

Team 33

Coleg Gwent- Torfaen Learning Zone 4 & Meritor Heavy Vehicle Braking Systems

Friction Pad measurement system

Team: Alex Jones
Cameron Fields
Rhys Cousins
Rowan Cowles
Fletcher Twinam
Harry McBrien
Ieuan Thomas

Teacher: Patrick Seale, Huw Phillips & Christopher Garrett

Company link: Mark Norman & Alexander Mat

Meritor is a global business that designs and manufactures many products (axles, suspensions, disc brakes etc.) Meritor HVBS specifically focus on the braking system. The company have a variety of different types of test rigs on site such as structural fatigue, performance and durability.

One of our most important test rigs in Meritor HVBS is the Dynamometer, this machine measures torque and rotational speed simultaneously - giving the performance of the brake. Some of the tests that are performed on the Dynamometer include, mechanical strength, thermal aging, wear test, and taper wear test. During these tests, interim checks are completed routinely where a technician hand measures the brake pad friction material's thickness. This data is recorded by hand and then typed into Excel to compare to previous checks. The task is to come up with a solution where the data can be more efficiently recorded as well as more visually representative. Possibly come up with system that can identify and provide a classification on what type of wear is present and how severe it is.

Torfaen

Team 34

Coleg Gwent- Torfaen Learning Zone 5 & Meritor Heavy Vehicle Braking Systems

Friction Pad measurement system

Team: James Pitt
Drhys Symunds
Patrick Taylor
George Bailey
David Stephens
Jessica Brain

Teacher: Patrick Seale, Huw Phillips & Christopher Garrett

Company link: Mark Norman & Alexander Mat

Meritor is a global business that designs and manufactures many products (axles, suspensions, disc brakes etc.) Meritor HVBS specifically focus on the braking system. The company have a variety of different types of test rigs on site such as structural fatigue, performance and durability.

One of our most important test rigs in Meritor HVBS is the Dynamometer, this machine measures torque and rotational speed simultaneously - giving the performance of the brake. Some of the tests that are performed on the Dynamometer include, mechanical strength, thermal aging, wear test, and taper wear test. During these tests, interim checks are completed routinely where a technician hand measures the brake pad friction material's thickness. This data is recorded by hand and then typed into Excel to compare to previous checks. The task is to come up with a solution where the data can be more efficiently recorded as well as more visually representative. Possibly come up with system that can identify and provide a classification on what type of wear is present and how severe it is.

North Wales

Conwy

Team 1

Ysgol Bryn Elian & KnitMesh Technologies

Mesh component measuring system

Team: Erin Meek
Imogen Jones

Teacher: Neil Humphreys

Company link: Peter Evans & Aled Williams

Wire mesh washers currently need to be checked manually at a set amount as they need to be a specific size. Only accurate dimensions are acceptable. A fast, reliable system is required to improve efficiency.

Wire mesh washers can be distorted with contact, so the measurement system should involve very light touch, or no touch at all. Consideration should be given to visual methods, including low-cost cameras or phone cameras.

Conwy

Team 2

Ysgol Dyffryn Conwy 1 & Mott MacDonald Bentley

Model the design of an economically viable and sustainable settlement tank for construction

Team: Jamie Williams
Sam Fahy
Elliot Wright
Chris Sabisky
Angharad Roberts

Teacher: Penri Jones

Company link: Prys Roberts, Connor Lackey, Prithula Roy Choudhury, Laker Wong & Chris Yanev

Mott Macdonald Bentley has been working in Dŵr Cymru for over 5 years and so far has been commended for its performance.

Currently there are schemes which span across Wales and the work involves sites which span the engineering disciplines of Process, Civil, Mechanical and Electrical engineering.

To protect the environment, there is a minimum quality standard that the final effluent from a wastewater treatment plant must achieve. One of the stages of the treatment process is to allow the incoming flows to settle, for the suspended solids to precipitate. This process often takes place in large settlement tanks.

Two new settlement tanks are required at a treatment work in North Wales. The flow to work is 69 l/s. The ground conditions at the site are very poor and the soil is known to liquify. The ground water table is very high and from preliminary surveys its assumed to be 1m bgl.

The site is located on top of a protected aquifer, which is roughly 8.8 -10m below ground level.

