**The IET**



**Airbus**

**Teacher Handbook**

**Could you be our engineer….?**

The IET DIY Faraday Challenge Day ‘Airbus’ is based on the Faraday Challenge Day of the same name, a STEM activity day written and delivered by the Institution of Engineering and Technology (IET).

The IET Education website hosts a wide range of teaching resources for science, design and technology and maths. These include classroom activities with film clips, online games, posters, careers resources and STEM activity days.

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**Stay safe**

Whether you are a scientist researching a new medicine or an engineer solving climate change, safety always comes first. An adult must always be around and supervising when doing this activity. You are responsible for:

* ensuring that any equipment used for this activity is in good working condition
* behaving sensibly and following any safety instructions so as not to hurt or injure yourself or others

Please note that in the absence of any negligence or other breach of duty by us, this activity is carried out at your own risk. It is important to take extra care at the stages marked with this symbol: ⚠

# Contents

1. The context 4
2. The brief 5
3. Checklist 6
4. Shop resources 7
5. Suppliers 11
6. Schedule of the day 13
7. Room layout 14
8. Marksheet (overview) 15
9. Assessment information and criteria 16
10. Risk Assessment 18

# Context

One very important aspect of the work of Airbus is the support of international aid organisations. Their products and resources, from relief flights to satellite imagery and helicopters, are used to support the work of emergency responders around the world.

A picture containing plane, outdoor, ground, truck

Description automatically generated

One way they do this is through the Airbus Foundation which has brought together a global network of airlines and relief organisations to support humanitarian causes. Since 2008, the Foundation has organised the delivery of 650 tons of aid materials around the world, delivering medical and school supplies, food, water sanitation equipment, toys, clothing and emergency response units to the most vulnerable.

Now they want your help in continuing to develop new and exciting ideas which can help them either:



* help transport or deliver the aid or,
* provide something which could be taken out to people in times of need.

**Remember, engineering is about people.** **Today is your chance to make a difference, could you be our engineer...?**

# 2. The Brief

The Airbus team wants you to:

* **Design and engineer ONE** prototype which will either help transport aid or help people in times of need. Your prototype must include **at least** one electronic circuit/component.
* **Complete** the planning and events log to show how you have designed your idea, and solved problems and worked as a team throughout the project.
* **Present** your prototype to the IET Faraday Airbus judge(s).

You will need to demonstrate the skills and attitudes we are looking for so:

* be creative;
* plan carefully;
* work within the resources and the budget available;
* be realistic about what is achievable in the time available;
* be resilient and persevere with problems;
* record your thinking;
* keep to strict deadlines.

**Considerations:**

* Weight – heavy things are more difficult to transport both through air and on land.
* Energy – access to power sources can be difficult.
* Flexibility – we need to be able to change things back quickly.
* Sustainability - what will happen to the things taken out to help in times of disaster once they are no longer needed? Could they be converted for alternative use or recycled?

# Checklist

|  |  |
| --- | --- |
| **Student tables** | **Notes** |
| Team number sign (laminated) | 1 per table in plastic stand |
| Student team registration form | 1 per student table |
| Student booklet | 1 per table |
| Accounts sheet | 1 per table |
| A3 Planning and Events Log | 1 per table |
| A3 Airbus ideas sheet (laminated) | 1 per table |
| Faraday branded currency | **Each team** - 1 x 20F, 6 x 10F, 6 x 5F, 10 x 1F = F120.00 |
| Engineering apprenticeship pack | 1 per table – box contains 2AA battery pack with battery snap, 3 x crocodile leads, piezo buzzer and light dependent resistor. |
| **Challenge Leader** | **Notes** |
| Presentation - hard and soft copy | Best to bring on your own laptop and presentation and video on a memory stick |
| Clicker for PowerPoint presentation | Carry spare batteries |
| Assessment matrix | 1 per event |
| Stickers – red and yellow | 1 of each colour for each team. Red sticker for project manager, yellow sticker for accountant. |
| Clipboard | For hard copy of presentation, assessment matrix, etc. |
| A4 plain paper | Up to 3 sheets free per team for presentation notes |
| Prizes (if required) | Schools to provide |
| Certificates | 1 per student |
| Shop | Notes |
| Shop manager account sheet | 1 per event - Put on a clipboard |
| Shop manager resources list | Laminated sheets on clipboard |
| Shop manager guidance | 2 x laminated sheet to give to shop keepers as briefing for role |
| Faraday branded currency | Shop change – 2 x 20; 10 x 10; 20 x 5; 20 x 1 |
| All shop items with price tags |  |
| Signage | Notes |
| Shop |  |
| Cutting station rules |  |
| Bargain bin | Use cardboard box or similar when you have enough spare items |

