



ENGINEERING FOCUS

JULY 2014



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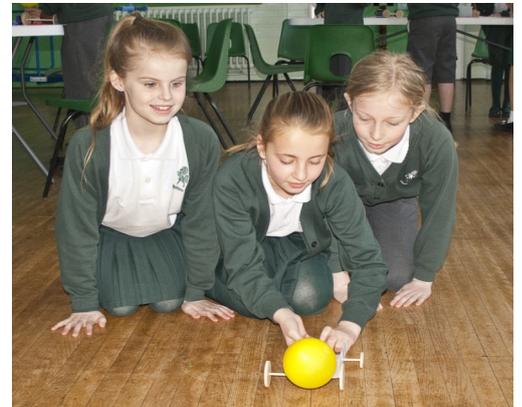


STATS FOR STEM

- 7 STEM outreach projects
- 8 new STEM initiatives
- 10 Primary Schools
- 38 Primary STEM Sessions
- 50 WGSB STEM Ambassadors and 20 STEM Helpers
- 205 Opportunities for our ambassadors to support students
- 550 Students attending the Bloodhound SSC event week
- 980 Students attending our outreach projects
- 1500 students benefitting from our WGSB STEM Outreach Projects in 2014

We have done a huge amount of work this year. My team of STEM (Science, Technology, Engineering and Maths) ambassadors have been constantly helpful and supportive to me volunteering for a wide range of different events. They have impressed the staff at the schools we have visited with their positive friendly attitude and approachability for the KS1 and KS2 students and they have encouraged and

WGSB STEM Ambassadors run a range of projects for Primary School students.

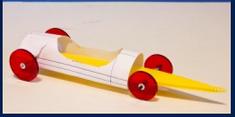


Students working on their balloon cars

enthused the students that they have helped them to complete their challenges successfully.

Building on the work students were already doing we introduced the WGSB STEM Ambassador award this year to recognise their excellent work. This new opportunity was taken by 50 students who completed training and fulfilled the requirements to achieve the nationally recognised STEM Leaders Award. As word of what we do spread further many students who had missed the training sessions joined the team as helpers with the intention of applying to be an ambassador next year.

We now have a solid core of Primary Outreach projects to run with schools who ask for help with STEM, including Balloon cars for KS1, K'nex cars and Science fairs for KS2 and the new CAD CAM Car project launched this year. For more details about the CAD CAM Car see page 2. Next we will turn our attentions to our own school and instigate clubs and challenges for our own students to learn more about the fascinating career paths for those who are interested in STEM.



“The turning point in our development work was seeing the Thrust 2”

Jan Smith

WGSB



The final product— a group of Thrust 2 balloon cars



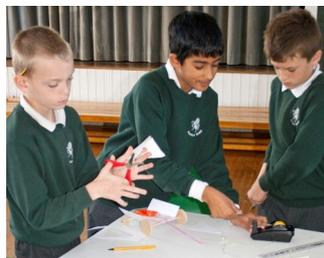
DESIGNING A BALLOON CAR EASY!?!



Laser cutters, vinyl cutters, vacuum formers and 3D printers are quite common in secondary schools but too expensive by far for the majority of primary schools.

In the past we have run projects taking vacuum formers out to schools and the students have always been thrilled to see the heated plastic take shape over the door sign or steady hand tester they have made.

We wanted to develop a project that would give year 5 and 6 students the opportunity to learn about some of the developing technologies in the manufacturing world around them as well as finding out about common manufacturing techniques



Teamwork and Technology Key to success

used to mass produce everyday objects.

As a Bloodhound SSC education centre it was obvious the new project would have to centre around the world land speed record theme and after long discussions the CAD CAM Car was born. In principle a simple project to make a balloon car - not quite. The car itself turned into a massive engineering challenge.

The original idea was that the shape should be based on the Bloodhound SSC and numerous prototypes were made using the laser cutter to cut chassis and pop rivets for friction free axles. It should have been simple, but the narrow chassis meant the movement of the balloon could cause the car to weave from side to side when the balloon moved. We were improving the distances it travelled but not the controllability and how do you attach a balloon nozzle to a single tailfin anyway?

