

BIEA 2019 International STEM Youth Innovation Competition

'Fighting Extinction' Handbook





We can achieve great things if we have the will.

The development of science and technology should focus on the comprehensive development and care of human beings and life in the wider environment, providing positive progress for the planet as a whole.

We should cultivate students' scientific, technological and humanitarian attitudes towards the world through education.

This is the aim of the BIEA International STEM Youth Innovation Competition.

 **David Hanson**, *BIEA STEM Chairman*

British International Education Association (BIEA)

The **British International Education Association, BIEA**, is a young non-profit organisation with a simple mission to promote the best of British educational practice overseas and encourage, develop, share and learn from best practice we find around the world.

BIEA International STEM Youth Innovation Competition

The BIEA International STEM Youth Innovation Competition is an event for students under the age of 18 which aims to raise the level of technological enthusiasm among students from all over the world as well as to stimulate students' passion for science, technology, engineering and mathematics (STEM). The competition builds bridges between science, technological innovation, education, and young people across a variety of industries. The competition is held every summer.

BIEA picks its yearly themes carefully to reflect the most pressing issues facing our planet, combining humanity, ecology and technology together into a holistic and multidisciplinary challenge for students around the world.

Theme of 2019: 'Fighting extinction'

2019 will be the first international competition, students from around the world will be set the challenge of using drone technology to help fight extinction and to preserve vulnerable animal species.

It is up to them to tackle this pressing global issue, they are free to choose a specific species to address and the way in which their drone could potentially help.

We hope that through the competition, students will be able to pursue their passion for STEM outside the classroom, see how it can be applied to real-world problems and make friends with like-minded people globally.

We welcome entries from all over the world and it is free to enter. The finals of this year's competition will be held in the UK in July 2019.

Competition Format

The BIEA International STEM Youth Innovation Competition is divided into three parts: Regional Heats, International Competition and Live International Finals.

The Regional Heats are divided into different global territories, and the final 36 teams representing different countries around the world will go on to participate in the International Competition. In order to compete, participants must form teams and sign up for the competition in the name of their school. The competition aims to cultivate the importance of teamwork, and help participating schools integrate STEM learning into their mainstream offerings.




Regional Heats

- ▶ Each school can enter teams of between 3-5 students;
- ▶ A teacher must register the school for the competition, and include the names of all the individuals in each team;
- ▶ Regional Heats in the UK and other countries include children from all primary and secondary schools;

International Competition

Thirty-six teams will be selected worldwide for the international competition. The finals will be held on 4th July 2019 at the Royal Air Force Museum in London, UK.

 The country that the international finals will be held at will vary year on year. Countries that are interested in becoming the host for the finals in 2020 should apply a year prior to the event.

Technology Achievement Showcase

The Competition provides a big chance for students to show off their achievements. Student's will exhibit their work in front of tens of thousands of educators, industry experts and fellow students. They will also have the chance to meet face-to-face with world-renowned enterprises and industry experts. The Showcase will be held at the Liverpool Exhibition Centre on the 2nd of July 2019.



Competition Flow and Process

Regional heats

- 15/Jan/2019 —● **Official launch**
- 31/Mar/2019 —● **Regional heats (first round) ends**
- 01-15/Apr/2019 —● **Judging period 1**
- 23/Apr/2019 —● **Finalist teams' announcement**
(Note: **100GBP** Innovation Fund available to 36 finalist teams for next round)

International competition

- 23/Apr/2019 —● **Winning team's notification and instruction sent out**
- 23/Apr – 4/Jun/2019 —● **Innovation and Presentation rounds begin**
- 20 – 31/ May/2019 —● **STEM ambassadors visit schools**
- 4/Jun/2019 —● **Presentation and Innovation Videos submission**
- 7-17/Jun/2019 —● **Judging period 2**

Live international finals

- 02/Jul/2019 —● **Technology Achievement Showcase**
- 03/Jul/2019 —● **Pre-competition orientation**
- 04/Jul/2019 —● **International finals, Awards Ceremony and celebration party**
- 05-11/Jul/2019 —● **Competition STEM Summer Camp and training**

