



ABOVE & BEYOND



DEVELOPMENT CLASS

PROFESSIONAL CLASS



COMPETITION REGULATIONS

2019/20



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## HOW TO USE THIS DOCUMENT

### CLASS DIFFERENTIATION

This document has been created to cover both Development **and** Professional Class competitions; however, some sections will only apply to one of the classes. Here's a quick key so you know what to look out for:

Applies to **Development Class ONLY:**



Applies to **Professional Class ONLY:**



### RULE REVISIONS FROM THE 2018/19 SEASON



At the end of each season we reflect on our rules and make any changes we think are important. If you see the 'NEW!' symbol next to any rule, we've made changes to it for the new season, so make sure you read it extra carefully.

### HELP TEXT

*When you see green italic text, this is intended to help clarify a regulation or diagram.*

## Welcome

Welcome to the Land Rover 4x4 in Schools Technology Challenge! This is a STEM (Science, Technology, Engineering and Maths) project which challenges teams all over the world to build a radio-controlled four-wheel drive (4x4) vehicle to a set of specifications set by real Land Rover Engineers. The vehicle will be required to successfully navigate and complete obstacles on an off-road test track that is just as demanding as the real thing, emulating the capabilities of a full size 4x4 vehicle. Each team will enter the vehicle into a Regional Final to compete for a place at the UK National Final. Land Rover 4x4 in Schools will assist you by monitoring your progress through the duration of the challenge, helping to ensure you will be ready to compete!

This document will identify the challenge along with the learning outcomes, accreditation and benefits of being involved in the project. This document along with the Technical Regulations document aims to inform you of all you need to know about the challenge and answer any questions you may have.

This document has been produced by educational and engineering experts to aid you through the Land Rover 4x4 in Schools Technology Challenge process. Please take the time to read through this document before you get started and hopefully with this guidance you will form a successful team and a winning vehicle.



# Are you ready for the CHALLENGE?

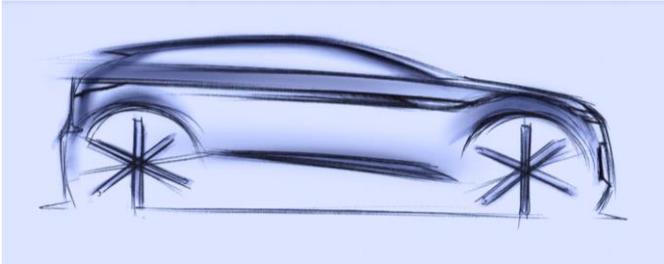


## C1.0 Design Brief

You are the design and engineering team tasked with the responsibility to create the vision for Jaguar Land Rover vehicles of the future. Your design ideas must encompass creativity and demonstrate innovative problem-solving skills, to design, develop and manufacture your solution as a working prototype.

### Understand the brand

Creativity and flair are at the heart of what Jaguar Land Rover does; from initial sketch to completed prototype, the design process gives designers and engineers the opportunity to apply their own flair to the product at all points. Form and function should be held in equal importance; one is never less than the other.



### Your assignment

Your design must resemble a four-wheel drive vehicle, capable of overcoming the hazards and obstacles of tomorrow's world. From the ground up, your design must have the ability to respond to hazards, perform on varied terrain and be capable of overcoming anything the world can throw at it. Consider how your idea could utilise alternative power sources, autonomous technology, connectivity and share it's understanding of the world with other vehicles through data sharing. From the outside, your designs must catch the eye in a way that only a crafted product can; your product should captivate, excite, enchant the viewer. Above all, your concept should make the heart beat a little bit faster.

### Innovate

Innovation should be at the core of your design; what does it do that sets it apart from the competition? The judges at Jaguar Land Rover want to see that you have a clear vision for what the vehicle of the future must be capable of; both technologically and emotionally. This can be working features, both electrical and physical; it could be mechanical features that are controlled either by the driver or autonomous features driven through software and sensors.

### ACES: Designing in theory

Creating a working prototype should be your aim, but don't let that hold you back from 'creating' several unique features for your concept. You can present your theoretical ambitions for your vehicle through the ACES Innovation Challenge, where points are awarded for 'future thinking' and coming up with ideas that may not be feasible yet, but you think could happen in years to come.

### The bigger picture

The designers and engineers responsible for this booklet are looking for the next generation of problem solvers. This is your time to show Jaguar Land Rover what you've got.



# THE BASICS:

## Understanding the Challenge



ABOVE & BEYOND



## C2.0 What to do first?

Okay, so you have decided you want to take up the challenge and enter the Land Rover 4x4 in Schools Technology Challenge, what do you do first? First, make sure you know what needs to be produced in order to compete at our events, using the table below:

### DEVELOPMENT CLASS



1 x Development Class remote control vehicle (see Technical Regulations)



1 x 10-page Portfolio (p23-24)



1 x Team Showroom display (p25-26)



1 x 5-minute Verbal Presentation (p21-22)



1 x A3 ACES Innovation Challenge submission (p30-32)

### PROFESSIONAL CLASS



1 x Professional Class remote control vehicle (see Technical Regulations)



1 x 20-page Portfolio (p23-24)



1 x Team Showroom display (p25-26)



1 x 5-minute Verbal Presentation (p21-22)



1 x A3 ACES Innovation Challenge submission (p30-32)

## PLOT YOUR ROUTE

Now you know what needs to be done, plot your route to Regional Finals on our handy flow chart below. It's a good idea to work up a team action plan at this point, splitting some responsibilities between you to make sure you can hit all your targets before competing.

### REGISTER AND READ ALL THE RULES!

- Register your team(s) as soon as possible at [www.4x4inschools.co.uk/registration/](http://www.4x4inschools.co.uk/registration/)
- Read the **Technical Regulations for your chosen class** carefully one section at a time, so your design complies. Pay EXTRA SPECIAL attention to any **critical rules, which are highlighted in yellow**. Breaking a critical rule means you will not be able to win certain awards, so keep any eye out for these!

### 1. PLAN

- Get together as a team and agree on your roles. Who will manage the team, who will be in charge of the various project elements? Who will lead enterprise and finding sponsors to help you on your journey.

### 2. PITCH

- Work up a sponsorship proposal for potential sponsors. Think about what you could offer a company in return for help sourcing materials, items, transport, services or anything else your team needs to compete.

### 3. SKETCH

- Using a **range of techniques**, sketch and model your ideas showing lots of creativity, flair and risk taking. Top automotive designers like **Ian Callum** (Design Director, Jaguar Cars), all start with freehand sketches, so whatever you do, don't throw away ANY rough ideas - they all count towards your design portfolio!

### 4. DESIGN

- Using sketching, modelling and CAD work, develop your design to meet all the requirements of the **UK Technical Regulations document**, making sure your design can realistically be manufactured in school. **Make sure your design is fully legal before you begin to manufacture your final product.**

### 5. ANALYSE

- Analyse all the components that will go together to make your vehicle, testing them for strength and durability. In the automotive industry it is essential that each individual part of a vehicle must be capable of doing its own job without failing, so get into the habit of double checking everything before it's too late...

### 6. MANUFACTURE / ASSEMBLE

- Using workshop tools and machinery, manufacture your body shell using suitable materials and processes. This could involve using CNC machinery such as routers, milling machines lathes and 3D printers, alongside more manual workshop tools. A healthy blend of each is the ideal option.

### 7. TEST

- **Make sure your design is fully tested before turning up to compete at your nearest Regional Final.** Your vehicle must be capable of overcoming obstacles without sustaining any terminal damage, so test it on gradients, slopes, rough terrain and any other awkward tests you can think of!

### 8. DRIVE AT YOUR NEAREST FINAL!

- Attend your nearest Land Rover 4x4 in Schools Regional Final to ready to compete!
- Check the Project Element Submission Checklist at the end of this document to make sure you have everything you need to compete.
- See [4x4inschools.co.uk](http://4x4inschools.co.uk) for full details of this season's UK Regional Finals.

**C2.1 Form your team** – Find three to six young people and form your team. The team members should all be ambitious, enthusiastic and dedicated young people who have a passion for designing, engineering and problem solving. Of course, your team needs a name, a name that will stand out against the rest so choose wisely. Think about your school / organisation, team members, a theme, a name that's easy to remember or simply a play on words. *Please note: Schools are permitted to enter up to a maximum of five (5) teams across all competition classes.*

**C2.2 Team Member Job Roles** – Each team member should be allocated a job role and title. They will then begin sole responsibility for that element of the challenge. Each team member should choose a job role that suits their abilities best and will gain the most enjoyment from doing. Ideally, one job role should be allocated to each team member, however you may have to double up on your responsibilities depending on the number of people you have in your team. One team member must also double up as the team's health and safety officer and will be responsible for and ensure each team member always works in a safe manner. The following job roles are examples of what could be covered by the team members. *Remember, no one person is more important than another!*

- **Team Manager** (*maximum of 1 person*) - This person could be responsible for managing the team, ensuring that the project is completed on time and may need to work closely with all members of the team, helping where necessary. The team manager may also take on the roll as financial manager and control the team's budget spend.
- **Design Engineer** – This person would responsible for the styling, performance and ability of the vehicle. Design Engineers will need to liaise with the manufacturing engineer to ensure their ideas can be realised. The Design Engineer is the person who makes rue the vehicle looks and goes well, so it's a very important job and one that requires lots of testing to ensure a quality product.
- **Manufacturing Engineer** – In this role, the team member(s) would be responsible for advising team members on the manufacture of the car and the constraints of the machining/production process.
- **Electronic Engineer** – A hugely important role and one that is becoming an area of need across the Automotive Industry. Your team's Electronic Engineer will lead the design and development of the vehicles electronic systems. This may include creating the code for programming certain features of the car, designing new autonomous features and designing a wiring harness to keep the various cables neat, tidy, and safely hidden from view.
- **Resources Manager** – As Resources Manager, this team member would organise time, materials and equipment for designing and making the vehicle. They would be responsible for developing ideas regarding the team marketing (Presentation) and will need to liaise with all members to check tasks are progressing on time and offer additional help, if needed.
- **Graphic Designer** – This person's roles would include being responsible for producing the colour schemes applied to the vehicle, including any special sponsorship decals, together with the any additional team marketing materials. They will liaise with the design engineer to ensure any schemes will fit the shape of the vehicle and the resources manager for additional marketing development.

