

Teacher Guide

Welcome to Tomorrow's Engineers EEP Robotics Challenge 2018/19. We're really looking forward to working with you!

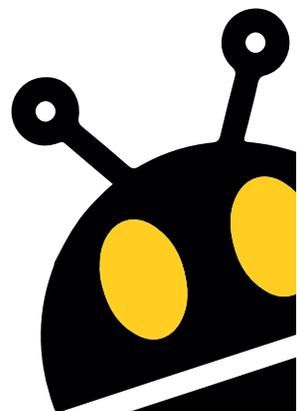
This fun, team-based competition - created by the [Helsington Foundation](#) in conjunction with Tony Purnell, Visiting Professor at the Department of Engineering, University of Cambridge and delivered by EngineeringUK - is guaranteed to transport students on an exciting voyage of exploration and discovery, fuelled by the STEM curriculum.



The challenge

It is aimed at 11-14 year-old students and is open to schools across the UK. At its core are real-world problems in need of innovative engineering, technology and computational solutions - all based on the application of key maths, physics and IT thinking...plus lots of inspiring LEGO® robot building.

Last year's Tomorrow's Engineers EEP robotics challenge attracted entries from 400 schools culminating in the grand final held at the UK Big Bang Fair at Birmingham's NEC. This year's challenge - which promises to be bigger and better - involving 500 schools from all over the UK!



**Tomorrow's
Engineers**

Partners

Our key partners are the Royal Air Force, who celebrated their 100-year anniversary in 2018 and Rolls-Royce. The exciting 'aviation missions' on which the student teams will embark, rely on pooled talents and brainpower - plus teacher support - in order to achieve successful outcomes. The missions will also require and promote commitment, staying power, problem solving capabilities, good communication, independent thinking and learning, project management and presentation skills, leadership and, above all, well-grounded confidence.

In the Robotics Challenge, fortune favours adventurous team players with great resilience, the will to learn and a 'can-do' attitude. It will all amount to a lot of fun, STEM-based discovery, and the chance to win some great prizes! The challenge has long term benefits for everyone involved. Its primary, long-term aim is to immerse young people in critical engineering principles, equipping them with key skills that, in years to come, can open the door to promising and rewarding careers. As in the past, the Aviation Challenge also provides great professional development opportunities for staff, via hands-on technical training for teachers that facilitates the introduction and the development of robotics within the curriculum. These training experiences will undoubtedly have a great impact on teachers and students all over the UK; creating a real buzz about robots and engineering! As the winning 2017/18 team from McLaren High School, Callander put it:

"I loved the Big Bang Fair, particularly the Red Arrows exhibit because I've never been next to a plane like it before"

"The robot challenge was amazing – it was so tense waiting to see if all our hard work would pay off"

"I really enjoyed being part of a team – it meant each of us was able to bring at least one skill to the group"

"I would encourage everyone to be involved with Robotics and the Tomorrows Engineers competitions – you don't need any previous experience, just good teamwork"

"I'm so proud of our team – they have worked hard for months. It's been great watching them improve over the year in so many ways – their skills in teamwork, initiative, persistence, adaptability, creativity & communication have all improved hugely during the process" Mr Macmillan (teacher)

"I was delighted to see the team win – even if they hadn't, I could tell that the team thoroughly enjoyed their experiences on the day. It was particularly pleasing to see the team perform well under pressure and to see all their hard work and preparation beforehand pay off" Mr Ross (teacher)

We can't wait to meet your students at this year's challenge!

What to expect & your steps to success

- Recruit a 50/50 split (where possible) of girls and boys aged between 11-14



REALLY IMPORTANT: Please make sure that the groups tackling the different challenges are representative of the team as a whole. We want males AND females involved in all the different activities. Robotics and Engineering is for everyone!