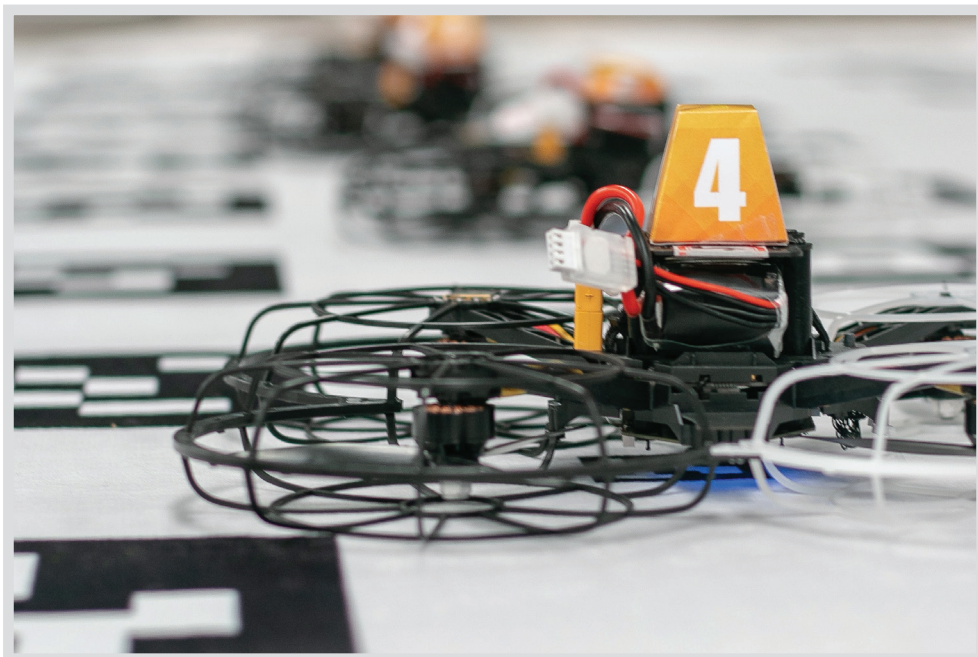


Competition Entry Requirement

- ▶ Participating age groups:
 - ▷ Primary school division: 9 - 11 years old
 - ▷ Junior High school division: 12 - 14 years old
 - ▷ High school division: 15 - 17 years old
- ▶ There must be a minimum of 3 and maximum 5 students per team
- ▶ Teams must register through their schools and operate under the name of the school
- ▶ Teams must have the support of a teacher/adult mentor from the school



International teams and accompanying teachers who will come to the UK to participate in the finals must purchase their own travel insurance.



Competition Round

Critical thinking, practice, eloquence, execution

Regional Heats:

- ▶ Report writing

International Competition:

- ▶ Innovation and design
- ▶ Oral presentation

Live International Finals:

- ▶ Mission execution
- ▶ Evaluation
- ▶ Work display

First round

Report writing (Score 25 points)

– Critical thinking: Report writing and creative thinking

This round aims to encourage students to apply their knowledge and understanding of science, technology, engineering and mathematics, and to enhance creative and critical thinking, argumentation, secondary source referencing and creative writing skills, as well as to stimulate students' innovative thinking.

Each group is required to submit a report (in English) by 31st March 2019.

Second round

Innovation and design (Score 25 points)

– Innovation, engineering and budgeting

Thirty-six teams from around the globe will qualify to enter this round. Each team will receive a budget of £100 to purchase a small drone. The teams will need to turn their ideas into reality and demonstrate flying skills within the required time and budget.

Participating teams will record their flight with the instructions provided by BIEA. UK-based STEM ambassadors will judge each team's flying skills and check that the budget has been met. Each team should submit the video by 4th June 2019.

Each finalist team should retain receipts as evidence of their purchases. The total expenditure must not exceed £100. Any amount in excess of £100 will result in instant disqualification.



Third round

Oral presentation (Score 25 points)

– Clarity of expression, planning and presentation-skills

The finalist teams are required to submit a video presentation (in English) to explain their project and to show how their project has developed from a report into a final drone design. Planning and producing a video encourages teams to develop their planning and oral presentation skills in summarising their project to date. The ability to present findings in a creative and original way is a key transferable skill which is valuable to future employers and universities.

Each team should submit the oral presentation video by 4th June 2019.

Forth round

Finals (Score 45 points)

– A great opportunity for cultural exchange and interaction

Task 1: Mission execution

Performing novel tasks, problem-solving and teamwork (Score 25 points)

The thirty-six finalist teams will follow a brief to complete the flying tasks. They will fly new drones provided by BIEA through a set course at the Royal Air Force Museum, London. This round is to judge the team's ability to work together to accomplish a complex task.