**C2.3 School/Organisation Support** – Approach your school / organisation and tell them what you are doing and ask for support in any way possible. That doesn't have to be financial support, it could be use of facilities, equipment, materials, classroom cover for regional finals and the national final or simply the use of the school / organisation's minibus to travel to the challenge.

- C2.4 Components** – Apart from the components you will decide upon during your design process you will need the core components such as the transmitter, receiver, servos and battery pack.
- C2.5 Seek Sponsorship** – At the first opportunity, seek sponsor from external companies / organisations to bring in funding for your vehicle. Sponsorship can come in many forms from money, component donation or printing, to external help and guidance.
- C2.6 Recruit a STEM Ambassador** – At the first opportunity recruit a STEM Ambassador from industry onto your team. This is highly recommended. These are Engineers from engineering companies including Jaguar Land Rover and the Institution of Engineering and Technology (IET) who will be able to support your team by acting as industrial advisers, mentors or providing ‘hands on’ support to your project and so giving it an essential industrial partnership. To recruit an ambassador, approach your local STEM Ambassador contract holders who will be able to put you in touch with a suitable ‘engineer’ to support your team as they develop their ideas. The Local STEM Ambassador Hubs for your area can be found at [www.stem.org.uk/stem-ambassadors/local-stem-ambassador-hubs](http://www.stem.org.uk/stem-ambassadors/local-stem-ambassador-hubs).



- C2.7 Benefit of doubt** – The chair of judges will, where appropriate, seek to use ‘benefit of doubt’ when the assessment of compliance is marginal or unclear. In this situation, teams will be given the benefit of doubt rather than a firm penalty if a penalty cannot be clearly measured or identified.



- C2.8 Spirit of the competition** – Teams are expected to act in the spirit of the competition, both before and during any Land Rover 4x4 in Schools events. A team deemed to be acting in an unsportsmanlike manner towards another team or other persons may be removed from some or all judging areas at the discretion of the chair of judges.

The spirit of the competition is simple; embrace and respect the rules and regulations, do your very best to compete legally and fairly, while contributing positively to Land Rover 4x4 in Schools. Make friends, create positive relationships, network professionally and enjoy yourselves.

## C3.0 Jaguar Land Rover Mentors

One of the most invaluable features of the Land Rover 4x4 in Schools Challenge is access to professional industry mentors from Jaguar Land Rover. These mentors are full-time Jaguar Land Rover Engineers assigned to each team that registers to take part in the challenge, to guide and advise teams through their design and build. *Please register as early as possible to secure your Competition Mentor.*

All communication with your mentors can be done via email and can be done by any member of your team, although mentors are often keen to meet up with their teams to see how they are progressing in person. Mentors are a very valuable resource to your team so make sure you make full use of them to get the best from your vehicle design.

Each team competing in the challenge can work with additional mentors and STEM Ambassadors to assist them with their preparations building up to and during the competition, so feel free to put some requests out for assistance.

## C4.0 Curriculum Material

**C4.1** Getting qualifications for your work - The Land Rover 4x4 in Schools Technology Challenge has now been mapped against the National Curriculum by OCR and project approach materials for the Cambridge Nationals in Engineering for four (4) qualifications...

- Principles in Engineering and Engineering Business
- Engineering Design
- Engineering Manufacture
- Systems Control in Engineering

These curriculum materials allows schools to run and deliver the challenge as part of their classroom activity and provide schools with a structured plan to teach the learners how a range of topics work together across a number of units, providing them with some understanding of how skills and knowledge could link together in a working environment. For more information about this curriculum material and project approach to delivery from OCR, please visit:

[OCR Cambridge Nationals Qualifications](#)

The Land Rover 4x4 in Schools Technology Challenge has now been mapped against the National Curriculum by OCR and project approach materials for the Cambridge Nationals in Engineering for four (4) qualifications...

**C4.2** Lesson planning made easy - In addition to the qualification documents, OCR have also produced a 'Project Approach' document, which spells out how teachers can deliver the Land Rover 4x4 in Schools Challenge as a project tailored towards the qualifications named above. This way, you can plan your whole year safe in the knowledge that you are hitting all the important parts of the Level 2 specifications. **This is available for download from:**

[OCR Cambridge Nationals: Land Rover 4x4 in Schools Project Approach](#)

## C5.0 Accreditation

Land Rover 4x4 in Schools acknowledges the importance of recognising the achievement of participants involved in the Land Rover 4x4 in Schools Technology Challenge and does so by providing:

- All young people who attend the finals and national final with a certificate which outlines the contributions that they would have been involved in during the challenge.
- All supporting staff who attend the finals and national final with a certificate which outlines the contributions that they would have been involved in during the challenge.

**Further accreditation can be obtained through registering for the following awards:**

- C5.1 Harper Adams University Scholarship** – Harper Adams University offers one of the team members of the Land Rover 4x4 in Schools Technology Challenge UK Champions a £1000 scholarship to attend any of the Engineering courses on offer at Harper Adams University.
- C5.2 Industrial Cadets** – A massive bonus to competing in the Land Rover 4x4 in Schools programme is the chance to gain an Industrial Cadets Silver Award if you manage to reach the UK National Final. The Industrial Cadets (IC) programme aims to raise awareness of local career opportunities in the industrial and manufacturing sectors, developing employability skills and raising the aspirations of young people. Student's aged 11-19 taking part in 4x4 in Schools will be given the opportunity to become an Industrial Cadet and gain an insight into industrial and manufacturing companies such as Jaguar Land Rover to raise awareness of local career opportunities in these sectors. To find out more about Industrial Cadets go to, [www.industrialcadets.org.uk](http://www.industrialcadets.org.uk).
- C5.3 Arkwright Engineering Scholarship** – Students in year 11 that are successful in an application for an Arkwright Engineering Scholarship through their schools **and** have successfully won through to the Land Rover 4x4 in Schools UK National Final, will be eligible for an Arkwright Engineering scholarship sponsored by Jaguar Land Rover. This scholarship provides financial support and engineering enrichment for their A level (or equivalent) studies. Only one Jaguar Land Rover Arkwright Engineering Scholarship can be awarded each year.
- C5.4 The Duke of Edinburgh Scheme** – Within the skills section of the scheme, the young people participating in Land Rover 4x4 in Schools Technology Challenge will be able to gain a Duke of Edinburgh Award. To find out more about the Duke of Edinburgh Scheme go to, [www.dofe.org](http://www.dofe.org)
- C5.5 CREST Awards** – The British Science Association CREST awards are nationally recognised by industry and employers. Students can use Land Rover 4x4 in Schools to complement the 'Skills' section of their Crest Award assessment process. You can find out more about CREST on their website, [www.britishscienceassociation.org/crest](http://www.britishscienceassociation.org/crest).



# COMPETITION:

## Understanding the challenge



ABOVE & BEYOND



## C6.0 Definitions

### C6.1 Regional and UK National Final

The Regional and UK National Finals are managed by Engineering in Motion and are held over several weeks in January and February ([check website for actual dates and locations](#)). Each event will be held on one day normally between 08:30am – 16:30pm.

### C6.2 Regional Final Event

The UK Regional Final events are managed by Engineering in Motion, held over one day to include various programmed competition activities. A selection of the top scoring teams from Regional Finals will be invited to compete at the UK National Final, which is held over two days in March-April.

### C6.3 Competition Program

The competition program will detail the schedule of judging activities for all teams. This is distributed at morning registration as teams arrive on competition day.

### C6.3 Key Performance Indicators (KPI's)

These are portions of text that feature on the scorecards within a corresponding points range. The KPI's describe the type of evidence the Judges will be looking for in order to score the team appropriately.

### C6.5 Project elements

These are any materials and resources that the team presents as part of its entry for any judging activity.

### C6.6 Engineering Drawings

Hand drawn or CAD produced drawings, which along with relevant machinery and/or CAM programs, could theoretically be used to manufacture the fully assembled car by a third party. Such drawings include all relevant dimensions, tolerances and material information. Land Rover 4x4 in Schools engineering drawings include detail to specifically identify and prove compliance with the technical regulations.

### C6.7 Computer Coding

Computer Coding and autonomous features can be integrated into vehicles with the use of an Arduino, Raspberry Pi or similar. [For more inspiration see the Jaguar Future Type concept.](#)

### C6.8 Track Assessment

This is a timed track assessment of each vehicle to successfully navigate around a specially made off road track to test the team's vehicle's 4x4 ability.

### C6.9 Trailer Test

This is a timed track assessment of each vehicle to successfully navigate around a specially made course while towing a standard trailer, as defined in the Appendix of the Technical Regulations document.

## C7.0 Competition Classes

The challenge is split into three classes for entry into the competition: Entry, Development and Professional. Each team must decide which class they would like to enter before taking part in the competition. For Entry Class, please download the Entry Class Guidebook on the 4x4 in Schools Website.

**C7.1 Entry Class (age 11–14)** – Any team entering the challenge for the first time can opt to enter the “Entry” class in their first year, by purchasing the recommended Land Rover 4x4 in Schools starter kit containing a remote-controlled vehicle. Teams wishing to enter the Entry Class must download and read the Entry Class Competition Guidebook. The remainder of this document is intended for Development and Professional classes ONLY.

