



IF YOU WERE an ENGINEER What would you do?®

Leaders Award 2020 Handbook

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IF YOU WERE an **ENGINEER** What would you do?

Hello and Welcome

This booklet is a guide on how to use the Leaders Award 'If you were, an engineer what would you do?' to raise the awareness of engineering and what engineers do and develop creative problem-solving skills in children and young people.

As a competition, this project accepts entries from everyone between the **ages of 3 to 19yrs.**

The **Deadline in 2020 is now 10th September.**

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What is the Leaders Award: 'If you were an engineer, what would you do?'

Primary Engineer launched this programme in 2015 to explain to primary and secondary pupils what it is to be an engineer. The idea was a simple one, look at what engineers do, interview a few of them, then look around and find a problem to solve. Draw your solution and annotate it. That way your imagination can take flight and there are no technical or financial limits. Finish the project with a letter addressed to an engineer explaining why they should choose that design to build.

Every year our offices in Burnley receive the entries from schools across the UK, last year that saw 49,000 land! They are then collated, packaged up and taken around the UK where engineers come together to read and grade them. Shortlisted entries are then taken to judging panels, one in each of the regions to choose the two best ideas in each age group. We then hold awards ceremonies and public exhibitions across the UK.

Over the last few years many of our university partners have been so inspired they have built some of the incredible ideas, as you can see below.





In 2020 'If you were an engineer, what would you do?' will be different

We have witnessed the creativity, enthusiasm, fun and empathy and in these troubling times suggest this is just what we all need.

There are two aspects of this programme –

- ▶ **the project**, the ideas generation, drawing and letter writing which will be completed at home and
- ▶ **the competition** where we choose regional winners and ideas to put on public display which we will be working on when we are all back at school and work!

From Now, We Will:

- ▶ extend the competition deadline to 10th September 2020
- ▶ keep the age group for the competition between 3 and 19 years of age
- ▶ invite all parents, guardians and carers to engage the young people in their care with the project
- ▶ give you access to resources and a plan how to deliver them
- ▶ make engineers available for weekly online interviews, as part of the project
- ▶ give you access to the recorded engineer interviews in case you miss the live ones

The Project Outline:

- ▶ listen to the engineer interviews
- ▶ each week generate one idea, drawing and a letter
- ▶ as a group you could choose the best of all the ideas each individual has created
- ▶ take the best idea, drawing and letter into school and we will ask the teachers to forward them to us in one big parcel

The Competition:

- ▶ when we get back to the office, we will open all the parcels
- ▶ we will take them to engineer grading days around the UK, where engineers will read and grade the entries
- ▶ certificates will be created with the grades on and sent to the school to be given out
- ▶ award panels will choose their favourites
- ▶ exhibition dates will be advertised via our website and social media



ENGINEERING?

ENGINEER EXTRAVAGANZA #BSW20 MEET AN ENGINEER

Leaders Award #IfYouWereEngineerWhatWouldYouDo competition brings you the Engineer Extravaganza for British Science Week 2020.

If you are a teacher and you want to bring STEM activities into the classroom, let the Leaders Award help you. From Friday 6th March to Friday 13th March the #IfYouWereEngineerWhatWouldYouDo will be holding two Live Online Engineer Events a day direct to your assembly hall or classroom. Where you and your class will get to meet an engineer.

MEET AN ENGINEER: ONLINE INTERVIEWS

Primary Engineer & Secondary Engineer Leaders Award are re-launching the online interviews in September 2019 with lots of exciting engineers to meet. The aim of the engineer online interviews is so pupils get the chance to meet real life engineers in a virtual environment and discover the wide variety of disciplines engineering covers, this in turn gives pupils an insight into engineering opportunities and careers. This is a great way to inspire your pupils' ideas for the Primary Engineer and Secondary Engineer competition 'If you were an Engineer what would you do?' This year we are focusing on different themes such as space, sea, recycling, medicine, the environment and so much more. Facebook will be doing regular interviews throughout the competition this year.

How do we get involved in the online interviews?