Task 2: Evaluation

Self- and team-reflection on the project's and team's strengths and shortcomings (Score 10 points)

Teams will prepare a speech without PowerPoint or similar resources. They will need to reflect on the positive impacts of the project, such as experience and knowledge gained. Probing questions will be asked by the judges to assess depth of understanding. We encourage each team member to participate in presenting a clear evaluation of their project, summing up the positive and negative experiences, and what they would do differently if they had to do it again. Students are encouraged to share their favourite moments of the competition.

Task 3: Work display

Clarity of explanations, creativity of displays (Score 10 points)

Each team will display their modified drones and key areas of their journey through the whole competition. Judges will assess clarity and presentation of their work, while each teams' peers will also get the chance to vote for their favourite display.



Competition Venues

Regional Heats:

In the participating teams' own schools

Technological Achievement Showcase (2nd July 2019):

The Exhibition Centre, Liverpool, UK

Live International Finals (4th July 2019):

The Royal Air Force Museum, London, UK

Awards Ceremony & British Celebration Party (4th July 2019):

In a venue in London



Royal Air Force Museum



Royal Air Force Museum, London, UK – Introduction

The Royal Air Force Museum in London is located at the former site of Hendon Airport and retells the history of the Royal Air Force. Established on 15th November 1972, it is the only national museum in the UK solely dedicated to aviation. The museum contains a number of exhibition halls, located in former hangars as well as a marine craft exhibition area. The museum exhibits military and civilian aircraft, and military marine vehicles from all over the world. One of the main purposes of the museum is to commemorate the conflicts and developments of aerial warfare from the First World War to the present. The finals of the BIEA 2019 International STEM Youth Innovation Competition will be held at the Royal Air Force Museum in London. Finalists and spectators from all around the world will gather in this impressive venue to compete and witness this fantastic event.



Liverpool Exhibition Centre

Liverpool exhibition Centre – Introduction

Located in the northwest of England, Liverpool is the fourth largest city in the UK. A large-scale exhibition related to STEM and organised by the Big Bang – an official partner of BIEA – will be held at the Exhibition Centre in Liverpool in July. Exhibitors and performers will showcase different STEM related technologies. School children will get the opportunity to meet face-to-face with engineers and scientists from academia and industry. The work of the contestants of the BIEA 2019 International STEM Youth Innovation Competition will form an important display in the exhibition. The winners of the Regional Heats will be showcasing their innovative work and have the opportunity to discuss the project with people who work in the STEM industry.



Awards and Honours

BIEA Grand prize

£5,000 and competition drone for the winning team

Awards

- ▶ Champion
- ▶ First Runner-up
- ▶ Second Runner-up
- ▶ Best Report Award
- ▶ Best Oral Presentation Award
- ▶ Best Flying Award
- ▶ Best Creativity Award
- ▶ Best Effort Award
- ▶ Best Instructor Award
- ▶ Best Display (Peers) Award
- ▶ Best Display Award

Special Award:


UK CREST Silver award

BIEA certificates:

The BIEA International STEM Youth Innovation Competition certificate is an international science and technology award recognised by British educational institutions. Winners who want to apply for schools or universities in the UK can use it in their application, showing that they have participated in the International Finals.

CREST Awards Introduction:

The CREST Awards Programme is a project developed by the British Science Association for young people. It provides a flexible project framework to motivate and engage young people between the ages of 5 and 19 to participate in technological innovation activities. They can earn UCAS (Universities and Colleges Admissions Service) credit for their participation, which is useful for applicants who want to apply for a UK university.

- ▶  The final awards are based on the score obtained by each team. A team may still win an award if they reach the required point total, even if they are unable to come to the UK to participate in the Live International Finals;
- ▶ Individual awards are based on the scores obtained by each team. An individual may still win an award if they reach the required point total, even if they are unable to come to the UK



Committee and Judges

(Sorted by alphabetical order)

ARRAN GOODCHILD

Arran is a passionate Chemistry graduate from King's College London and has been leading a large STEM outreach programme in the UK for young people.



ALEX HOLMES

Alex is BIEA International STEM Youth Innovation Competition designer. She has spoken at many international conferences on increasing engagement in STEM and has also authored several school books concerning STEM.



BRONAGH LIDDICOAT

Bronagh is a chartered engineer and member of the Institution of Civil Engineers in the United Kingdom, and is the Founder and Head of STEM Sussex.



CLAUDIO SILLERO

Born Free's Chief Scientist, Professor Sillero is based at Oxford University's Wildlife Conservation Research Unit (WildCRU). With a background in wildlife monitoring, disease dynamics and protected area management. He is Chair of the IUCN Species Survival Commission Canid Specialist Group.