Idea after idea was tested until a news item brought the solution into sharp focus; last year was the 30th anniversary of the Thrust 2

Session 1—teams built and tested their balloon cars



taking the world land speed record. With its wide, stable chassis the weaving was solved. The twin tail fins gave a suitable mounting point for the balloons and the new shape meant a rigid vacuum formed body shell could make an excellent top to the car.

Distance was important, we wanted the car to travel the standard distance of a primary school hall but it was too heavy. The build quality would also affect the car's ability to travel in a straight line. Lightening holes added to the correx chassis and thinner high impact polystyrene for the shell brought the weight down from 90g to 80g and a rear steering mechanism solved the problems of inaccurate building.

After months of development we finally had the car we wanted and just needed a school willing to be first to try the new project.



CAD CAM CAR TECHNOLOGY AND TEAMWORK



New technologies and hand skills come together to make a CAD CAM Car



Warren Road Primary School have supplied us with many excellent engineering students and this year is the first year we have worked with them and given their old students the chance to go back and work with their primary school.

An introductory session was run for the group at Warren Road, teaching them about the Bloodhound SSC project and highlighting issues to do with new technologies used in the build of the car as well as the importance of teamwork for this project to be a success.

After lots of questions students worked in teams to

design and build a balloon car with some very simple materials including sheets of card, straws and a range of mdf wheels. This lead into the second session of the activity's run at WGSB a few weeks later.

Arriving at WGSB the Warren Road students were greeted by a team of STEM Ambassadors ready to work with them and teach them how to build their car.

Laser cut chassis, wheels and tail fins. 3D printed balloon

nozzles. Vacuum formed shells. Vinyl cut names. As the students saw the parts of their cars manufactured they collected parts and started to assemble the final product.

It was hard work for everyone and after a few sessions we had nearly 30 cars to return to the students of Warren Road, and what a reception we had.

The final testing of the cars in Warren Road school hall began with 8 students at once sending their cars racing down the hall. Re-aligning the steering and testing again a great activity full of excitement and success.

This is a big project for the students to work on and I would like to thank the WGSB ambassadors as well as the Warren Road staff and students for their support in getting our new super project off the ground.

“3D printing has generated a huge level of media coverage recently, and talking to the students about their impressions of a technology that I have had the opportunity to work with was fascinating !”

**Year 5 Pupil
Warren Road Primary School**



PRIMARY ENGINEER SOUTH EAST REGIONAL FINALS



“I really enjoyed working with such enthusiastic kids. I liked seeing their faces light up when they got their trophies.”

Hannah Knight
WGSB
Ambassador



These cars were entered in the 3D class



Excited Apprentice and Engineering level students arrived at Wilmington Grammar School for Boys ready to take part in the South Eastern Regional Finals for the Primary Engineer Challenge 2014.

Teams of students from as young as 6 had designed, built and tested cars. Analysed and improved performance and recorded their thoughts and decisions in a portfolio of their work. Based on themes including Ice Cream Vans, Thomas the Tank



The best Apprentice Level vehicle covered nearly 14m coming to a halt when it hit the windows at the end of the hall



Engine Characters and McDonalds the most imaginative car designs came to life with bright colours and informative pit displays show casing the student's work.

At apprentice level (KS1) students are required to



Teams explain their work to the judges and then show them what their cars can do



design and build a car that will securely and safely hold a favourite cuddly toy and which, when released down a ramp, will travel the furthest in the straightest line.

Alongside this challenge they were interviewed by our panel of judges and talked about the process they had gone through to reach this level of the competition, discussing their portfolios and demonstrating their communication skills.

Engineering level students (KS2) have to build a battery powered car that can climb the steepest ramp as well as



RECEIVING THEIR AWARDS



WGSB STEM Ambassadors assisted our visiting judges with testing the teams cars and interviewing the teams about their projects



move both forwards and in reverse in a straight line over a 2m course.