ENGINEER EXTRAVAGANZA #BSW20 SCHEDULE:

FRIDAY 6TH MARCH:
10:30 – LAURA BÜCHELER, BIOMEDICAL ENGINEER, CO-FOUNDER & MANAGING DIRECTOR OF GHOST - FEEL IT



Read About Laura

An artificial intelligence start-up based in Berlin. GHOST – feel it uses the sense of touch to make people move, feel or learn faster. For example, they create a car seat that taps the driver on the shoulder to make him look in this direction before overtaking.



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PROFESSOR OF
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**DR MATT DICKINSON,
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COMPUTER-AIDED
ENGINEERING UCLAN**



**NAZIYAH MAHMOOD,
AEROSPACE ENGINEER
& ASTROPHYSICIST
SCOTTISH ENGINEERING**

Task 1: Discovering Engineering

Complete task 1 in the Engineers Logbook.

Engineering is a field that is centred around problem solving and is made up of many disciplines, [here](#) are just a few engineers who took part in our on-line interviews this year so far. You can find more engineers [here](#) or access engineer CV's in the resource folder.

The first part of the project is to find out as much as you can about what engineers are and what they do. On the resources area of the Leaders Award page you will find many recordings of different types of engineers answering questions about their work.



Task 2 - What questions could you ask an engineer?

Complete task 2 in the Engineers Logbook to construct a list of questions to ask the engineering professional during the live interview.

For those who have a friend or family member that is an engineering professional, perhaps you could interview them over a phone call, video link?



To access the live online engineer interviews, check the home page www.leadersaward.com and follow the link to **ONLINE INTERVIEWS**, from here you will be able to see the schedule and how to 'book a seat'!

If you are unable to access one of our online interviews, you can use the Engineer CV's in the resource folder to further understand what specific engineers do and do some further research on what they do and the skills involved!

Task 3 - Let's get creative!

Now that we have a better understanding of what engineering is and who is an engineer, we are going to look at the functionality of some products and items we use every day. All of them will have been engineered in some way!

Take a toothbrush for example...There are different kinds of toothbrushes, manual, electric, hard, soft. The toothbrush overtime has been adapted and improved to cater for different needs.

Complete task 3 in the Engineers Logbook, which is the **Product Functionality** task. We would like you to pick some items from around your home and evaluate them under Function, Safety, Aesthetics, Ergonomics, Durability, Cost, Materials, Environment. You will need to make notes in the boxes and then score the item under each heading from 1 to 5 (1 = Poor, 5 = Excellent).

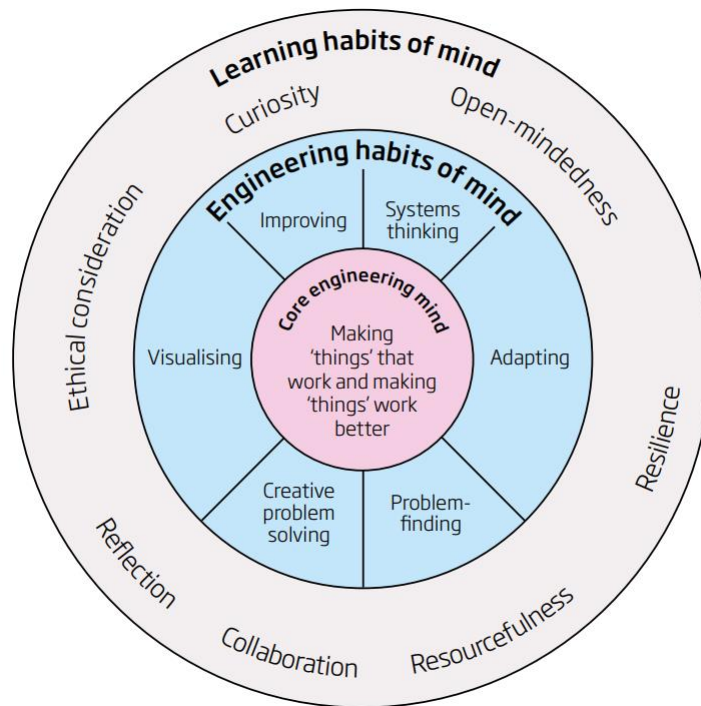


Task 3 Extra Support

The following information is to help you come up with lots of ideas for task 4!