- How you recruit is up to you. Last year, some schools organised a competition based around the Tomorrow's Engineers' 'Save Lives' poster and resource pack, focusing on the question in the pack (Activity 5, page 3): Can you come up with a brand new solution or piece of equipment/technology that would help revolutionise the way we respond to disasters?
- Many schools work initially with around 20 students who learn how to use LEGO® MINDSTORMS® Education EV3, research engineering topics, engage with our website and prepare for the competition day elements
- HOWEVER, for venue capacity restrictions, only a maximum of 10 students from each school can attend the Regional Competition

The competition consists of:

Speed Challenge 20 points	Get your EV3 robot to cover 400cms as quickly as possible! (Full details in the Student Guide).
Robotics Challenge Mat 40 points	You will have 2 chances to score as many points as possible on the table-top challenge under time pressure! (Full details in the Student Guide).
Project Presentation 40 points	A formal presentation (that doesn't have to be PowerPoint!) to a panel of judges. In addition to the score obtained on the Robot Challenge mat, schools will gain credit for presenting research on a topic of interest that is based on the solution to the problem 'How could engineers support humanitarian aid in the future?' (Full details are included in this guide).
Robot Design 40 Points	Teams present their robots to judges. Teams explain what they have learnt about the robot and solutions they have developed to complete the aviation themed missions on the Robot Challenge mat. Judges will be assessing the engineering process that teams have adopted pre-competition, as well as any lessons learned by the team. (Full details are included in this Guide).
Teamwork Challenge	We can't say anything about it as this will be set on the day. It will be an exciting surprise. Please wish your group good luck!

What you've got!

1. A Challenge Mat and LEGO builds
2. Student Guide and Teacher Guide
3. Ramp and Dual Lock Tape (to secure the ramp to the mat), make the ramp up using the three wooden dowells and secure with rubber rings. Change the position of the dowells to alter the height.
4. Tomorrow's Engineers Careers Resources including 'Save Lives' poster and teacher notes resource pack sent to your school or download here <http://www.tomorrowsengineers.org.uk/savelives>

For more careers case studies and downloadable resources go to www.tomorrowsengineers.org.uk

Remember...

It is really important that we get every school team to the Regional Competition – if you feel you need extra help, just reach out! We will get you there – no problem! We will be available for calls, emails and webinars to answer any questions about the competition.

Remember to keep checking our webpage

<http://www.tomorrowsengineers.org.uk/robotics> for the latest updates and to learn more about the competition elements and also help to make links to careers in Engineering! That's why we have been provided with funding to make this challenge free for schools to enter. We have a shortage of engineers in the UK and we want you to help us to inspire the next generation.

Speed Challenge (20 Points)

We are really excited about this! It is all about speed. Get your MINDSTORMS moving as quickly as possible over 400cms. There are not many rules - just go fast. And...