Their designs also require the back up of a substantial portfolio and explanatory pit display. Along with the interviews from the judges, students had the opportunity to demonstrate their detailed engineering knowledge of the challenges faced and overcome during the design and manufacture of their car.

The finals, run by Angela Greene from Primary Engineer and hosted by Wilmington Grammar School for Boys is an annual event marking the highest level of the competition. Only 5 regional finals are held in England and Scotland and the



work of the winning teams at each event is then judged to decide who will be awarded the title of National Champions 2014.

Judging at the event is always fascinating and we are, as always, grateful to Steve Smith for organising a team of experienced Judges from Delphi Diesel Systems to come along to the competition.

Feedback from the judges on the ingenious solutions the students have devised to solve their engineering problem is

always interesting to hear. Personally, I always find the creativity of the teams amazing with their imaginations being given every opportunity to lead to a stunning, visual final product.

I would also like to thank our Year 7 and 12 WGSB STEM Ambassadors and helpers who worked with the judges in running the challenges, interviewing the teams and presenting the awards.

Our congratulations go with the winning teams and we wish them success in their bid to become National Champions 2014.

If your school is interested in getting involved in this amazing national competition then go to www.primaryengineer.com to find out more information or contact the team.

“This was a great event and gave the primary students the chance to demonstrate what they had learnt”

Seyi Sholola
WGSB
Ambassador





The 14m model of the Bloodhound SSC arrives ready for a week of show and tell

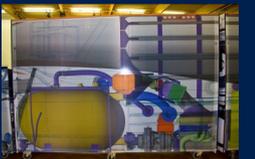


“Our Bloodhound SSC day was brilliant, it inspired me to become an engineer or ambassador just like them!”

Jonny Zaple
Year 7
WGSB



Bloodhound SSC inside and out



BLOODHOUND SSC THE APOLLO EFFECT

The Mayor of Dartford came to learn more about the project and enjoyed taking part in the activities



How do you inspire a generation of students to consider Science, Technology, Engineering or Maths as a career?

Build a car to travel at 1000mph and leave the rest of the world standing.

The education team from Bloodhound SSC call it the Apollo Effect, after Neil Armstrong set foot on the moon the number of young people that started to study STEM degrees rocketed.

Nationally we are in desperate need of scientist, mathematicians and engineers and to encourage students onto these courses. Bloodhound are showing thousands of people how much fun you can have with STEM.

The Bloodhound project is based near Bristol and since the start of the project there has already been a surge of interest with 30% more students taking up these courses at



the local universities.

Wilmington Grammar School for Boys has been an education centre for the Bloodhound SSC project for over two years and we have regularly visited primary



schools in the area to show them what STEM is all about.

This year we had a new opportunity when the Bloodhound Education team was looking for schools to host their launch events and we were an obvious choice. During one week at the start of July we had over 550 students take part in a series of activities run by the team at our school.

Our visitors were from both KS2 and KS3 and their day started with an introductory



presentation to the project. Explaining the plan to build a 1000mph car and what it would need to do to break the current World Land Speed Record; describing the testing and prototyping that has taken place to be able to produce an aerodynamic car capable of travelling at 1000mph as well explaining the jet and rocket that will be used to push the Bloodhound SSC through the 1000mph barrier. Comparing facts about the car to sizes we can understand, at top speed it will travel the length of 4 football pitches in 1 second; impressive facts and figures that defied imagination.

After their initial introduction the students were given the opportunity to take part in four workshops designed to challenge their understanding and develop their skills.

Show & Tell
Students were introduced to the full-size model of BLOODHOUND SSC.

During their 'guided tour' of the car and its components, they discussed the design



GETTING TO GRIPS WITH STEM



and science that goes in to building a 1,000mph car. They also saw a model of a hybrid rocket, tried on a hazmat suit and for a few lucky ones took a seat in the BLOODHOUND Driving Experience – driving simulator.