North Wales

Conwy

Team 3

Ysgol Dyffryn Conwy 2
& Mott MacDonald Bentley

Model the design of an economically viable and sustainable settlement tank for construction

Team: Elen Jones
Olivia Wilding
Zosia Cywinska
Morgan Fivash-Henderson
Jonathan Driver

Teacher: Penri Jones

Company link: Prys Roberts, Connor Lackey, Prithula Roy Choudhury, Laker Wong & Chris Yanev

Mott Macdonald Bentley has been working in Dŵr Cymru for over 5 years and so far has been commended for its performance.

Currently there are schemes which span across Wales and the work involves sites which span the engineering disciplines of Process, Civil, Mechanical and Electrical engineering.

To protect the environment, there is a minimum quality standard that the final effluent from a wastewater treatment plant must achieve. One of the stages of the treatment process is to allow the incoming flows to settle, for the suspended solids to precipitate. This process often takes place in large settlement tanks.

Two new settlement tanks are required at a treatment work in North Wales. The flow to work is 69 l/s. The ground conditions at the site are very poor and the soil is known to liquify. The ground water table is very high and from preliminary surveys its assumed to be 1m bgl.

The site is located on top of a protected aquifer, which is roughly 8.8 -10m below ground level.

Flintshire

Team 4

Coleg Cambria Deeside Sixth Form Centre
& Raytheon Technologies

Method of retaining Electronic equipment to an aircraft cabin table or structure

Team: Thomas Billington
Ocean-Lee Wayman
Caleb Dore
Rosie Kite
Chloe Miller
Naomi Morgan

Teacher: Faye Wallace

Company link: Laurence Baron

Raytheon UK is a subsidiary of Raytheon Technologies. They 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.

Items such as laptops, large tablets and special equipment are deemed 'carry on equipment' by aerospace regulatory authorities and as such are not subject to some safety requirements permanently fitted items are. However, they have to be put away for take-off and landing and when there is bad turbulence. There is a need for a quick release clamping device that can hold the item to a table of piece of structure while being used but be able of allowing quick stowage when needed.

ng a clamping device (or range of devices) to clamp electronic items to aircraft tables, seats and structure to hold the device securely but allow easy removal when the item needs to be put away. This must be made from materials that are environmentally friendly, durable, long lasting, fireproof (for internal use) and lightweight.

North Wales

Gwynedd

Team 5

Coleg Meirion Dwyfor, Dolgellau 1
& Cardiff Metropolitan University

Improving the design of cyberspace and our online experiences

Team: Charles Buffery
Kian Jones
Jake Saunders
Kane Triggs
Owain Williams

Teacher: Suzi Slaney

Company link: Clara Watkins, Fiona Carroll & Catherine Tryfona

Cyberspace is the term used to describe the virtual environment of the Internet. It is now ubiquitous, available to anyone with a device and connection. Beyond being easily and constantly accessible, it is increasingly remoulding our lives, influencing the way we communicate and the way we behave. Certainly, cyberspace is an area of information that does not correspond with the physics of the environment in which our physical bodies spend time, and when interacting in this environment we become almost desensitized to our physical surroundings. By entering into the world of cyberspace, we change the way we find one another, the way we exist and communicate with one another, the way we participate, interact, and work with one another.. This raises the question of whether the almost default design of cyberspace is fit for purpose and whether cyberspace needs to be designed to fit better with us?

The task is to design and develop a digital support/ application/potential cyberspace experience that supports the end user to be more aware of the environmental footprint of their technology usage, a cyberspace design that complies with their physical environment's wellbeing.

Gwynedd

Team 6

Coleg Meirion Dwyfor, Dolgellau 2
& Cardiff Metropolitan University

Improving the design of cyberspace and our online experiences

Team: Jac Edwards
Tyler Bryant
Cian Pugh-Jones
Jacob Skelton
Kai Tudor

Teacher: Suzi Slaney

Company link: Clara Watkins, Fiona Carroll & Catherine Tryfona

Cyberspace is the term used to describe the virtual environment of the Internet. It is now ubiquitous, available to anyone with a device and connection. Beyond being easily and constantly accessible, it is increasingly remoulding our lives, influencing the way we communicate and the way we behave. Certainly, cyberspace is an area of information that does not correspond with the physics of the environment in which our physical bodies spend time, and when interacting in this environment we become almost desensitized to our physical surroundings. By entering into the world of cyberspace, we change the way we find one another, the way we exist and communicate with one another, the way we participate, interact, and work with one another.. This raises the question of whether the almost default design of cyberspace is fit for purpose and whether cyberspace needs to be designed to fit better with us?

The task is to design and develop a digital support/ application/potential cyberspace experience that supports the end user to be more aware of the environmental footprint of their technology usage, a cyberspace design that complies with their physical environment's wellbeing.