**D** **C7.2 Development Class (age 11–19)** – New teams or those who have completed the Entry Class can opt to enter the “Development” class by purchasing the recommended Land Rover 4x4 in Schools starter kit, containing a ready-to-drive, 2-wheel steer, 4-wheel drive remote controlled vehicle. Other remote-controlled vehicle models are available but may not be suitable for the competition. The starter kit will also include a vehicle battery and battery charger.

*Please note: All vehicles competing in the Development Class must use a standard, unmodified, 2-wheel steer Rock Crawler chassis, with the exception of Technical Regulations T6.0, T7.0, T9.0 and T10.0, as explained below.*

The standard vehicle will be allowed to be entered into the challenge; however Development Class teams must also manufacture ONLY the following items in line with the Technical Regulations (Please refer to the 2019/20 Technical Regulations for more detail):

**T6.0 Vehicle Body Shell** - The vehicles body must have a shell that covers all the main mechanical elements including the vehicles battery, all motors and all four (4) wheels and tyres from plan view (above) but still fit within the overall dimensions of the vehicle.

**T7.0 Vehicle Electronics** (light and tilt sensor) - Each vehicle must have a lateral (centre to left and centre to right) tilt detection system to trigger lights or a buzzer on the vehicle when the angle tilt is greater than 25°, and an automated system to turn the vehicle lights on when the light level drops to 25 lux (below a set level – dark).

**T9.0 Tow Bar** - All vehicles must be fitted with a tow bar which must be carried by the vehicle throughout the competition.

**T10.0 Chassis** – Development Class teams may choose to modify the standard spring / damper assembly to counteract body roll and achieve a different setup for their car.

Development Class teams may modify or substitute the standard wheels and/or tyres on the standard 2-wheel steer Rock Crawler chassis, while still using the standard wheel mounting locations. *Please note: teams may ONLY modify the spring and damper unit, while using the standard chassis spring / damper assembly mounting points.*

The team must also have a basic knowledge and understanding of the vehicle’s suspension, drive train, chassis and wheels, as the judges will be asking about the design and function of these items. Teams entering the challenge can only compete in the Development Class for one year and then must enter the Professional Class for all subsequent years.

**P**

### C7.3 Professional Class (age 11-19) –

Professional Class challenges the teams to push their car design skills to the next level. In addition to the items manufactured for Development Class (T6.0, T7.0, T9.0), a Professional Class team must also design and manufacture part or all of their vehicle's rolling chassis, in line with the Technical Regulations 2019/20 document. These teams may reuse components from their Development Class vehicle. A Professional Class team is defined as a team that also modifies or manufactures one or more of the following items in addition to the requirements of Development Class:

- Chassis
- Suspension
- Steering
- Powertrain

*(Please refer to the 2019/20 Technical Regulations and the official scorecards later in this document for more details)*

## C8.0 Teams

Competing teams must meet the below requirements to be able to take part in the 2019/20 season:

- C8.1** Each team must consist of a minimum of three (3) and maximum of six (6) young people.
- C8.2** All student team members must be aged between 11-19. The students may all be of the same age or a mixture of young people of different ages. Educational organisations may set teams with young people from across different year groups. Teams of more than six will not be allowed to enter the competition. All teams must follow a safe working practice at all times of their vehicle build.
- C8.3** Only members of the official competing team (maximum 6) are permitted to wear the team's uniform.
- C8.4** During the competition, only the official competing teams' members can represent the team at registration, Team Showroom set up, Verbal Presentation, Design Portfolio judging, Engineering judging, Scrutineering, critical rule fix, Track assessment, on-stage presentations and any direct communication with the Chair of Judges or Event/Competition Directors.
- C8.5** A team can be formed from any out of school organisation such as home-schooled students, Scouts, Cadets or Girl Guides.
- C8.6** Any school or organisation may enter up to a maximum of five (5) teams across all competition classes.

## C9.0 Registration

Registration is simply the process of sending us your team details so we know you're actively competing in the 2019/20 season, which is completed online at <http://www.4x4inschools.co.uk/registration/>. Each Development and Professional Class team wanting to compete and enter the 2019/20 Land Rover 4x4 in Schools Technology Challenge will be required to raise a one-off registration fee for their regional final, of **£75+VAT**. The key here is to try NOT to pay this yourself! Businesses will happily sponsor young, ambitious teams with the right approach; or if you know your way round a packet of cake mix, why not raise the money with an off road-inspired bake sale?!

We strongly suggest trying to raise your registration fee through either sponsorship or fundraising. At **£12.50** per team member for a team of 6, this is your first chance to practise raising money ahead of

the bigger task of attracting team sponsorship later in the project! Get your thinking caps on and work out how to raise your portion of the team registration fee, which ensures your team can take part in your nearest regional final.

This registration fee is non-refundable and must be paid in full before your regional final date to Land Rover 4x4 in Schools.

## C10.0 Time Management

Managing your time is one of the most important elements of the challenge. If done correctly all aspects of the challenge will be completed in time to compete. It is recommended that your team meets once a week minimum to begin with, and then increase the number of sessions as you draw closer to your final and set deadlines. When you do meet, try to make the session as productive as possible with all team members working on their element of the project but don't forget to communicate. You should include all your timing plans and deadlines in your portfolio to provide the judges with the evidence that you have successfully planned your time.

**C10.1 Regional Finals** – A one day event held in the following regions from January 2020.

- North East
- North West
- Central
- South East
- South West
- Scotland

**C10.2 UK National Final** – Depending upon the number of UK National finalists, the UK National Final will either be held on one day or as a two-day event in March 2020.

*Please check the website for regular updates and announcements of the actual dates and venues for both the Regional Finals and the UK National Final.*

## C11.0 Starter Kits

Any team entering the challenge for the first time can opt to enter the “Development Class” by purchasing the recommended Land Rover 4x4 in Schools starter kit. The starter kit consists of all the essential components to get you started in the challenge:

- Rock Crawler Remote Controlled Car
- 2.4 GHz Transmitter
- 2.4 GHz Receiver
- Battery Pack
- Battery charger unit

*Other rock crawlers are available but may not be suitable for the competition.*

Please note all the above items are not to be included in your project budget and can only be used if entering the Development Class in the challenge. **For Professional Class teams**, if you require additional equipment such as a more powerful motor you will need to source these separately.

Teams that have participated in previous years are encouraged to use components from their existing vehicles, particularly the essential components listed above but **must not re-enter** their existing vehicles from previous years into the new 2019/20 season without the minimum modifications made to it as detailed in the 2019/20 Technical Regulations.

Please visit the Land Rover 4x4 in Schools website, <http://www.4x4inschools.co.uk/starter-kits/> to order your starter kit. Please allow time for delivery so we recommend you order your starter kit as soon as you can and take the delivery time into account when organising your timing plan.

## C12.0 Judging Criteria

All teams will be judged by a panel of experienced engineering and/or educational experts. Each team will be given the opportunity to present to the judges and explain any aspects of their vehicle, team and project however they wish.



### C12.1 Critical Regulations – identified with a hazard symbol

**IMPORTANT:** The below scrutineering rules are classified as critical regulations, which carry much heavier penalties than non-critical regulations. If a team breaks any one or more of these critical regulations, they will not be eligible to win the Best Engineered Vehicle and Best Track Performance awards so **please take extra time to check your car doesn't break any of the below critical Technical Regulations:**

- **T3.1** – Overall length
- **T3.2** – Overall width
- **T3.3** – Overall height
- **T4.1.1** – Powered by electric motor(s)
- **T4.1.2** – Caterpillar track
- **T4.2** – Four wheels only
- **T5.1** – Vehicle weight
- **T6.1.1** – All wheels/tyres covered by body shell in plan view
- **T9.1** – Fixed tow bar
- **T9.2** – Tow bar suitable for use
- **T10** – Chassis (Development Class ONLY)

**C12.2** You may be asked to declare your radio control frequency and channel if you are not using a 2.4GHz transmitter/receiver.

**C12.3** You will be asked not to turn your transmitter on until it is your track run. You may also be asked to hand in your transmitters at the beginning of the day and only be issued with them for your track run.

**C12.4** The organisers may make additions to the vehicle. e.g. the addition of a self-adhesive sensor.

**C12.5** A Chair of Judges will be appointed and announced at each event final. The Chair of Judges will oversee all judging processes and will make overall decisions when necessary.

**C12.6** A photograph will be taken of your vehicle with and without the body shell and kept on file for following year entry.

## C12.7 Point Allocations

Points will be awarded to teams across five (5) categories with maximum possible scores as detailed in the scorecards (Please see appendix). Please read these carefully to understand how you will be assessed and how you score points, but please remember that **THE JUDGE'S DECISION IS FINAL!**

CATEGORIES	POINTS	
	Development Class	Professional Class
Scrutineering	150	
Verbal Presentation	100	
Design Portfolio	140	
Team Showroom	65	
Engineering	245	290
ACES Innovation Challenge	30	
Track	125	
Trailer Test	20	
<b>TOTAL</b>	<b>875</b>	<b>920</b>



## C8.10 Getting prepared

To aid teams in their preparation for the judging process at a competition event, we have listed below several key questions the judges may ask to evaluate the level of knowledge and understanding they would expect the team members to have.

- What is the purpose of a **differential**?
- What features of a modern vehicle are controlled using **code**?
- What sort of **autonomous features** do current vehicles demonstrate?
- What are the benefits of a **plug-in electric hybrid** vehicle?
- How does an **electric vehicle (EV) transmit drive** to the wheels of the vehicle?
- What is the need for different **gear ratios**?
- What is **articulation** and **suspension** used for?
- What is a **lux & tilt** sensor and **how** do they work?
- What means of **suspension** have you used and **why**?
- What **drive system** have you used and **why**?
- What **material choices** have you made for the different parts of your vehicle and **why**?