DAVID HANSON

David is BIEA's STEM Chairman and is an influential senior education expert. He is the Founder of the iTrust charity and former CEO of the UK Independent Association of Prep Schools IAPS.



FRANS COENEN

Frans is a Professor of Computer Science at the University of Liverpool specialising in AI and machine learning. He is also a member of The British Computer Society (BCS) and the BCS' Specialist Group in AI (BCS-SGAI).





⌘ GARETH BULLOCK

Gareth leads the BIEA Board, he is the current chairman of The Development Bank of Wales PLC, and former Trustee of the British Council.



⌘ NIKKI COLLINS

Nikki is a trustee of BIEA. She has 35 years of experience in teaching, and is passionate in improving literacy in young people.



⌘ ROBERT COLSON

Robert is an experienced teacher of computer science and an early pioneer of postgraduate courses (UK and overseas) at Middlesex University.



⌘ RAUL QUESADA

Raul is a Senior Research Associate at the Materials Chemistry Centre, UCL. His current research focuses on semiconductor photochemistry.



the Royal Institution:

Dr. Shaun Fitzgerald, an academic and business leader, Shaun is the Director of



⌘ STEPHEN PRIOR

Stephen is a Reader in Unmanned Air Vehicles at the University of Southampton. His research interests are in the areas of Drone Design, Robotics and Design Engineering.



⌘ YIKE GUO

Yike is a world-renowned Professor in the Department of Computing at Imperial College, with extensive experience in computing science.