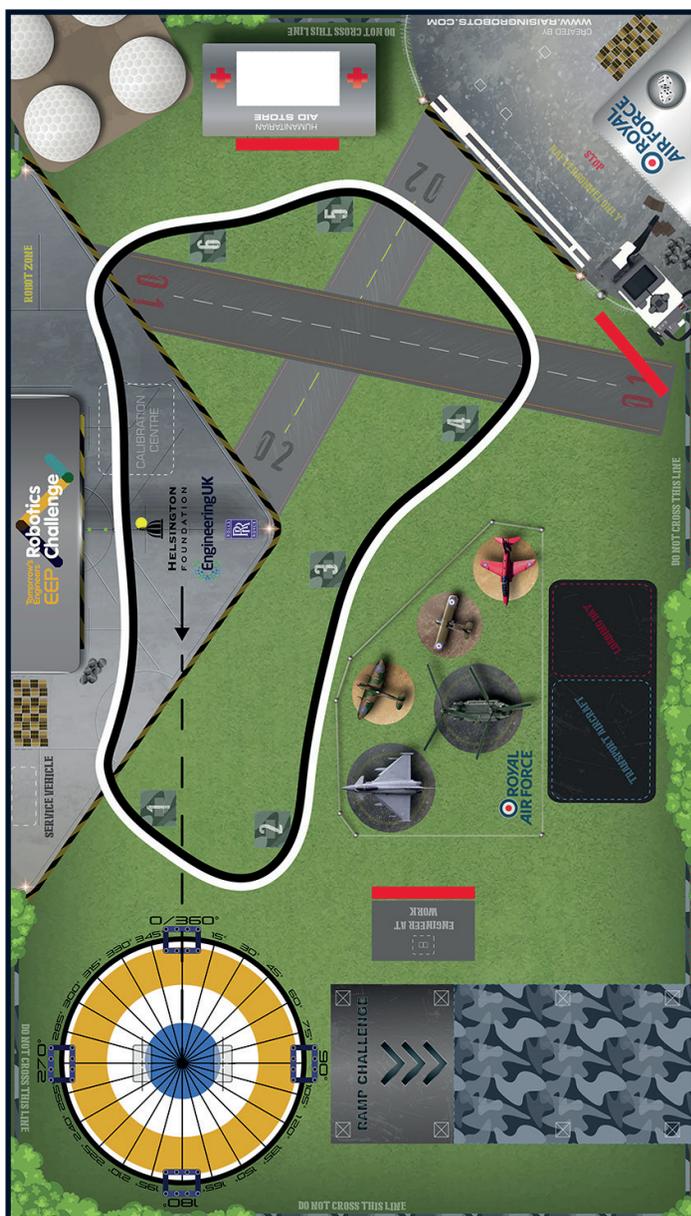
- You can only use LEGO MINDSTORMS parts
- You can only use one LEGO MINDSTORMS Intelligent Brick
- You must stay within the confines of the track which is 400cms long and 50cms wide – but obviously you can shoot off the end of it in style!

You will get TWO attempts on the day and your best time will be the one that counts. We will have a 'Top Gear' style scoreboard that will track your position!

Full details in the Student Guide.

Robotics Challenge Mat (40 Points)

Get your MINDSTORMS EV3 Robot solving a range of exciting challenges. All the challenges are outlined in the Student Guide and the score sheet is available under the 'Teacher Zone' tab - click 'Resources' - click 'Competition day' and the Robot Challenge Score sheet is there.



Build the LEGO aircraft following the instructions provided

- Attach the Rolls-Royce and Royal Air Force stickers to the plane engines etc, in place of the original LEGO Stickers
- Build the mini-figures
- Choose which LEGO head you will have on the engineer – we've provided a female to encourage diversity and inclusion as female engineers are often under-represented in engineering
- Build a storage container for the humanitarian supplies that your robot will be able to collect by picking up off the mat (not it dragging across the mat). An example build guide is available for this at the back of the Student Guide.

Interlocking dual tape – cut this up and place it on the 8 squares for the Ramp Challenge section. When you press this tape together it locks together and is more hardwearing than Velcro. It will help to keep the ramp in place for your robot to climb. Remember - students will set their own level of challenge!

Project Presentation (40 points)

Our volunteer STEM judges are very keen to hear (in no more than five minutes) what solution the team has researched to answer the question 'How could engineers support humanitarian aid in the future?'



Elements to consider:

- Robots of the future
- Technology in the future
- Medical technology
- Detection sensors
- Limb replacement technology
- 3D printers
- Data capture and analysis
- Search and rescue
- Engineering recovery vehicles
- Environmental factors
- Image analysis and facial recognition software
- Drones
- Designing apps

Suggested starting point:

1. Discuss as a group what topics you think you would like to investigate.
2. Decide which topic interests you all the most. You are more likely to score highly when you yourselves find the topic interesting.
3. Put together an engaging presentation.

During the competition you will be scored on:

- Introducing yourselves as a team
- What science or engineering solution are you presenting?
- How will your solution benefit people in need of humanitarian aid?
- Where you obtained your information, extra points for variety and if you contacted a specialist!
- Explaining any challenges you overcame during the research project
- Explaining the research and presentation skills you have developed.

How the students make the presentation is entirely up to them.