K'Nex Cars

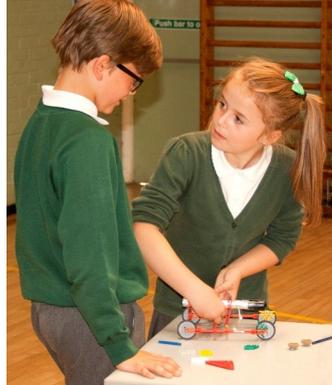
Competing for the opportunity to have their names permanently etched on the tailfin of the car teams of students built K'Nex cars and fired them down the gym using compressed air.

Following a brief introduction highlighting some of the key design areas of BLOODHOUND SSC, students worked in teams to design their own K'Nex car, which was required to travel in a straight line as far as possible down a track.

They made informed and appropriate decisions about the size and shape of their car, its wheels and the method they should use to



Gareth Johnson, MP for Dartford, learns about data handling and telemetry

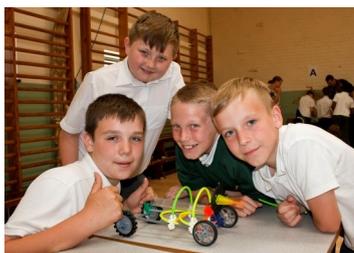


secure the rocket that powered it.

All students had the opportunity to race their car (using an air-powered launcher) and then make improvements before re-testing.

DynaKars

BLOODHOUND SSC will have over 400 sensors on board to transmit live data about the performance of the car to their team of engineers, when the car is doing a run. This is known as telemetry. Students were introduced to telemetry using DynaKars. (The Dynakar is a model car with an internal axle rotation sensor, which is programmed so the on board sensor transmits its data by Bluetooth to a computer loaded with the partner software.) Students were able to see how live data from their cars could be displayed in graphical format and they were asked to investigate how the movement



of the car changes and how their graphs change when conditions are altered.

Additive Manufacture

This session covered the development of components for BLOODHOUND SSC using additive manufacture (3D printing), the green credentials of 3D Printing in comparison to traditional manufacturing techniques and the future potential of this exciting technology. Working in small groups, students created their own simulated 3D object from neoprene.

After a full day of hands-on activities the students had the final chance to ask questions about this engineering adventure and left excited and intrigued by what they had learned.



“Majestic. It was a fun day and we gained a detailed understanding of the Bloodhound SSC”

**George and Harry
Year 9
WGSB**



JAGUAR PRIMARY SCHOOL CHALLENGE NATIONAL FINALS 2014



"I sincerely hope that I get to take part in the future."

Zoe Smith
Year 5
Oaklands school



These cars were entered in the 3D class



Regional Centres play a major role in the National Finals.

Becoming a judge for the day rather than a competitor was real eye opener.

Having hosted our first regional final in April I was invited to Coventry as a judge and I accepted the invitation so that I could learn more about how students tackled the challenge nationally.

There are two levels, 2D where students use a CNC plotter to cut out the net for their car and then assemble it, and 3D where the car is machined from a block of balsa. Both levels were being judged at this huge event.

As a portfolio and pit display judge I had a great opportunity to chat to the teams and examine the



The highlight of the event is seeing the cars fired down the track at nearly 20 Metres/second

work they had done to get to the finals. Teams ranging in age from 7 to 11 years old had put on detailed displays including a plethora of marketing products to bribe the judges.

Students' detailed knowledge of the work they had done, the decisions they had made and how they had dealt with disagreements in the team or



tackled time management issues to juggle SATs and the Finals was amazing.

I came away with a far better understanding of what is involved in running the project in schools as well as the standard of the work needed to complete at the National Level.

WGSB will be looking for more school to take part at the regional level at the start of next year.

One primary school student at the event was there on a fact finding mission, and this is her report.

Teams produce a pit display, presentation and portfolio as well as their car



Designing, Making, Competing!