North Wales

Gwynedd

Team 7

Coleg Meirion Dwyfor, Pwllheli 1
& Cardiff Metropolitan University

Improving the design of cyberspace and our online experiences

Team: Robert Arwel Roberts
Lewis Wyn Jones
Owi Lloyd

Teacher: Suzi Slaney

Company link: Clara Watkins, Fiona Carroll & Catherine Tryfona

Cyberspace is the term used to describe the virtual environment of the Internet. It is now ubiquitous, available to anyone with a device and connection. Beyond being easily and constantly accessible, it is increasingly remoulding our lives, influencing the way we communicate and the way we behave. Certainly, cyberspace is an area of information that does not correspond with the physics of the environment in which our physical bodies spend time, and when interacting in this environment we become almost desensitized to our physical surroundings. By entering into the world of cyberspace, we change the way we find one another, the way we exist and communicate with one another, the way we participate, interact, and work with one another.. This raises the question of whether the almost default design of cyberspace is fit for purpose and whether cyberspace needs to be designed to fit better with us?

The task is to design and develop a digital support/ application/potential cyberspace experience that supports the end user to be more aware of the environmental footprint of their technology usage, a cyberspace design that complies with their physical environment's wellbeing.

Gwynedd

Team 8

Coleg Meirion Dwyfor, Pwllheli 2
& Cardiff Metropolitan University

Improving the design of cyberspace and our online experiences

Team: Aron Davies
Celt Jones
Caron Thomas
Tomi Jones

Teacher: Suzi Slaney

Company link: Clara Watkins, Fiona Carroll & Catherine Tryfona

Cyberspace is the term used to describe the virtual environment of the Internet. It is now ubiquitous, available to anyone with a device and connection. Beyond being easily and constantly accessible, it is increasingly remoulding our lives, influencing the way we communicate and the way we behave. Certainly, cyberspace is an area of information that does not correspond with the physics of the environment in which our physical bodies spend time, and when interacting in this environment we become almost desensitized to our physical surroundings. By entering into the world of cyberspace, we change the way we find one another, the way we exist and communicate with one another, the way we participate, interact, and work with one another.. This raises the question of whether the almost default design of cyberspace is fit for purpose and whether cyberspace needs to be designed to fit better with us?

The task is to design and develop a digital support/ application/potential cyberspace experience that supports the end user to be more aware of the environmental footprint of their technology usage, a cyberspace design that complies with their physical environment's wellbeing.

North Wales

Gwynedd

Team 9

Ysgol Friars 1
& JCB Transmissions

Automated kitting board

Team: Emilia Spindley
Hannah Morgan
Oscar Downing
Anton Petkov
David Moss
Amy Mano

Teacher: Shaun Holdsworth

Company link: Chris Morris, Ben Williams, Jamie McCulloch & Tomos Jones

JCB Transmissions design, develop and manufacture gearboxes and axles for use in JCB machines such as Backhoes, Loadalls, Excavators and Fastracs. JCB Loadall machines require a 'Bevel Box' between the engine and the gearbox. This is due to the engine being mounted perpendicular to the machine, for space saving purposes. The bevel box consists of a pair of matching bevel gears, which transfer the engines power through 90 degrees.

Like all JCB products, it is essential that the bevel box is assembled correctly and to a high standard. Products which are not built to a high standard may fail prematurely or be noisy in use.
JCB Transmissions would like to make it as easy as possible for the fitters to assemble the gears and to try remove human error from the build (POKA-YOKE). Therefore, they have asked the team to design and build an automated kitting board which will show all the parts required for the build, and the sequence in which they are installed.

Gwynedd

Team 10

Ysgol Friars 2
& TATA Steel, Shotton

The switch to carbon neutrality

Team: Flynn Holt
Paul Braganca
Archie Westerberg-Liptrot
Cameron Shaw
Rory White

Teacher: Shaun Holdsworth

Company link: Julie Baddock & Billy Payne

Tata Steel, Shotton has the desire to become an industry leader in making the switch to carbon neutrality. The site currently has both a high electricity and fuel requirement. Electricity is required, not only for lighting and office purposes, but to also to power the pumps, compressors, and other relevant instruments. All 3 of the process lines have a fuel requirement in which natural gas is the fuel used. There is also a steam requirement on site for heating purposes which also uses natural gas boilers.
It is up to the team to decide upon the most economically viable solution for the site to achieve carbon neutrality based on the lowest payback period. The team should:

- Decide upon an alternative fuel source to satisfy direct combustion fuel and steam generation requirements.
- Decide upon an alternative method of electricity production, ensuring it is from renewable sources.
- Think about ways in which electricity can be generated without using valuable land space.
- Think about producing enough electricity that can be sold back to the national grid to reduce the payback period of the installation.