At the core of engineering is to make things that work or make something work better. To do this we must problem solve, adapt and improve which over time moulds and shapes a person to be open-minded, considerate and resilient.

The Engineering Habits of Mind was developed by University of Winchester's Centre for Real World Learning as part of their Report [Thinking like an Engineer](#) for the Royal Academy of Engineering. Thinking like an engineer is something we should all do. The model below shows you how you can develop these key thinking skills by learning to be more reflective, open minded and curious (to name a few). We encourage you to act this way during the Leaders Award!



The 'Engineering Design Process' is a series of steps used by engineers to create innovative solutions to problems and new ideas. There are different versions of the engineering design process available, however, they all aim to explain the same thing.



Why not use this to help you come up with your own ideas and solutions?

1. Define a problem – WHO needs WHAT and WHY?
 - a. What is the problem or need?
 - b. Who has the problem or need?
 - c. Why is it important to solve?
2. Do some background research – Learn from the experience of others, this can help you avoid mistakes that have been made in the past.
 - a. Users/Customers/Consumers
 - b. What existing solutions are already out there?
3. Specify the requirements – One of the best ways to do this is to look at similar solutions and identify its key features
4. These requirements will state the important characteristics that the solution needs to be a success
5. To explain the Engineering Design Process in a simpler form please follow [this link](#) and watch the animation (please check link first before sharing, it was correct at time of publishing).
6. Storyboard solutions – Engineers try to come up with as many solutions as they can when problem solving, there are always many ways to solving design problems, if you go with your first solution without even exploring any alternate ideas, then you may be overlooking the best one.
7. Choose your best solution – Look at whether each solution meets the design requirements, some solutions will meet more of the requirements than others and those that don't meet the design requirements should be rejected.
8. Develop the solution – Development involves the refinement and improvement of a solution and is consistent throughout the design process – generally, it continues even after the product has been shipped to customers and clients.

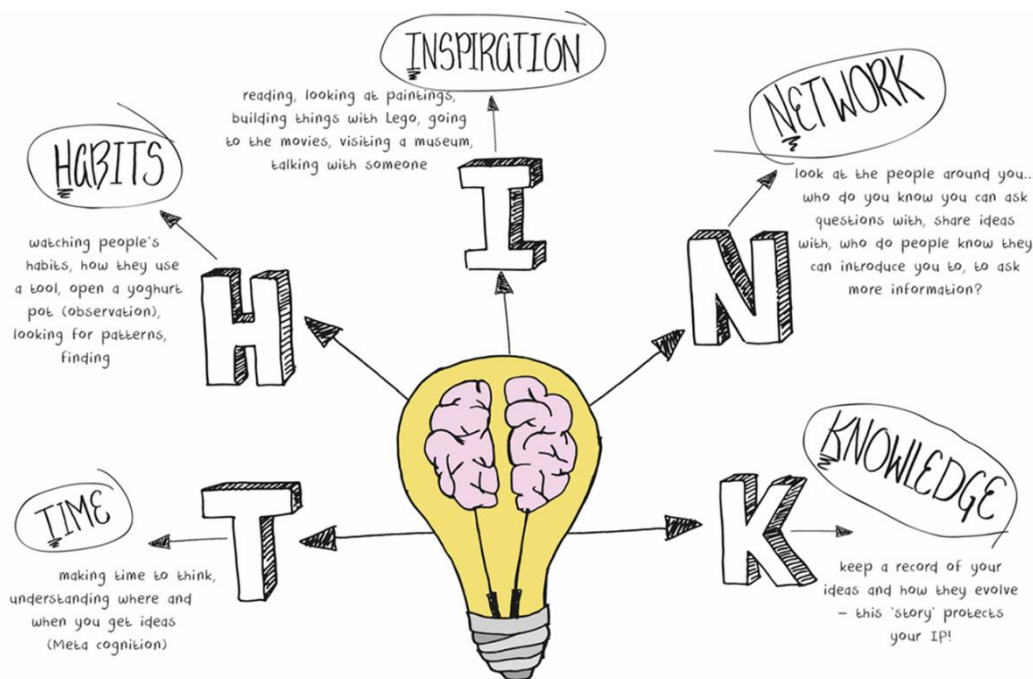


Points 9-11 are not part of the Leaders Award 'If you were an engineer, what would you do?' project or competition, but here for your information.