36 teams, finalists from primary schools throughout the nation had to design a car, then make it on a cameo silhouette plotter, and finally race it to try and impress the huge team of judges at the national finals, to win the top prize of a trip to Silverstone during the F1 Grand Prix as well as being crowned National Champions 2014.

My name is Zoe Smith (10) and I go to Oaklands Primary School. On Tuesday 24th June this year I went to Coventry, to the Ricoh Arena, to the F1 in Schools Jaguar Primary School Challenge National Finals.

The co-ordinator of the challenge is Mr David Barnard, whom I interviewed with a voice actuated tape recorder to find out why he organises this enormous event.



F1 IN SCHOOLS

SPEAKING TO DAVID BARNARD



David Barnard, co-ordinator of the challenge, found the time during his hectic schedule to be interviewed by Zoe Smith

Some of the variety of questions I asked Mr Barnard were:

What is your work background? – “I trained as an aeronautical engineer and then went into teaching for over thirty years.”

Is this your first year? - “No, it’s been going on now for 9 years, but it is the third year nationally and the second year here in the Ricoh Arena”

How many miles have you travelled around the country? - “I’ve been from Plymouth to Glasgow and then across to Llandudno and across to Norwich. Those are the extremities of the project this year, and next year we’ll be going into Northern Ireland. So yes, many miles, but enjoyable times.”

I was intrigued by the answers that Mr Barnard



gave, particularly the reason he decided to create this challenge which was that he wanted to influence students to be able to say to themselves that ‘yes, I can do this because I can design and I can make something professionally’. Therefore encouraging them to think



about manufacturing and engineering in the future, because all types of design involves CAD/CAM and engineering is a fascinating career to get into.

The question is, has he succeeded?

I interviewed two of the teams: Fruity Frenzy and The Achievers, and most of the answers I received were rather spectacular.

The students felt they had been given the opportunity to try a new initiative with excellent support for the challenge and a member of



Fruity Frenzy felt that this could definitely lead on to a future career, commenting “that it isn’t about gender, it was about ability and enjoyment”. I would like to bring to your attention the girl to boy ratio, which I calculated as 4:5.

It seems like Mr Barnard has succeeded in achieving his goal and with all of the excitement of the day I know that he has enthused thousands of students across the country with this amazing challenge. It hasn’t just influenced the teams but it has also influenced me and I sincerely hope that I get to take part in the future.

Zoe Smith

Oaklands Primary School
Report for the Primary Engineer STEM Leaders Award



“Every year we have doubled in size and this year we have 12,000 children taking part nationwide”

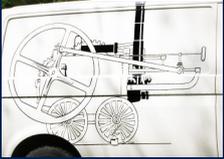
David Barnard

Founder - Jaguar Primary School Challenge

TREVITHICK'S INDUSTRIAL DARTFORD 2014



The engineering of today built on the engineering of the past



"I have been branded with folly and madness for attempting what the world calls impossibilities"

Richard Trevithick
Approx 1832 A.D.



Steam Wagons, Traction Engines and Vintage Vehicles were all on show

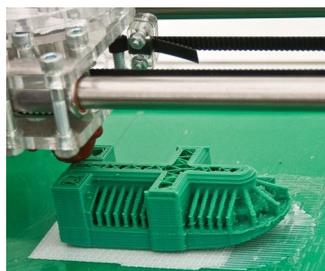


Richard Trevithick was a man ahead of his time. His inventiveness was so ostentatious that people of the time just weren't ready to accept his ideas.

High pressure steam pumps saving lives in the Cornish mines, The London Steam carriage offering transport to the masses with 10ft diameter wheels to deal with the potholes of the London Roads and the Steam Locomotive, only defeated because the technology did not exist to manufacture track that could support the weight of the train without cracking.

As an engineer he was a huge success, but sadly as a business man he was not.

Born in 1771 in Tregajorran, a hamlet near Camborne in Cornwall this talented engineer formed most of the theories about



the use of high pressure steam as a feasible replacement for horsepower.