North Wales

Gwynedd

Team 11

Ysgol Friars 3
& WSP UK

Reducing CO2 Emissions from Concrete

Team: Benjamin Groom
Mathew Jones
Alex Hummel
Pierre Gutierrez
Tomas Bezkorowajnyj
Leon Hughes
George Nightingale

Teacher: Shaun Holdsworth

Company link: Mike Wellington

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

Concrete is the single most widely used material in the world. It is used in such large amounts as it is such a reliable building material - evidenced by the fact that Roman concrete, over 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.

Isle of Anglesey

Team 12

Ysgol David Hughes 1
& Virustatic Shield

The Future of Face Coverings

Team: Myesha Hussain
Dwynwen Holland
Mari Baker
Matthew Jones
Jack-Lee Worthington

Teacher: Geraint Llyn & Lowri Rees

Company link: Lucy Hope & Dr Anna Stedman

The world is struggling to cope with the COVID-19 pandemic. A new way of life will emerge from this and we will learn to co-exist with many novel viruses as they continue to emerge. Protecting ourselves is key and personal protective equipment (PPE) will become as routine as putting on your shoes to go out of the door.

Virustatic has developed an innovative face covering (the Virustatic Shield) which is coated in a protein with proven anti-viral capabilities. The snood design is breathable, comfortable for long wear, reusable and washable. In order for this product to be placed on the market, the protective capabilities must be scientifically proven and rigorously tested.

The project brief is to design a study to determine:

1. If a face covering protects the wearer from infection via the respiratory route
2. If an infected person (who is wearing a face covering) exposes others to infection
3. How the Virustatic Shield face covering compares to other face mask/face covering products available
4. If a face covering is two-way protective no matter what physical activity is being undertaken

North Wales

Isle of Anglesey

Team 13

Ysgol David Hughes 2
& Virustatic Shield

The Future of Face Coverings

Team: Beca Wright Hughes
Catrin Jones
Erin McKiernan
Nadia Mohammed
Lucretia Williams-Jones

Teacher: Geraint Llyn & Lowri Rees

Company link: Lucy Hope & Dr Anna Stedman

The world is struggling to cope with the COVID-19 pandemic. A new way of life will emerge from this and we will learn to co-exist with many novel viruses as they continue to emerge. Protecting ourselves is key and personal protective equipment (PPE) will become as routine as putting on your shoes to go out of the door.

Virustatic has developed an innovative face covering (the Virustatic Shield) which is coated in a protein with proven anti-viral capabilities. The snood design is breathable, comfortable for long wear, reusable and washable. In order for this product to be placed on the market, the protective capabilities must be scientifically proven and rigorously tested.

The project brief is to design a study to determine:

1. If a face covering protects the wearer from infection via the respiratory route
2. If an infected person (who is wearing a face covering) exposes others to infection
3. How the Virustatic Shield face covering compares to other face mask/face covering products available
4. If a face covering is two-way protective no matter what physical activity is being undertaken

Our Sponsors and Partners

bpu Chartered Accountants

Institution of MECHANICAL ENGINEERS

EngineeringUK

THE POWER TO SOAR · RHENYDD YR ERYR
PEIRIANYDD YFORY
ENGINEER TOMORROW
SWIEET 2007

THE BIG BANG AT SCHOOL

UNDEB EWROPEAIDD
EUROPEAN UNION
Llywodraeth Cymru
Welsh Government
Cronfa Gymdeithasol Ewrop
European Social Fund

F1 in Schools Wales

IET The Institution of Engineering and Technology

Llywodraeth Cymru
Welsh Government

DIWYDIANT CYMRU
Hybu Busnesau Technoleg a Gweithgynhyrchu drwy'r Byd
INDUSTRY WALES
Growing Welsh Technology & Manufacturing Businesses Globally

Welsh Automotive Forum
Fforwm Modurol Cymru

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

EESW
Waterton Centre
Waterton
Bridgend
CF31 3WT

Tel: 01656 669381
E-mail: info@stemcymru.org.uk

UNDEB EWROPEAIDD
EUROPEAN UNION

Llywodraeth Cymru
Welsh Government

Cronfa Gymdeithasol Ewrop
European Social Fund

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

Engineering Education Scheme Wales Ltd
Registered Charity
1144651
Company limited by gurantee
07776138