9. Build a prototype – A prototype is an operating version of a design and can be used for testing and the engineers may go to potential consumers for feedback. Prototypes play a key part in the final development of a solution.
10. Testing and Redesigning – The engineer must use the information gathered from testing the prototype to make changes before settling on a final design. This part of the process is called 'Iteration' and may have to be repeated multiple times before the engineer can settle on their final solution.
11. Communicating Results – Once the design has been finalised, the engineer would share the solution to their problem to others (other engineers, general public, their chosen audience, potential investors).

'The Lightbulb Moment'

Usually at school, when we complete problem solving activities, it is our teachers that present students with a problem to solve. This project asks you to not only solve the problem but to define it in the first place. Here are a few strategies you can use.



The Acronym **THINK** stands for Time, Habits, Inspiration, Network and Knowledge, developed by Philip Hannay. All these aspects come together to help generate ideas.



“If at first the idea is not absurd, then there is no hope for it. “

Albert Einstein (1879 – 1955), Mathematician

Grumpy Grandad

**“If necessity is the mother of invention,
grumpy grandad could be her closest relative!”**



If you find it difficult to identify a problem, a useful strategy is the ‘Grumpy Grandad’ approach. This involves thinking about the complaints people have about day to day tasks.

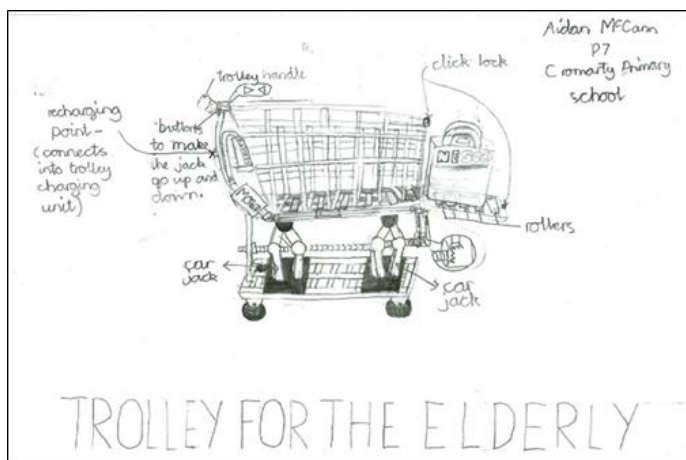
Things to think about:

- ▶ how things work
- ▶ how we travel
- ▶ how we eat/drink
- ▶ **most importantly** what do people most complain about – the trick is to listen and observe!

Complete task 3.1 in the Engineers Logbook, which asks you to think about other ideas. What do you like? What would you change? Complete the table and spark your imagination!

For example, Aidan created the ‘Trolley for the Elderly’ due to observing his little lovely (and definitely not grumpy!) Grandmother trying to lift the shopping out of her shopping trolley and into the boot of her car. His idea was a shopping trolley that lowered, the front flicked open and the base of the trolley had rollers which would enable the shopping to be rolled into the boot of the car.

The University of Strathclyde choose to build it, as you can see from the photo below.



More examples can be found on the website and in the ‘If you were an engineer examples PDF’



Task 4 - Idea Flowchart

Complete Task 4 in the Engineers Logbook, which asks you to map out your problem and brainstorm potential solutions to the problem.

**IF YOU WERE AN
ENGINEER**
What would you do?

Primary Engineer Programmes
...the first step®

Create an Idea Flow Chart

What is the problem you have found?

What is your first solution?

What is your second solution?

Who will it help?
Who is the audience?