Using Powerpoint is fine but we also love creative approaches to presentations!

Full scoring details are available here: <http://robotics.tomorrowsengineers.org.uk/teacher-zone/resources/> and click 'Competition day'.

The Big Bang Competition is the UK's top STEM competition open to all UK residents aged 11-18 years old, in full-time education or training. Your students can take part by entering their research presentation or any other STEM project; for more information please visit thebigbangfair.co.uk/competition

Robot Design (40 Points)



A maximum of 40 points are available as teams present their robots to judges. Teams explain what they have learnt about the robot and solutions they have developed to complete the aviation themed missions on the Robot Challenge mat. Judges will be assessing the engineering process that teams have adopted pre-competition, as well as any lessons learned by the team.

The engineering process includes generating initial ideas, selecting and building the best idea, testing and analysis, review and revision of ideas and communication. Teams may feel more confident if they have a portfolio to show with images and descriptions of their robot designs. Fun team photos welcome too!

- Students should describe the robot hardware and software designs for the aviation themed missions
- Students should explain the development process as well as challenges or things they would change
- Students should include the things that didn't go to plan and how they overcame these barriers
- All of this information is communicated in no more than 5 minutes

Full scoring details are available here: <http://robotics.tomorrowengineers.org.uk/teacher-zone/resources/> and click 'Competition day'

Teamwork Challenge (40 Points)



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Setup

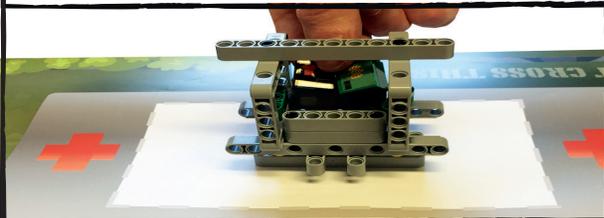
1 FOLLOW THE LEGO BUILDING INSTRUCTIONS PROVIDED