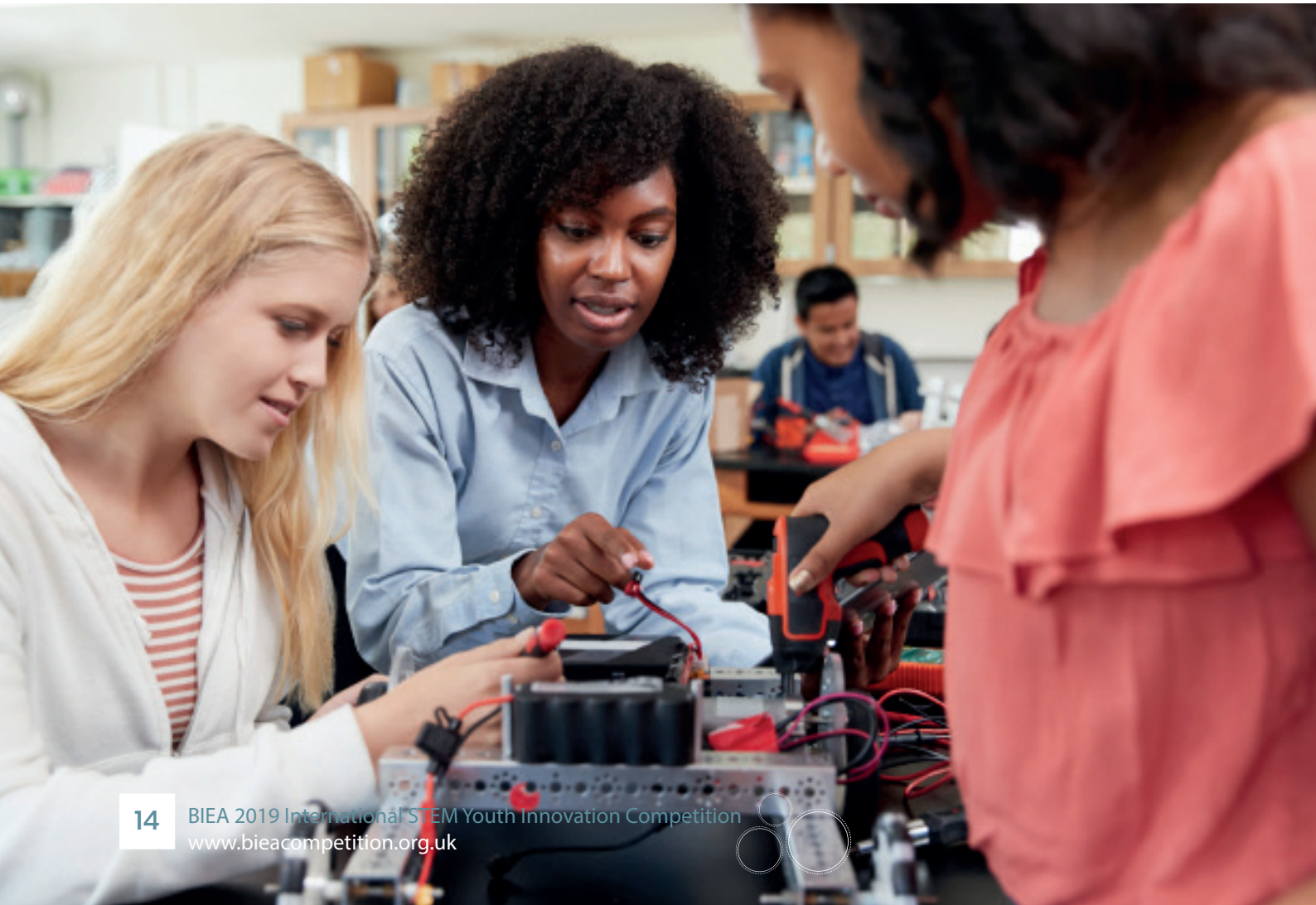
Competition STEM Summer Camp

After travelling from across the world to participate in the finals, following the competition, there are more surprises waiting for this group of young people.

Two days of classroom-based STEM sessions, taught by top STEM experts in the UK;

Three-day STEM visit - which is not just a tour, but one organised to inspire and provide insights in STEM-related disciplines.

(For more information, please email us: competition@biea.org.uk)



Special Thanks



Born Free Foundation

As BIEA's strategic partner, the Born Free Foundation is bringing in their extensive expertise in wildlife conservation to the competition. Born Free's mission is to ensure that all wild animals, whether living in captivity or in the wild, are treated with compassion and respect and are able to live their lives according to their needs. Born Free opposes the exploitation of wild animals in captivity and campaigns to keep wildlife in the wild.

Born Free promotes Compassionate Conservation to enhance the survival of threatened species in the wild and protect natural habitats while respecting the needs of and safeguarding the welfare of individual animals. Born Free seeks to have a positive impact on animals in the wild and protect their ecosystems in perpetuity, for their own intrinsic value and for the critical roles they play within the natural world.

Thanks to our supporters



Thanks for media support



Appendix

1

Reason for adopting drones as the basis of the competition:

Designing a drone consists of systematic engineering and design principles. The design and manufacture of drones involves multiple disciplines such as material science, mechanical and electronic engineering, computer programming, and aeronautics, to name a few. A built drone can carry innumerable sensors and be used for real world applications. Sensors, communications, data collections and AI are utilized in many drones in different industries. These complex systems require a team of people who all have comprehensive and solid professional knowledge, as well as the ability to cooperate and communicate across different disciplines.

Through the different stages of the competition – report writing, innovation and design, oral presentation, mission execution, evaluation and work display, we believe that our competition integrates creativity, competitiveness, fun, and cooperation to enhance students' interest and passion for science and technology. The theme of drones is challenging, active, and involves multiple fields of science and technology. It also provides a valuable opportunity to learn about science and technology in the real world.



Animals, technology, youth

These three concepts are a fundamental part of human lives. We are living in a golden age of technological development and innovation, but there is a dark side as we consume our fragile planet’s resources. It is an undeniable fact that our planet has a large number of species becoming endangered and in some cases, extinct. We are aware of the increasing numbers of vulnerable species becoming endangered due to human activity. But just as it may contribute to it, technology also has the potential to stop the decline in the Earth’s biodiversity. As we develop new tools, today’s children will become the adults be able to use technology to help prevent the loss of species, enhancing the world that they live in.

The competition enables students from around the world to think about the serious ecological problems that the Earth is facing, and channel their enthusiasm into thinking up ways to protect endangered species, whilst simultaneously helping them develop their STEM skills.

Thousands of animal species become extinct each year while hundreds are added annually to critically endangered species list. This human-aided extinction and biodiversity loss has swiftly become one of the most critical issues facing our planet today. However, there have been some recent reversals of this trend, with the Giant Panda being a notable example thanks to human intervention and the use of technology.

We believe technology, and especially the latest generations of drones, can play a critical role in helping to save endangered animals. Being able to fly in areas considered to be dangerous or difficult for humans, they provide a game-changing way to keep tabs on vulnerable animal populations without intruding into their natural habitats. Drones can also be used by anti-poaching forces to track their targets and allow them to be intercepted before they can come into contact with the animals.