# JUDGING:

## The format and scorecards



ABOVE & BEYOND



## C13.0 Verbal Presentation (100 points)

Each team is required to produce a Verbal Presentation to a panel of judges by the whole team detailing all aspects of the project including research, generation of ideas, testing, building, finance and evaluation.

### C13.1 What will be judged?

The Verbal Presentation Judges will assess each teams' **5-minute (10 minutes for National Finals)** Verbal Presentation across the areas of technique, composition and subject matter. **Please read the Verbal Presentation judging scorecard at the end of this section for detailed point scoring and key performance indicator information.**

### C13.2 Team preparation

Each team is required to prepare a Verbal Presentation. Any multimedia content slides etc. must be saved on, and shown, using the teams' own laptop. Teams need to have all presentation resources tested and ready with them for Verbal Presentation judging. Most importantly, teams should read the Verbal Presentation judging scorecard carefully to ensure their Verbal Presentation features all elements and content that the Verbal Presentation judges will be looking for.

### C13.3 Who needs to attend?

All team members must be present during the Verbal Presentation judging session.

### C13.4 Judging process / procedure

Verbal Presentation judging is scheduled for the same duration of other judging sessions, usually 15 minutes. Teams will be given an opportunity at the start of their time to set-up and test their laptop and any other presentation technologies and resources. The team will inform the judges when they are ready to begin. The judges start timing the 5-minute (10 minutes for National Finals) duration and will provide a discreet time warning signal when one minute of presentation time remains. The team will be asked to cease presenting when the time limit has been reached. At the conclusion of the team's presentation time, the judges may choose to provide some feedback and / or ask any clarifying questions they feel necessary. Verbal Presentations may be filmed for judge's review or promotional and future resource purposes.

### C13.5 Verbal Presentation judging provisions

Land Rover 4x4 in Schools will provide a dedicated private space, such as a small meeting room, where each team will deliver their presentation to the judges. This space will include a data projector, screen and multimedia sound system. These will be in fixed positions but usually with sufficient cable length to allow teams some freedom for choosing where they wish to locate their laptop. A single table will also be made available with its use and location in the presentation space being optional. Teams must make sure their device has at least a HDMI or VGA output to be compatible with the judging area.

### C13.6 Verbal Presentation video recordings

The Verbal Presentations of all teams may be video recorded by Land Rover 4x4 in Schools for the purpose of judging review and / or post event publicity and promotional purposes.

# Verbal Presentation

Team Number:  
Team Name:  
School:

KPIs	Low	Medium	High	Score
<b>Content (knowledge and understanding)</b>	1 2 3 4 5	6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
	Basic knowledge with few items covered	Good understanding of concepts, most areas covered	Excellent content, full explanation and understanding of key concepts including innovation and sustainability	
<b>Structure of Presentation</b>	1 2 3 4 5	6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
	No clear format to presentation	Good attempt at presentation, intro, main and conclusion	Excellent presentation. Clearly defined & consistent intro, main sections and conclusion	
<b>Team Contribution</b>	1 2 3 4	5 6 7 8 9	10 11 12 13 14 15	
	Single presenter; no teamwork	Multiple presenters; some teamwork	All team members involved; smooth teamwork	
<b>Presentation / Appearance</b>	1 2 3 4	5 6 7 8 9	10 11 12 13 14 15	
	Little care shown towards overall visual presentation of the team	Smart team appearance, some effective use of visual aids	Highly professional appearance of team members, original use of props and visual aids which add value to the presentation	
<b>Engagement</b>	1 2 3	4 5 6	7 8 9 10	
	Low energy, little engagement with audience (e.g. reading from slides)	Some energy, good use of eye contact and positive attitude	Demonstrating passion for the topics, excellent delivery, engaging and positive attitude	
<b>4x4 in Schools learning experiences</b>	1 2 3	4 5 6	7 8 9 10	
	No real reflections discussed	Good explanation of some learning outcomes with reference to career aims	Compelling accounts of how the competition has impacted on life skills and career aspirations for a range of team members	
<b>Timing &amp; Balance</b>	1 2 3	4 5 6	7 8 9 10	
	Significantly under/over time – little balance between sections	To time (+-3 mins) – good balance between sections	To time or under – appropriate depth for each topic with little or no wasted time	

**VERBAL PRESENTATION TOTAL**

**/100**

Please use below or the back page for any additional comments

## C14.0 Design Portfolio & Team Showroom (205 points)

Each team will be provided with a Team Showroom area which will be the team's base for the event and is required to produce a Design Portfolio describing in a brief and concise manner the experience, design and decision-making process that the team has gone through in the design and build of their vehicle.

### C14.1 What will be judged?

The Design Portfolio and Team Showroom judges will examine each teams' **10-page (Development Class)** or **20-page (Professional Class)** Design Portfolio and Team Showroom so that they can assess a range of specific areas.

**Please read the Design Portfolio and Team Showroom judging scorecards at the end of this section for detailed point scoring and key performance indicator information.**

### C14.2 Team preparation

Each team must prepare a Design Portfolio and Team Showroom. Most importantly, teams need to read the Design Portfolio and Team Showroom judging scorecards carefully to ensure that all areas to be assessed are included within the context of their Design Portfolio and Team Showroom. It is each team's decision how and where each area is presented. Teams should be mindful of the time constraints of judging when making these decisions.

### C14.3 Who needs to attend?

All team members must be present during the Design Portfolio and Team Showroom judging session.

### C14.4 Judging process / procedure

Design Portfolio and Team Showroom judging will take place at each teams' Team Showroom. The Judges will usually introduce themselves then ask the team to stand clear of their Showroom so the Judges can conduct assessments. Team members may be asked questions by Judges to help them find certain content and or seek further explanation. Design Portfolios will be returned to teams so that these can be integrated into each teams' Showroom.

### C14.5 Design Portfolio requirements



**Development Class:** The Design Portfolio is limited to **10 pages** which **does not** include the front and back covers. This can be 10 single sided or 5 double sided sheets. If a portfolio comprises more than 10 pages, the Judges will only assess the first 10 PRINTED pages after the front cover.



**Professional Class:** The Design Portfolio is limited to **20 pages** which **does not** include the front and back covers. This can be 20 single sided or 10 double sided sheets. If a portfolio comprises more than 20 pages, the Judges will only assess the first 20 PRINTED pages after the front cover.

Please refer to the Design Portfolio scorecard for detailed scoring information and guidance.

# Design Portfolio

Team Number:  
Team Name:  
School:

KPIs	Low	Medium	High	Score
<b>Research</b>	1 2 3 4 Little evidence of research into different systems used in 4x4 vehicles and their purpose.	5 6 7 8 9 Good overview of different 4x4 systems and basic understanding of why they are used. Good interpretation of information.	10 11 12 13 14 15 Range of research techniques of the different technologies & systems used on multi terrain vehicles. Suitable engineering principles identified and justified for the task	
	1 2 3 Basic list of points describing a number of elements required	4 5 6 Basic use of research to create a detailed list describing important aspects of the project.	7 8 9 10 Research used to create detailed, fully justified design specification, covering key aspects of the project.	
<b>Initial ideas</b>	1 2 3 4 5 One page showing a few basic sketches or models, little annotation	6 7 8 9 10 11 One page showing at least 4 annotated ideas, using different media and showing some creativity	12 13 14 15 16 17 18 19 20 Multiple pages showing a wide range of initial design concepts, including detailed annotations, 3D sketching and modelling.	
	1 2 3 Concept decided on with little reasoning or evidence of a selection process.	4 5 6 Selection of basic concepts, use of a selection process to record strengths and weaknesses of ideas.	7 8 9 10 Comprehensive selection process resulting in fully justified final design decision, examined against the Design Specification.	
<b>Development &amp; manufacture</b>	1 2 3 4 5 Limited development & poor manufacture record.	6 7 8 9 10 11 Design development covering concept to manufacture, basic component selection and manufacturing processes.	12 13 14 15 16 17 18 19 20 Comprehensive design development, component selection and Bill Of Materials (BOM). All manufacturing processes defined. Sustainability addressed throughout.	
	1 2 3 Little or no evidence of vehicle testing or improvement.	4 5 6 Some testing conducted and running changes made.	7 8 9 10 Comprehensive vehicle testing conducted, results analysed, changes made and re-evaluated. Improvement in performance recorded.	
<b>Sponsorship</b>	1 2 3 4 Little or no effort to obtain any form of sponsorship	5 6 7 8 9 Some evidence of effort to obtain sponsorship with little sponsorship granted through schools/establishment	10 11 12 13 14 15 Good attempt to obtain sponsorship with a good level of sponsorship obtained from external organisations	
	1 2 3 4 Inconsistent, limited or obscure identity	5 6 7 8 9 Effective team identity consistent through various project components e.g. car matches team uniform	10 11 12 13 14 15 Excellent and highly effective team identity. Team 'brand' consistently applied through all project elements.	
<b>Project Management</b>	1 2 3 4 No or very limited project management	5 6 7 8 9 Simple management and planning used to guide progress. A range of project resources identified including basic team budget. All team job roles explained.	10 11 12 13 14 15 Comprehensive project management, including clearly defined job roles. A range of factors considered and evaluated; e.g. scope, time, resources and project risks. Comprehensive financial management.	
	1 2 3 Difficult to follow with basic presentation standard	4 5 6 Clear structure, well organised.	7 8 9 10 High impact and professional layout throughout. Consistent and clear organisation.	