What is your third solution?

Fill in the flow chart by thinking of an audience you want to help and some problems or complaints they have. See if you can come up with different solutions to the problems then explore why they would work and, in some cases, why not.

Annotating your design

Annotating means adding purposeful notes and labels to add detailed explanation to the drawing. The annotations on a drawing are a crucial part of the entry process for the Leaders Award as it can give key details that may not be seen clearly on a drawing, explain how the materials will be joined together, what they will be made of, what the parts will do, how they will respond to different uses, how they will move – the more annotated detail the better!

The Leaders Award participants range from 3 to 19 years of age. Obviously, drawing skills can range across the board and it must be noted that the entries are not judged on drawing ability, it's about the identification of the problem and the creative solution to it so it is graded on the idea and concept. Younger pupils can expect help on the annotating from an adult.

During **task 3**, we looked at existing products and considered things such as how it looked, or where was it used. Those questions can also be considered when annotating designs (Function, Materials, Aesthetics, Safety and anything you want to include that may not be clear on the drawing). Look at the 'If you were an engineer examples PDF' and the website for many more examples



Task 5 - Time to Shine!

Complete task 5 in the Engineers Logbook which is where your drawings of solutions can be collected, annotated and stored. When you have finished, discuss the range of ideas you have identified with someone else. Here are some suggested questions to help you:

- ▶ What are the main advantages of your design?
- ▶ How do you think your design solves your initial problem?
- ▶ Does your design meet the requirements of your target audience?
- ▶ How do you think this could be made in real life?
- ▶ What materials are used for your product? Is there a better material that could be used?
- ▶ Have you considered the impact your product or the making of your product could have on the environment?
- ▶ What are the limitations of your design?
- ▶ What do you think you could put in place to make your design better?
- ▶ How did you come up with this solution?
- ▶ Do you feel confident enough to propose your solution to someone else?

You could present ideas to the group as a type of Dragon's Den activity where the idea is presented, and everyone gets to ask questions about it – you can then **pick the best idea to put forward in the competition.**

You may come up with different solutions to different ideas. For each problem, the aim is to have one idea drawn, annotated and an accompanying letter each week between now and when we return to school. You will then choose your best idea to send into us when you return to school. (Drawing sheet in Leaders Award Engineer Logbook task 5, or just use any A4 or A3 sheet of paper.)

Task 6 - The Engineer's Letter

Learners should write a letter (one side only of A4 paper) that is focussed on persuading engineers why they should choose to build your invention. The engineers who will be grading each entry will be looking at how good a solution your idea is to the problem you have found. They will award Pass, Merit, Distinction and Shortlisted grades. The Shortlisted are taken to



the judging panels and as many as possible are placed on exhibition. Engineering students from universities around the UK will visit the exhibitions and choose one or more idea to build from each region. It may not be a winner but one that appeals to the engineering students, so it is important to annotate and explain your drawings well.

The letter must tell us...

- ▶ What problem does the idea solve?
- ▶ Why did they think it is a problem?
- ▶ How does the solution work?
- ▶ Who or what benefits from the invention?
- ▶ Why should their invention be built as a prototype?
- ▶ Why is their solution special?
- ▶ Who or what was their inspiration to invent this solution?
- ▶ What would they like to be when they leave school?

The letter could tell us things like...

- ▶ Did interviewing an engineer help them to think of the solution?
- ▶ Did they enjoy inventing and illustrating the solution?
- ▶ What STEM projects/activities are they involved with at school and/or outside of school?

What's next?!

Each week we will be hosting online interviews with engineers you can tune into either live or the recorded versions.

Use the interviews and home-based research to think of ideas and work through the different activities – the more you and yours do, the better you will get at it!

Just before schools re-open, we will be asking you to sit down and choose the best of all your ideas. These will be taken into school and sent to us, along with all the other Leaders Award entries.

Keep us updated with your engineering activities on social media and don't forget to tag us
@LeadersAward @PrimaryEngineer #LA2020 #IfYouWereAnEngineerWhatWouldYouDo #EngineersAtHome