We believe children and students can play an immensely important role in shaping the future that they will grow up in. Not constrained by conventional thinking, children are able to come up with imaginative solutions to some of the world’s most serious problems. It is also important for children to understand just how important biodiversity is for the Earth and for them to consider their interconnections with the natural world so that they grow up understanding the complexity of life on Earth. Through supporting today’s children to conserve endangered animals, we may just be able to help tomorrow’s future.

The theme and overriding goal of the BIEA 2019 International STEM Youth Innovation Competition is thus Fighting Extinction.



'Fighting extinction'

With many animals across the world facing extinction, scientists need to be able to accurately count populations of wild animals, so we can notice small changes. If we see animal numbers decreasing sooner, we might be able to conserve a threatened species before an easily noticed big decline in numbers makes it too difficult to save them.

Scientists and researchers are starting to use drones as a powerful tool for preserving endangered species.

You work for an international conservation organisation who gathers data about numbers of animals in the wild. Wildlife experts go to different places around the world and use binoculars and telescopes to count individual numbers of animals in the wild. The wildlife spotters find it very difficult to count some species that are easily disturbed or live in difficult to access or dangerous environments, as well as those animals that are dangerous to be near to. They want to know whether a drone could provide more accurate data than the wildlife spotters.

Your team has been asked to produce a report for a drone which can be used to count numbers of animals in the wild. You can use the Internet, books and media articles to research information and use this to design a drone suitable for counting numbers of a species.

We have made the BIEA drone challenge flexible so there are no wrong answers – we just want you to show us how creative and innovative you can be! Your report will need to include several different key ideas. This will depend on your age group.

If you are in the 9–11 age category, you will need to include:

- ▶ A description of the animal species, including where they live and at least two reasons why a drone might be better than a human spotter to count them.
- ▶ Your drone design:
 - ▷ Materials – suggest what your drone could be made from and why you chose these materials.
 - ▷ Aerodynamics – what shape is your drone going to be?
 - ▷ Size – how big will your drone be?

You will also need to include some information about how your drone could gather the data using a camera.

If you do experiments to test different design ideas, please include your experiment methods and results in your final report.

If you are in the 11–14 age category, your drone design will need to include all of the above, plus:

- ▶ You will need to discuss potential problems with using a drone to count animals and how you might combat these. You might want to think about some of the following:
 - ▷ Noise
 - ▷ Flight altitude
- ▶ You will need to discuss at least three advantages and three disadvantages of using a drone versus a human spotter



If you are in the 14–17 age category, your drone design will need to include all of the above, plus:

- ▷ Battery life – this is influenced by materials, size and speed
- ▷ Radio-transmitter distances – what range will your drone travel from the transmitter
- ▷ Camera resolution – how is this related to altitude
- ▶ Suggest some advantages and disadvantages to using an algorithm to computerise counting.

All age groups must make sure that to reference your sources and add these to the end of your report or presentation (a website name will be fine for internet sources)

Report design

Your report can be in any digital format. We recommend a summary document (pdf), poster or drawing of your design if you are uploading your report as a video or sound recording.

Rules

You should work in team of between three and five people.

The work you submit must be your own (and any secondary sources **must be referenced**).

Your report should not be longer than 2,000 words – this can be typed or hand written.

This competition is open to anyone between the ages of 9 and 17 years old. Entries will be divided into three age groups:

- ▶ 9–11
- ▶ 12–14
- ▶ 15–17

Winners will be announced in mid-April. If you are part of a winning team, you will receive £100 funding towards purchasing a small drone for the Innovation Round. This drone will be used to take part in the practical flying heats, which will take place at your school. Further information will be given to the winning teams in April 2019.

Submission

Your entry must be submitted by the lead teacher or responsible adult via email. Please email your final report to competition@biea.org.uk by 5pm (UTC) by the 31st March 2019. Maximum attachment size per submission: 25 MB. We recommend that files are submitted in pdf format. For files in larger size, please upload the files via <https://wetransfer.com/>, with competition@biea.org.uk as the recipient.

You must need to include these details with your submission: Your team name, your year group, your school, teacher contact name, plus report.

Please make sure your final entry includes your full names and age group you are entering into.

Terms and conditions: THE ENTRY AND COMPETITION

Please click www.bieacompetition.org.uk for details or email competition@biea.org.uk



Conservation cannot be effective
without technological education for
the younger generation.

David Hanson, BIEA STEM Chair

Come and join us,
**support us, let's create a world
we want to visit!**

www.bieacompetition.org.uk