Please use the back page for any additional comments

**DESIGN PORTFOLIO TOTAL**

**/140**

## C14.6 Team Showroom setup and parameters

- C14.6.1** Land Rover 4x4 in Schools will provide each team with a display space including a trestle style table (use of this is optional and by request). The precise space description and detailed dimensions will be announced closer to the event. Display spaces are normally of approximate dimensions 2m wide x 1m deep.
- C14.6.2** A time period will be scheduled for when all teams will set-up their Team Showrooms, usually on the morning of the competition day prior to judging commencing. A time limit will be enforced. Land Rover 4x4 in Schools reserves the right to apply a penalty of **up to 20 points** at the discretion of the Chair of Judges for teams that do not complete their set-up within the time limit and/or do not leave their stand in a safe state and clear their pit and surrounding area of all rubbish.
- C14.6.3** No part of the teams completed Team Showroom may protrude beyond the physical dimensions of their allocated pit space. This includes anything that might protrude above the highest point of the space provided e.g. flags.
- C14.6.4** **ONLY** student team members are permitted to set-up their Team Showroom. There must be no supervising teacher / adult or other outside assistance, unless deemed by Land Rover 4x4 in Schools to be a health and safety issue.
- IMPORTANT HEALTH & SAFETY:** *Please ensure that health and safety measures are considered when working at height on your Team Showroom.*
- C14.6.5** Land Rover 4x4 in Schools and / or the Chair of Judges may instruct a team to take action to reduce noise or remove display items deemed to be inappropriate. Land Rover 4x4 in Schools will instruct teams to remove or alter any display items considered to be a safety hazard.
- C14.6.6** Any electrical appliance connected to the power supply must be safe and compatible with the host country power rating.

# Team Showroom

Team Number:  
Team Name:  
School:

Key Performance Indicators	Low					Medium						High						Score	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		18
Showroom Design	Basic structure with limited display, little or no graphics or reference to the team's identity.					Good display with a reasonable amount of graphics relating to the team's identity. Colour scheme consistent with other items						Excellent, well-structured display with professional looking graphics, linked to the team's corporate identity. Use of different media to highlight different components							
Content	Repetition of Portfolio contents. Limited organisation of materials.					Clear and effective presentation and messaging. Multimedia used to enhance display						Clean, well-organised with high impact. Highly professional with attention to detail. Excellent integration of technology and multimedia							
Prototype Models	Little or no prototype work on display			Good attempt – some prototype work on display			Lots of prototype work on display with a very good level of development. Clear and accurate definition of different types of costing provided												
Marketing	Little or no evidence of marketing				Good attempt – some marketing material on display					An excellent understanding of marketing with marketing material on display linked to sponsorship & sponsor 'return on investment' (ROI)									

Please use the back page for any additional comments

**TEAM SHOWROOM TOTAL**

**165**

## C15.0 Engineering (290 points)

Teams will be interviewed by a panel of judges about how their vehicle was manufactured and why/how they made the design choices on the vehicle.

### C15.1 What will be judged?

The Engineering judges will assess the team's use of technologies along with the quality of manufacture of the team Vehicle, in a wide-ranging assessment.



**IMPORTANT:** Development Class teams will not be assessed in the areas shaded in grey in the Engineering I Scorecard, as these points are reserved for teams in the Professional Class who are permitted to design and manufacture their own vehicle chassis components.

*Please read the Engineering judging scorecards at the end of this section for detailed point scoring and key performance indicator information.*

### C15.2 Team preparation

The team **MUST** have their vehicle fully assembled and ready to present to the judges. A laptop may be taken to engineering judging along with the design portfolio. Other items may also be taken to help the team explain any engineering or manufacturing concepts. The Engineering judges will not have access to the Team Showroom for judging purposes. Preparation should include careful reading of the scorecard describe what the judges will be looking for.

### C15.3 Who needs to attend?

This judging session must be attended by the team manager and team design and manufacturing engineers as a minimum.

### C15.4 Judging process / procedure

Teams will be awarded points as per the key performance indicators shown on the Engineering scorecard. This is an informal interview where judges will ask the team to explain and query teams on what they have done, including the quality of vehicle manufacture and vehicle assembly.

# Engineering 1

## Vehicle Component Engineering

Team Number:  
Team Name:  
School:

Key Performance Indicators	Low	Medium	High	Score
<b>Body Shell</b>	1 2 3 4 5 Donor body used with minor modification. No attempt to cover key mechanical components.	6 7 8 9 10 11 Modified or self-made body shell, showing some attention to detail. Body shell adequately attached to chassis.	12 13 14 15 16 17 18 19 20 Self-made body. Robustly constructed and attached to chassis, with some after treatment and / or graphic additions evident.	
	1 2 3 4 Off the shelf wheels/tyres. Little thought given to selection. Basic understanding of wheel and tyre design and how they work.	5 6 7 8 9 Off the shelf wheels/tyres. Some thought shown in selection. Good understanding of wheel and tyre design and how they work.	10 11 12 13 14 15 Off the shelf or manufactured wheels/tyres. Good thought shown in selection. Excellent understanding of wheel and tyre design and how they work.	
<b>Tow Bar</b>	1 2 3 Simple tow bar with basic understanding of how it works	4 5 6 Functional tow bar, good level of understanding of the requirements for towing heavy loads	7 8 9 10 Inventive tow bar design, showing good understanding of towing dynamics. Constructed well, robust and some after treatment evident.	
	1 2 3 4 5 Off the shelf chassis used. Basic understanding of chassis design and how it works.	6 7 8 9 10 11 <b>PRO:</b> Off the shelf chassis modified to suit requirements. Good understanding of chassis design and how it works.	12 13 14 15 16 17 18 19 20 <b>PRO:</b> Designed and manufactured own chassis. Excellent understanding of chassis design and how it works.	
<b>Suspension</b>	1 2 3 4 5 Off the shelf suspension system used. Basic understanding of suspension design and how it works.	6 7 8 9 10 11 Off the shelf vehicle suspension system modified to suit requirements. Good understanding of suspension design and how it works.	12 13 14 15 16 17 18 19 20 Designed and manufactured own suspension system. Excellent understanding of suspension design and how it works.	
	1 2 3 4 5 Off the shelf steering system used. Basic understanding of steering design and how it works.	6 7 8 9 10 11 <b>PRO:</b> Off the shelf steering system modified to suit requirements. Good understanding of steering design and how it works.	12 13 14 15 16 17 18 19 20 <b>PRO:</b> Designed and manufactured own steering system. Excellent understanding of steering design and how it works.	
<b>Powertrain</b>	1 2 3 4 5 Off the shelf powertrain used. Basic understanding of powertrain design and how it works.	6 7 8 9 10 11 <b>PRO:</b> Off the shelf powertrain modified to suit requirements. Good understanding of powertrain design and how it works.	12 13 14 15 16 17 18 19 20 <b>PRO:</b> Designed and manufactured own powertrain. Excellent understanding of powertrain design and how it works.	

Please use the back page for any additional comments

**ENGINEERING 1 TOTAL** /125

**IMPORTANT:** Grey shaded areas denote assessment criteria **only** for Professional Class teams

# Engineering 2

## Design, Construction & Electronics

Team Number:  
Team Name:  
School:

Key Performance Indicators	Low	Medium	High	Score
<b>Vehicle aesthetics</b>	1 2 3 4 5 Limited evidence of vehicle aesthetic consideration, vehicle has a functional appearance.	6 7 8 9 10 11 Attractive vehicle design showing consideration of aesthetic issues. Some unique design features.	12 13 14 15 16 17 18 19 20 Unique, eye catching vehicle aesthetics, showing clear understanding of car design principles and attention to detail.	
	1 2 3 4 Limited evidence of logical decision making. Vehicle not fit for purpose.	5 6 7 8 9 Good logical decision making. Most elements of vehicle fit for purpose.	10 11 12 13 14 15 High level of design trade-off. Good logical decision making. All elements of vehicle fit for purpose. Some evidence of risk taking.	
<b>Materials used</b>	1 2 3 4 Limited material selections made. Basic understanding of material properties.	5 6 7 8 9 Some evidence of logical material selections. Good understanding of material properties.	10 11 12 13 14 15 Good evidence of logical material selections. Excellent understanding of materials and their applications.	
	1 2 3 4 5 Limited manufacturing processes performed. Basic understanding of manufacturing processes.	6 7 8 9 10 11 A range of manufacturing processes performed. Good understanding of manufacturing processes.	12 13 14 15 16 17 18 19 20 Wide range of appropriate manufacturing processes used. Excellent knowledge and understanding of manufacturing processes.	
<b>Quality of finish</b>	1 2 3 4 5 Basic construction with rough, unfinished elements.	6 7 8 9 10 11 Good quality of manufacture evident in many elements, vehicle shows some consideration of surface finishes.	12 13 14 15 16 17 18 19 20 Excellent quality of finish throughout the vehicle, showing high quality surface finish and attention to detail.	
	1 2 3 4 Little/ no evidence of Sustainability considered in materials and manufacturing.	5 6 7 8 9 Some evidence of Sustainability considering recyclability, material choices and impact of manufacturing processes.	10 11 12 13 14 15 Thorough account of sustainability considering recyclability, life cycle, CO <sub>2</sub> footprint, material choices and impact of manufacturing processes	
<b>Electronics design</b>	1 2 3 4 5 Basic circuit design showing little creativity. Basic understanding of electronics.	6 7 8 9 10 11 Some evidence of logical electronic circuit design. Some understanding of electronics.	12 13 14 15 16 17 18 19 20 Good understanding of electronics, creatively applied to design effective systems.	
	1 2 3 4 5 Limited electronics manufacturing processes performed. Basic understanding of manufacturing processes.	6 7 8 9 10 11 A range of electronics manufacturing processes performed, showing some understanding of appropriate processes.	12 13 14 15 16 17 18 19 20 Wide range of electronics manufacturing processes used. Good knowledge and understanding of appropriate processes.	
<b>Coding</b>	1 2 3 4 5 Little or no use of coding to enhance vehicle functionality.	6 7 8 9 10 11 Coding used to perform some basic functions, showing some understanding of programming.	12 13 14 15 16 17 18 19 20 Good understanding of programming applied to creating advanced vehicle functions via a programmable computer.	