2 USE THE 'NEW' CHALLENGE STICKERS IN PLACE OF THE LEGO STICKERS...

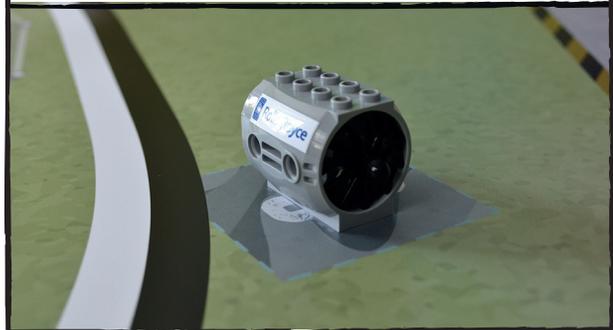


3 PUT YOUR HUMANITARIAN STORE STRUCTURE IN PLACE...



PLACE THE FOUR HUMANITARIAN AID PARCELS INSIDE YOUR STRUCTURE

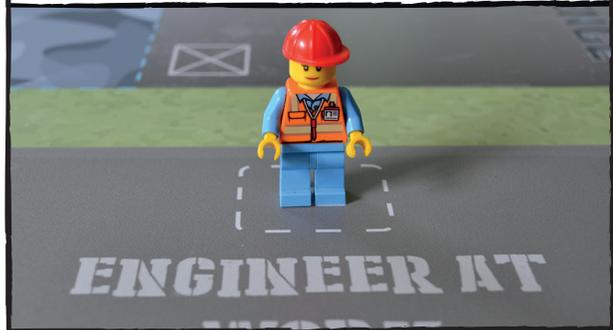
4 ROLL THE DICE AND PLACE YOUR ENGINES



5 POSITION THE TRANSPORT AIRCRAFT IN PLACE AND MAKE SURE THE TAIL IS IN AN UPRIGHT POSITION



6 PUT THE ENGINEER IN HIS OR HER POSITION... YOU CHOOSE WHICH HEAD!



7 PUT THE YELLOW SERVICE CAR IN THE BAY WITHIN THE ROBOT ZONE...

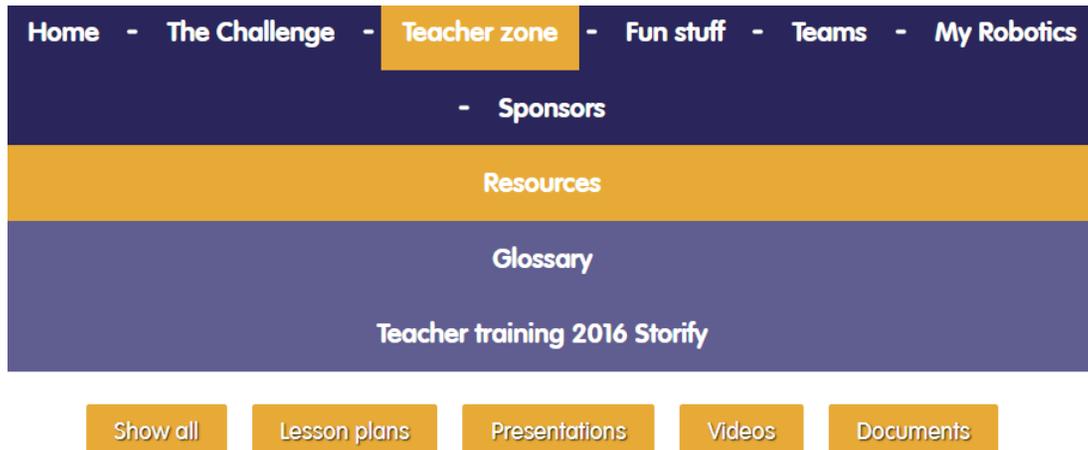


8 POSITION THE RAMP WITH THE VELCRO PROVIDED



Access the resources

To do this go to <http://robotics.tomorrowsengineers.org.uk/teacher-zone/resources/>



Home - The Challenge - **Teacher zone** - Fun stuff - Teams - My Robotics

- Sponsors

Resources

Glossary

Teacher training 2016 Storify

Show all Lesson plans Presentations Videos Documents

Teachers' Resources & Support



John Pinkney
Raising Robots
LEGO Education Certified Trainer

"I am really excited to have developed the aviation challenge with Tomorrow's Engineers BUT we are now focused on making sure that you and your team make great progress with your LEGO MINDSTORMS EV3s. We can't wait to see you and your robotic creations on competition day.

We have developed some easily accessible teaching resources to support you with the challenges AND if you get stuck, simply log a support call – no question is a silly question. We are here to help!"



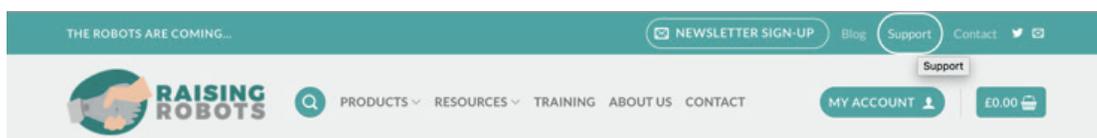
To access our support and resources, you simply need to register with us at the Raising Robots website:
www.raisingrobots.com

Complete the registration form to create an account. Once you have registered, it will automatically log you in.

Whatever the question... We are here to help you get to grips with the challenges and get ready for competition. It would be great to get all school teams to their Regional Finals!

Create a support ticket

To do this, make sure that you are logged in and then click on support.



THE ROBOTS ARE COMING... NEWSLETTER SIGN-UP Blog Support Contact

Support

RAISING ROBOTS PRODUCTS RESOURCES TRAINING ABOUT US CONTACT MY ACCOUNT £0.00

Then create new ticket. Simply put the details of your problem and we will get it sorted out!

Please could we ask that all 'support requests' are logged by teachers as we can't communicate directly with students. Thanks and good luck raising your robots!