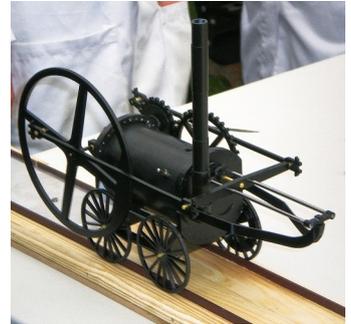
His extraordinary life took him around the world but left him a pauper working in Dartford for John Hall & Co. He died at the age of 62 and was buried here in 1883. Each year the Trevithick's Industrial Dartford event celebrates the great engineering legacy that Trevithick left behind.

Dartford is a town proud of its industrial heritage and engineering pioneers and to see such a wide array of engineering marvels collected together in Dartford's Central Park is a real spectacle.

Wilmington Grammar School for Boys have supported this event for years and we look to the engineering of the future as the core of our display as well as giving young visitors to get engineering!

The 3D printer is the source of some fascinating discussions when people see what it can do and the potential for it in the future.

What would Trevithick have said?



Trevithick's 1804 Loco was built by students in our first year at the event



The K'nex cars are always popular but this year we had the added attraction of the Caterham with many young people leaping in for a photo opportunity



IMAGES TO ENTHRAL

This year's event was slightly unusual as one of the school's main supporters for the event was not able to be there and I am very grateful to Mr Knights, Mr Riches and Mr Collins for their help in setting up and manning our marquee along with three of our STEM Ambassadors: Josh, Tim and Nathaniel.

Tim, Nathaniel, Josh and Myself were on hand with the camera—would what interested us interest you?



As our usual photographer was not there I asked the students to go out into the event and record images of the engineering marvels that interested them most ...

“As a child if I went missing at the steam fairs I was always found by the fairground organ, mesmerised by the movement of the musicians and musical instruments”

Jan Smith
WGSB

ENGINEERING EDUCATION SCHEME



Students demonstrate the IES software to visitors and judges at their stand

Engineering is the cornerstone of all industries and giving students the opportunity to work on real world projects brings the range and breadth of this massive....into sharp focus for our students.

The Engineering Development Trust (EDT) is an independent registered charity whose mission is to encourage young people to fulfil their potential through careers in STEM (Science, Technology, Engineering and Maths).

By organising the Engineering Excellence Scheme they bring together students and industry and have provided thousands of young people with a head start in their career.

Each year industrial sponsors set a team of 6 year 12 students from their link school a challenge that their own engineers are busy working on. Crofton Design set our students the challenge of designing a

Shrivar Govender and Greg Blanchard were representing Dartford Grammar School for Boys



The Newstead Woods for Girls team included Mr Nelson, Tiren Ogunde and Matt Wain

zero carbon dwelling within a dense urban environment, their solution had to comply with the UK Carbon Emissions of Buildings regulations.

As a team they undertook extensive research into energy efficient materials, renewable energy methods and CO2 emissions. They then used IES software to build and test a computer simulation of their design, being able to test the building during all weather conditions it would encounter during its lifetime.

The culmination of over 420 hours of work put in by members of the team is the celebration and assessment day hosted by the University of Kent, Canterbury. Having selected the most appropriate solution the team had to produce a display showing their work as well as give a presentation to a team of judges explaining the thinking behind their solution.

As a result of completing their project our students have each received an EES certificate of achievement as well as a Gold CREST Award, both of which are viewed highly by universities and employers.

Whilst at the event we had the chance to catch up with some of our old WGSB students who were representing their new schools, as well as having a chat with Mr Nelson from Newstead Wood for Girls who was Director of Engineering at WGSB until 2007. Further proof that engineering is key to our school can be found on the judging panel; Brian Hyland, chairman of the judges, attended WGSB in 1956.

Our students receiving their Certificates of Achievement



For further information regarding any topic in the Engineering Focus please contact esmith@wgsb.org.uk
Or visit our website at <http://wgsbengineeringfocus.weebly.com/>



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