Please use the back page for any additional comments

**ENGINEERING 2 TOTAL**

**/165**



## C16.0 'ACES' Innovation Challenge: BACKGROUND

# The automotive industry is going through a massive revolution.

The automotive industry is moving from ICE (internal combustion engines) to **ACES (Autonomous, Connected, Electric and Shared)** - the immediate future of mobility. The modern-day consumer wants access to on-demand services, choice and to be always connected. We have a social conscience to be cleaner, want more personal time and are looking at alternative options. The way people are moving around their lives is changing - we aim to be Clean, Safe and Smart.

From 2020 all new Jaguar Land Rover vehicles will be electrified, giving customers even more choice. We will introduce a portfolio of electrified products across our model range, embracing fully electric, plug-in hybrid and mild hybrid vehicles as well as continuing to offer ultra-clean petrol and diesel engines.

As we have said, the automotive industry is currently facing four main areas of challenge: Autonomy, Connectivity, Electrification and Shared. But what do they mean?

**Autonomy** - in the automotive industry, this refers to the ability of the car to sense the surrounding environment and navigate itself without human intervention. Autonomous development is happening now (UKAutodrive).

**Connectivity** - this refers to the ability of the car to be connected (i.e. receive and/or transmit information) to other devices whether through Bluetooth, internet, or other means. Hint: think about cars being as connected as smartphones. Our cars are Connected (InControl Apps).

**Electrification** - this refers to switching to electrical systems whether in terms of the propulsion system (powertrain) or any other systems in the car (e.g. electric differential vs. traditional mechanical differential). Our first electric vehicle, the Jaguar I-PACE is now on sale.

**Shared** - there is a growing popularity for sharing economy (think Airbnb!). People prefer to borrow and pay for a specific amount of time than spending money to own. This trend is also true for the automotive industry. Shared mobility is a reality with tech giants (e.g. Lyft / Uber).

Jaguar Land Rover is looking for young designers with ideas that can shape the future of the automotive industry... What features or systems can YOU develop to overcome one or more of these challenges?

## C16.0 'ACES' Innovation Challenge (30 points)

### C16.1 What will be judged?

As a team, your challenge is to come up with a concept for a future ACES feature or system. This idea can be proposed in reference to your Land Rover 4x4 in Schools vehicle, or theoretically applied to another current or future vehicle.

### C16.2 Team preparation

Consider the challenges associated with ACES in the real world; **we'd like you to demonstrate how your new idea overcomes one or more of them.** We want you to consider what technology it would require; how feasible it would be to implement and the potential benefits.

We want to see how conceptually innovative you are and get an insight into your ability to solve engineering problems, coming up with creative, functional solutions for the current challenges faced by the automotive industry. This is your chance to let some of your wildest ideas off the leash and really explore them!

### C16.3 Who needs to attend?

This judging session must be attended by the team manager and any additional team members responsible for the ACES Innovation Challenge concept.

### C16.4 Judging process / procedure

Teams will be judged by a judging panel and awarded points according to the key performance indicators on the official ACES Innovation Challenge scorecard. The judges will ask you to present your concept and ask questions about the idea(s) to gain a full understanding of your ideas. It is important to explain your ideas fully, even if you didn't include it on your presentation sheet!

### C16.5 ACES Innovation Challenge requirements:

Your concept proposal is to be presented as a separate document, comprising **no more than 1 side of A3 or equivalent.** You must include as much detail as possible so that your proposal *could* be judged without you. Please note that we are **not** expecting you to physically make a working prototype of your feature or system. We want you to include as much of the following as possible:

- Relevant research findings
- Design sketches / models / diagrams
- Development of concept
- Use of different technologies, whether existing, new or emerging
- Fully annotated final concept proposal

Please see the scorecard below for full details of how the ACES Innovation challenge will be judged. This will be awarded with a trophy and the recognition of Jaguar Land Rover engineers, who are looking for the brightest minds with the most creative ideas. This is your time to shine, so let's see what you've got.

# ACES Innovation Challenge

Team Number:  
Team Name:  
School:

Key Performance Indicators	Low	Medium	High	Score
	1 2 3	4 5 6	7 8 9 10	
<b>Innovation/originality</b>	High similarity with existing technology	Innovative but there are some similarities with other existing technology. Some but not much evidence of research.	Innovative, original idea with strong evidence of research.	
<b>Problem Solving</b>	Proposed concept has little or no impact in solving the challenges of ACES.	Proposed concept may have some impact in solving the challenges of ACES. More development of concept is required.	Proposed concept is highly relevant and if implemented could have significant impact in solving the challenges of ACES.	
<b>Concept Development</b>	Little or no development of concept with no feasibility evaluation	Some development of concept and some evaluation of feasibility.	Well-developed and ambitious concept, with a clearly demonstrated consideration of technology and feasibility.	

Please use the back page for any additional comments

**Innovation Challenge TOTAL**

**/30**

## C17.0 Track Assessment (125 points)

Each vehicle will be expected to successfully navigate around a specially made off road track just as demanding as the real thing to test your vehicle's 4x4 ability.

### C17.1 What will be judged?

The track assessment will test your vehicle's 4x4 ability in a range of specific areas.

**Please read the example Track Assessment scorecards at the end of this section for detailed point scoring and key performance indicator information.**

### C17.2 Team preparation

Each team must ensure their vehicle is ready for their track assessment, ensuring the vehicle batteries are fully charged and the transmitter/receiver are synchronized. The team should review the track elements and decide which team member will drive what element. All team members should practice driving and controlling their vehicle as much as possible prior to the event.

### C17.3 Who needs to attend?

This judging session must be attended by all team members. All team members must drive a minimum of at least 1 track element each.

### C17.4 Judging process / procedure

Teams will be awarded points as per the key performance indicators shown on the track assessment scorecard.

**C17.4.1 Breakdowns** – If a vehicle suffers a mechanical failure during its attempt on the track it can be repaired within the allocated track time limit. It will then be allowed to continue on the track for the remaining time.

If a team's vehicle is unable to be repaired, the team can proceed on track with a back-up vehicle provided by Land Rover 4x4 in Schools, at the discretion of the judges. In this case a 75% deduction will be applied for each element completed using the back-up vehicle.

**C17.4.2 Track procedure** – One team member may be appointed as being responsible for positioning the car in the beginning of each stage and transporting the car between stages.

**C17.4.3 Judges handling cars** – The race Judges will not be required to comply with any special car handling requests made of them by teams.

**C17.4.4 Radio Control Frequency** – At the beginning of the competition event you may be asked to declare your radio control frequency and channel being used. This is to avoid interference from teams using the same channel or frequency.

**C17.4.5 Transmitter** – You will be asked not to turn your transmitter on until it is your track run. You may also be asked to hand in your transmitters at the beginning of the day and only be issued with them for your track run.

# Track Assessment

## Section 1 (EXAMPLE)

Team Number:

Team Name:

School:

Element	Entry	Obstacle	Exit	Back Up?	Score
<b>1. Variable Hill</b>	2 Passes through cones without touching	2.....+2 2 = Front axle passes line, +2 = hold for 3 seconds	2 Reverse back through cones without touching	(tick)	/8
<b>2. Up Ramp</b>	2 Passes through cones without touching		2 Passes through cones without touching	(tick)	/4
<b>3. Wire Bridge</b>	2 Passes through cones without touching	1.....2 Control of vehicle on bridge	2 Passes through cones without touching	(tick)	/6
<b>4. Down Ramp</b>	2 Passes through cones without touching	2 Controlled descent (without flipping)	2.....+2 Passes through cones without touching (+2 = both gates)	(tick)	/8
<b>5. Hub</b>	2 Passes through cones without touching	1.....2.....3 Control & manoeuvrability of vehicle over element (1 = 2 wheels dropped, 2 = 1 wheel, 3 = 0 wheels)	2 Passes through cones without touching	(tick)	/7
<b>6. Pipe Bridge</b>	2 Passes through cones without touching	1.....2.....3 Control of vehicle on bridge	2 Passes through cones without touching	(tick)	/7
<b>Time remaining for stage:</b>					
<b>TRACK SECTION I TOTAL</b>					<b>/40</b>

**Hand Over to Track Assessment Section 2 Judges**

Notes:

# Track Assessment

Team Number:  
Team Name:  
School:

## Section 2 (EXAMPLE)

Element	Entry	Obstacle	Exit	Back Up?	Score
7. Low Mu	2 Passes through cones without touching	1.....2 1 = Control of vehicle over element, 2 = not touching central posts	2 Passes through cones without touching	(tick)	/6
8. Side Slope	2 Passes through cones without touching	1.....+10 1 = Control of vehicle over element, +10 = buzzer/lights on ( $\pm 5^\circ$ )	2 Passes through cones without touching	(tick)	/15
9. 'V' Gully Traverse	2 Passes through cones without touching	1.....+2 2 wheels on each side of 'V', 2 = wheels maintained level throughout	2 Passes through cones without touching	(tick)	/9
10. Hill Climb	2 Passes through cones without touching	1.....2.....+2 Control of vehicle on hill ascent/ramp over/descent (1-3 for control, +2 = 3 second hold on descent)	2 Passes through cones without touching	(tick)	/8
11. Up Ramp	2 Passes through cones without touching		2 Passes through cones without touching	(tick)	/4
<b>Time remaining for stage:</b>					
<b>TRACK SECTION I TOTAL</b>					<b>/42</b>

**Hand Over to Track Assessment Section 3 Judges**

Notes:

# Track Assessment

## Section 3 (EXAMPLE)

Team Number:  
Team Name:  
School:

Element	Entry	Obstacle	Exit	Back Up?	Score
<b>12. Camber Dome</b>	2 Passes through cones without touching	1.....2 Controlled and balanced operation of Seesaw (1 = control, <b>+1 = front axle over line for 3 second hold</b> )	2 Passes through cones without touching	(tick)	/6
<b>13. Seesaw</b>	2 Passes through cones without touching	1.....+3 Controlled and balanced operation of Seesaw (1 = control, <b>+3 = front axle over line for 3 second hold</b> )	2 Passes through cones without touching	(tick)	/8
<b>14. Tunnel</b>	2 Passes through cones without touching	1.....+10 1 = control of vehicle over element, <b>+10 = lights come on (± 5 lux)</b>	2 Passes through cones without touching	(tick)	/15
<b>15. Articulation</b>	2 Passes through cones without touching	1.....2 Control of vehicle over element (Straight line, no wheels off/in between humps)	2 Passes through cones without touching	(tick)	/6
<b>16. Rock Crawl</b>	2 Passes through cones without touching	1.....2.....+2 Control of vehicle over element (1-2 = control, <b>+2 = without touching barriers</b> )	2 Passes through cones without touching	(tick)	/8

Time remaining for stage:

TRACK SECTION 3 TOTAL

/43

Notes:

## C18.0 Trailer Test (20 Points)

Each vehicle will be expected to successfully tow a trailer and navigate around a specially made course designed to test your vehicle towing ability.

### C18.1 What will be judged?

The trailer Test will test your vehicle's towing ability in the following specific areas.

- Tow Bar
- Speed control
- Steering
- Reversing

Refer to the example Trailer Test scorecard for key performance indicator information.

### C18.2 Team preparation

Each team must ensure their vehicle is ready for their trailer test with the vehicle batteries fully charged and the transmitter/receiver are synchronized. The team should review the trailer course and decide which team member will drive. All team members should practice driving and controlling their vehicle as much as possible prior to the event.

### C18.3 Who needs to attend?

This judging session must be attended by all team members but only one (1) team member is required to drive/tow the trailer.

### C18.4 Judging process / procedure

Teams will be awarded points as per the key performance indicators shown on the trailer test scorecard.

**C18.4.1 Breakdowns** - If a vehicle suffers a mechanical failure during its attempt on the track it can be repaired within the allocated track time limit. It will then be allowed to continue on the track for the remaining time.

If a team's vehicle is unable to be repaired, the team can proceed on track with a back-up vehicle provided by Land Rover 4x4 in Schools, at the discretion of the judges. In this case a 75% deduction will be applied for each element completed using the back-up vehicle.

**C18.4.2 Radio Control Frequency** - At the beginning of a competition event you may be asked to declare your radio control frequency and channel being used. This is to avoid interference from teams using the same channel or frequency

**C18.4.3 Transmitter** - You will be asked not to turn your transmitter on until it is your trailer test. You may also be asked to hand in your transmitters at the beginning of the day and only be issued with them for your trailer test.

**C18.4.4 Judges handling cars** - The race Judges will not be required to comply with any special car handling requests made of them by teams.

# Trailer Test

(EXAMPLE)

Team Number:  
Team Name:  
School:

	No. of Line Faults (Deduct 1 point per fault)	No. of Cone Faults (Deduct 2 points per fault)	No. of Assessor Interventions (Deduct 3 points per fault)	Back Up?	Score
<b>Section 1</b>				(tick)	/5
<b>Section 2</b>				(tick)	/5
<b>Section 3</b>				(tick)	/5
<b>Section 4</b>				(tick)	/5
<b>Time remaining for stage:</b>					
<b>TRAILER TOW TOTAL</b>					<b>/20</b>

NOTES:

## C19.0 Scrutineering (150 points)

Each vehicle will be assessed by judges, who will check various elements of the vehicles in line with the Technical Regulations document. Such checks include the vehicle size (length, width and height), tilt sensors (the tilt sensor should trigger a buzzer or lights), automatic lights, weight, etc. Vehicles failing on any dimensions/feature will be penalised but not excluded from the challenge.

### C19.1 What will be judged?

Scrutineering judging is a detailed inspection process where the vehicle is assessed for compliance with the Land Rover 4x4 in Schools UK Technical Regulations. Refer to the Scrutineering judging scorecard for key performance indicator information.

### C19.2 Team preparation

The team MUST have their vehicle fully assembled and ready to present to the judges. A laptop may be taken to scrutineering judging along with the design portfolio. Other items may also be taken to help the team explain any engineering or manufacturing concepts. The Scrutineering judges will not have access to the Team Showroom for judging purposes. Preparation should include careful reading of the scorecard describe what the judges will be looking for.

### C19.3 Who needs to attend?

This judging session must be attended by the team manager and team design and manufacturing engineers as a minimum.

### C19.4 Judging process / procedure

Teams will be awarded points as per the key performance indicators shown on the Scrutineering scorecard. This is an informal interview where judges will ask the team questions and check the above using scrutineering gauges.

# Scrutineering

Team Number:  
Team Name:  
School:

Reg	Regulation Overview	Min/Max Quick Guide	Pass/Fail	Penalty	Comments	Score
<b>T3.0 Vehicle Dimensions</b>						
T3.1	Total length	Min: 200mm Max: 375mm		-25	Critical Rule - Measurement:	
T3.2	Total width	Min: 100mm Max: 215mm		-25	Critical Rule - Measurement:	
T3.3	Total height	Min: 100mm Max: 200mm		-25	Critical Rule - Measurement:	
T3.4	Ground clearance	Min: 20mm		-5		
T3.5	Approach angle	Min: 25°		-5		
T3.6	Departure angle	Min: 25°		-5		
T3.7	Break Over angle	Min: 40°		-5		
<b>T4.0 Drive, wheels and steering</b>						
T4.1.1	Powered by electric motor(s)	One or more electric motors		X	Unable to be track assessed	
T4.1.2	Caterpillar tracks	Not permitted		X	Unable to be track assessed	
T4.1.3	All wheels must be driven	Must be 4-wheel drive		-5		
T4.2	Four wheels only	Must have 4 wheels only		X	Unable to be track assessed	
<b>T5.0 Vehicle Weight</b>						
T5.1	Vehicle Weight	Max: 2kg (Deduction of 5 points for each 50g overweight – penalty from 2.002kg)		-5 per 50g	Weight:	
<b>T6.0 Vehicle Body Shell</b>						
T6.1.1	All four (4) wheels covered	All wheels & tyres covered from plan view		-25		
T6.1.2	All batteries covered	All batteries covered		-5		
T6.1.3	Motors, receivers & wiring	All motors, receivers & wiring covered		-5		
T6.2	Challenge Logo	Logo displayed on the vehicle		-5		
T6.3	Team number decal	Logo displayed on the vehicle		-5		
<b>T7.0 Vehicle Electronics</b>						
T7.3	Cable Management	Neat cables, protected by body where poss.		-5		
<b>T8.0 Vehicle control equipment</b>						
T8.1	Radio control equipment	Must use digital speed controller		-2		
T8.2	Drive Battery pack	One battery - maximum 7.4v		-5		
<b>T10.0 Chassis (Development Class Only)</b>						
T10.0	Standard / modified spring, damper, wheels and tyres	Spring / damper / wheels / tyres only to be modified. 2 wheel steer only.		-25		
<b>Total Deductions</b>						
<b>Points Available</b>						<b>150</b>
<b>Score = Points Available – Total Deductions =</b>						

**IMPORTANT:** T10.0 Chassis - assessment criteria / penalty **only** for Development Class teams. If penalties total more than 150 points, total score for Scrutineering will be zero.



# DETAILS:

## Things to be aware of...



ABOVE & BEYOND



## C20.0 Team Accounts

Each team is required to record an account of all the team's income and expenditure. The accounts must clearly show all sponsorship, in-house made components and the team's budget.



**C20.1 Budget** – At UK Regional Finals, the budget for each team to spend on components to build their vehicle is £250 (GBP – British Pound) **excluding** the cost of registration, starter kit or equipment. Teams are encouraged to make as much as possible themselves. For the UK National Finals, this budget is £500, which can include components reused from Regional Finals. *Refer to C20.3.3 below for details on how to account for this.*

**C20.2 Sponsorship** - Teams are encouraged to seek sponsorship for external companies or organisations for buying components and developing their team image and branding.

**C20.3 Income & Expenditure** The accounts drawn up must clearly itemise the income and expenditure for the team.

**C20.3.1** Income through sponsorship and/or provision from educational establishments.

**C20.3.2** Any parts made in-house can be costed as free and not included in the £250

**C20.3.3** Any parts received free due to donations, recycling components from previous model or sponsorship should be included in the budget at 33.33% of their RRP price.

**C20.3.4** Any components bought in should be included in the **£250 / £500** budget at the full cost price.

**C20.4 Finance Sheet** - Each team is required to produce a finance sheet which details all the above information. Please note the finance sheet is different to the Bill of Material (B.O.M).

**C20.5 Bill of Material (B.O.M)** - Each team is required to produce a B.O.M which clearly details the team's expenditure itemising each item/component purchased out of the £250 budget.

## C21.0 Environment and Sustainability

The Engineering judges will review teams' environmental and sustainability impact on their vehicle and project approach. The judges will consider the following elements which contribute towards an environmentally friendly and sustainable vehicle:

- Vehicle weight
- Recyclable materials used on vehicle and throughout the project
- Carbon footprint
- Elements of the project that can be re-used in future years

## C22.0 Use of Social Media

Teams have the option to create their own team profile pages on social media sites like Facebook and Twitter. This is also a great opportunity to advertise and promote the team and keep supporters up to date on progress. Any posts, tweets, photos or status updates should be linked to the Land Rover 4x4 in Schools Facebook and Twitter.



## C23.0 Awards

### C23.1 Awards Celebration

The UK Regional and National Final awards will be presented at the Awards Ceremony at the end of the competition.

### C23.2 Participation Recognition

All students will receive an official participation certificate from Land Rover 4x4 in Schools.

### C3.3 List of awards to be presented

A full list of awards to be presented will be announced before the Regional or UK National Final event. All awards will be presented to the team that achieves the highest score in each category taken from the scorecards, a judge's decision or a mixture of both.

## Achievement Awards (one or more to be presented)

- 1st Place Professional Class
- 2nd Place Professional Class
- 3rd Place Professional Class
- 1st Place Development Class
- 2nd Place Development Class
- 3rd Place Development Class
- Best Engineered Car Professional Class
- Best Engineered Car Development Class
- Best Track Performance Professional Class
- Best Track Performance Development Class

## Star Quality Awards (one or more to be presented)

- Design
- Team Identity
- Sponsorship & Marketing
- Research & Development
- Portfolio
- Verbal Presentation
- Team Showroom
- Judges Choice



## C24.0 Project Element Submission Checklist

Below is a checklist to make sure you have everything you need to compete at UK Regional Finals. It's a good idea to print this out and make your own checklist so you can check off your work.

<b>Team Number:</b>			
<b>Team Name:</b>			
<b>School:</b>			
<b>Project Element</b>	<b>Submitted? TEAM USE</b>	<b>Received? OFFICIAL USE</b>	<b>Comments: OFFICIAL USE</b>
<b>1 x 10 (DEV) / 20 (PRO) page Design Portfolio</b>	TICK	TICK	
<b>1 x Set Engineering Drawings (optional)</b>	TICK	TICK	
<b>1 x 4-wheel drive Remote Control car</b>	TICK	TICK	
<b>1 x Remote Controller</b>	TICK	TICK	
<b>1 x Spare Battery (max. 7.4v)</b>	TICK	TICK	
<b>ACES Innovation Challenge Submission</b>	TICK	TICK	
<b>5-minute Verbal Presentation (Inc. HMDI / VGA Laptop)</b>	TICK	TICK	
<b>1 x Team Showroom display</b>	TICK	TICK	
<b>Sign-off by</b>	<b>Name</b>		<b>Signature</b>
<b>Team Manager:</b>			
<b>4x4 in Schools Official:</b>			



# APPENDIX:

## Additional information...



ABOVE & BEYOND



## Appendix i: Track Rules

### PRE-TRACK

- Teams will have two attempts at all track stages over both competition days, taking their best score from each stage as their final track performance. *Plan your tactics carefully!*
- Teams are initially scheduled to arrive at the track for a 10-minute preparation period. During this time, teams will have a 5-minute track briefing to reinforce the procedure and answer any questions the teams have. For the remaining 5 minutes, teams will be able to check the running of their car using the Proving Ground area, which allows teams to test the forward/back/left/right function of their vehicle, along with the function of their light and tilt sensors.
- If a team fails to prepare their car in 5 minutes, they will do so with the track timer counting, so make sure everything is ready **BEFORE** arriving at the track.

### ON-TRACK

- The time limit and live timer for each stage will be displayed on a large screen beside the track.
- Competitors must **NOT** start their track run until instructed to do so by the track judge.
- Track timer starts at the discretion of the track judges.
- Each team member must drive at least one element. Lanyards will be distributed by a track judge before the track run and these will be returned by each team member as they drive. At the end of all stages all lanyards should have been returned to the track judge.
- Teams must drive into a designated trailer hitch area, where they will be allowed to connect the trailer to their car. This must be done at the discretion of the judges and while the clock is running. Teams will then drive into a designated trailer unloading area, at which point teams will be allowed to remove the trailer.

### DRIVER ETIQUETTE

- Drivers can stand anywhere within the track area to get the best view of their car but must **NOT** stand on any of the track elements or podiums, being respectful of all other teams on track.
- Only team members must stand in the designated area when they are not driving. Any non-team members must stand behind the tensor barrier line.
- Driver handover **MUST** take place in the 'dead' space between elements (i.e. in between the exit cones of the last element and the entry cones of the next element). If a driver passes through the entry cones of any element, then he/she must complete that element.

### SCORING POINTS

- If the stage time runs out, the track run will cease and all forward points for that stage will be lost. A track judge will move the competitor car to the next stage.
- Points are awarded for passing between the entry/exit cones **WITHOUT** touching them and for demonstrating controlled driving over the elements.
- Once cones are touched, those points are lost, so don't waste time trying to avoid them again.
- Points can be lost by touching the sides/barriers of elements and the suspended track.

### WORST CASE SCENARIOS

- If the car is touched by a competitor while on track, the team will be disqualified from the whole track run – **this will be strictly applied.**
- If the car falls over or falls off the track, a track judge will place the car between the exit cones of the last attempted element. Competitors must **NOT** catch the car or prevent its fall.
- If the car is unable to proceed during the track run the following procedure will be followed:
  - Teams will advise track judge to remove car to repair table
  - Judge will move car to table, where teams may attempt a repair
  - Teams then advise judge to move car back to track

- Judge will position car between the exit cones of the last attempted element and the track run can continue
- Throughout the repair procedure, track stage time will continue
- If the competitor car is unable to continue the track run, a 'Land Rover 4x4 in Schools Technology Challenge' car can be used to complete the run at the discretion of the judges
- Competitors will only be awarded 25% marks for elements attempted with the use of a 'Land Rover 4x4 in Schools Technology Challenge' car
- If a competitor is unable to complete an element, they may elect to be moved on by a track judge. In this instance, all forward points for that element are forfeited. A track judge will move the car to the exit cones of the attempted element and the track run can continue.

#### **JUDGES DECISION IS FINAL**

- The judges reserve the right to stop a team if they deem that they are acting in a manner that could cause damage to any of the track equipment. In this instance, all forward points will be forfeited.

**Most importantly, relax and enjoy the track session. If you're unsure about anything, just ask.**

## Appendix ii: Tie Break

### In the event of a tie:

If, after all scores have been counted, verified and consolidated, there is a points tie arising for one of the podium positions, the following total points scored by the teams in question will be used to decide the winner for that position:

- **Engineering I&2**
- **Track and Trailer Test**
- **Scrutineering S1 & S2**

If a tie still exists, the following total points scored by the teams in question will be used to decide the winner for that position:

- **Engineering I&2**
- **Track and Trailer Test**

If a tie still exists, the following points will be considered:

- **Engineering I&2**

If a tie still exists, the following points will be considered:

- **Engineering I**

If a tie still exists, the following points will be considered:

- **Track and Trailer Test**

If a tie still exists, the following points will be considered:

- **Track and trailer Test, excluding the team's best performance on each stage**

If a tie still exists, the following decider will be:

- **Coin toss by Chair of Judges**

## Appendix iii: Car Service Procedure (UK National Final ONLY)

### DURATION: 25 mins

The following is a procedural guide for Judges supervising the Car Service Area at UK National Final events. Car Service takes place after each team has completed all their track assessments on Day 1. Car Service occurs directly after the track session, where teams can fix any damage to their cars sustained during the track assessment. It is crucial that the teams are supervised here to ensure they do not make any intentional setup changes to the car, such as different wheels, tyres, suspension or other performance modifications. Teams may maintain or repair anything damaged during the track run, using their own materials and tools.

### Basic Procedure:

- Teams will arrive to the service area after their timetabled track sessions. The cars will be delivered to the car service area by the Track judges. Under no circumstances are teams to be allowed to transport their cars or move them between areas.
- Remind team members of the time constraint and the need to hand cars and COMPLETED service log back to the Judge before the end of their service time interval.
- Provide teams with a reminder when FIVE (5) minutes of interval time are remaining.
- When team has completed their service, collect each team's car and car service log.
- With the team present, weigh the car and record the measured weight on the team's car service log, including the time of team submitting their car.
- Scrutineer must verify the information completed by the team is accurate, true and legal.
- Return the car and car service log to Parc Fermé.

### Basic Rules:

- Only student team members are permitted to enter the Car Service Area
- Teams must supply their own tools and maintenance equipment. The Car Service Area Official is NOT to assist teams with resource requirements.
- Teams are permitted to service their cars as per the scope identified on the Car Service Log form.
- Teams MUST hand their car and COMPLETED Service Log to the Service Area Official before the conclusion of their service interval.

### LIMITATIONS:

Teams are permitted to carry out maintenance of their cars, to repair any damage sustained during the team's track session. Teams MUST NOT modify the performance of their car, unless this is an indirect consequence of performing essential maintenance.



### CRITICAL Regulations:

Below are the Critical Regulations, which should be checked during Car Service. Teams already with Critical Regulations going into Car Service will maintain all scores, but it is important to check that teams do NOT modify their vehicles beyond these rules during Car Service:

- T3.1 – Overall length
- T3.2 – Overall width
- T3.3 – Overall height
- T4.0 – Drive, wheels and steering
- T5.1 – Vehicle weight
- T6.1 – Body shell cover
- T9.1 – Tow bar: fixed
- T9.2 – Tow bar: suitable for use



Please make sure you have also read the Technical Regulations

**GOOD LUCK - SEE  
YOU AT REGIONAL  
FINALS!**

**Land Rover 4x4 in Schools Technology Challenge**

Engineering in Motion

Armytage Rd, Brighouse HD6 1QF

T: 020 7344 8444

F: 020 7344 8450

[contactus@4x4inschools.co.uk](mailto:contactus@4x4inschools.co.uk)

[www.4x4inschools.co.uk](http://www.4x4inschools.co.uk)