**Shop manager resource sheet**

**Items to buy**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Electrical components** | | | | |
| **Item** | **Description** | | **Unit** | **Cost** |
| Crocodile leads |  | Lead with crocodile clips at each end | Each | 4 Faradays |
| Terminal blocks |  | Can be used to connect insulated wire | Block of 4 | 1 Faraday |
| Piezo buzzer | Kittronic buzzer | Connect in a circuit to give a sound output | Each | 6 Faradays |
| LED – various colours |  | Light Emitting Diode which lights up when connected in a circuit. Choose from red, orange, green or blue. | Each | 6 Faradays |
| Motor |  | Connect in a circuit to create clockwise or anti-clockwise movement. Will **not work** with a solar panel or an LDR. | Each | 6 Faradays |
| Solar motor | A close up of a device  Description generated with high confidence | Connect to a solar panel to create clockwise or anti-clockwise movement. | Each | 6 Faradays |
| Servo motor  (0 to 90 degrees) | A picture containing wall, indoor, table  Description generated with very high confidence | Use with a servo motor control unit to control movement from 0o to 90o | Each | 6 Faradays |
| Servo motor (continuous) | A picture containing wall, indoor, table  Description generated with very high confidence | Use with a servo motor control unit to control continuous movement through 360o | Each | 6 Faradays |
| Light Dependent Resistor (LDR) | LDR 2 | Component that detects the light level and changes resistance in a circuit. | Each | 8 Faradays |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Push to make switch |  | Connects a circuit when pushed down and breaks the circuit when released. | Each | 6 Faradays |
| Moisture sensor |  | Component which detects moisture in the surroundings. Can also be used to detect materials which conduct electricity. | Each | 8 Faradays |
| Servo motor control unit |  | Use this to control a servo motor. **You MUST** read the ‘How to …’ sheet before connecting this component. | Each | 8 Faradays |
| Motor holder |  | Used to fix a motor or a syringe in position. NOTE: you will need the insert to connect a syringe. | Each | 4 Faradays |
| Gear attachment for motor |  | Used to connect a motor to a cog. | Each | 2 Faradays |
| Pulley attachment for motor |  | Used to connect a motor to a pulley wheel – will need connector (e.g. elastic band) | Each | 2 Faradays |
| Solar panel |  | Used to power components using the power of the sun. **You MUST** read the ‘How to …’ sheet before using. | Each | 6 Faradays |
| 2AA cells in battery holder with battery snap |  | Used to provide power for your circuit | Each | 4 Faradays |
| 4 AA cells in battery holder with jumper leads | A picture containing wall, indoor  Description generated with very high confidence | **ONLY** **to be used** with servo motor control unit. | Each | 6 Faradays |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Construction materials** | | | | |
| **Item** | **Description** | **Unit** | | **Cost** |
| Correx | Used to create structures | Piece | | 6 Faradays |
| Plastic syringes with tube | Used to develop pneumatic system | Pair of syringes with plastic tube | 6 Faradays | |
| Small cog | Used in gear systems with motors | Each | 2 Faradays | |
| Medium cog | Used in gear systems with motors | Each | 2 Faradays | |
| Large cog | Used in gear systems with motors | Each | 4 Faradays | |
| Dowel | Piece of solid cylindrical wooden rod used to create structures | Each | 4 Faradays | |
| Pulley wheel 54cm | Used to connect to pulley attachments on motor | Each | 6 Faradays | |
| Wooden wheel 54cm | Used with motors to drive something | Each | 4 Faradays | |
| Plastic reel | Used in construction | Each | 4 Faradays | |
| Polyfoam | A5 sheet – assorted colours | Each | 4 Faradays | |
| Coloured card | A4 sheet of card – assorted colours | Each | 4 Faradays | |
| Aluminium foil | A conductive material which can be used to make pressure pads or switches (**MUST NOT** be used in place of connecting wires) | 10cm strip | 6 Faradays | |
| Masking tape | Can be used to secure light parts in your design. **NOTE:** excessive use of tape will result in an additional charge | Roll | 6 Faradays | |
| Sponge | Can be used to make pressure switches or enhance your design. | Each | 6 Faradays | |
| Paperclip | Used to create switches or in construction | Each | 1 Faraday | |
| Paper fastener | Used to create switches or in construction | Each | 1 Faraday | |

|  |  |  |  |
| --- | --- | --- | --- |
| Elastic bands | Used to hold or create working parts, including driving pulley wheels | Each | 1 Faraday |
| Cable ties | Can be used to hold your structures in place | Each | 2 Faradays |
| String | Can be used as part of your product design | 30cm piece | 4 Faradays |
| Baking parchment | Can be used as part of your product design | 10cm strip | 6 Faradays |
| Wooden lolly sticks | Can be used as part of your product design | Each | 4 Faradays |
| Hire Centre Trade Card | Use this to hire various items from the hire section of the shop – see below for details | One per team | 6 Faradays |

**Available with your Hire Centre Trade Card**

These items can be hired from the shop if you buy a Hire Centre Trade Card. You will need to take it to the shop and show the shopkeeper each time you want to use of one of these items. You may only get one item at a time.

|  |  |
| --- | --- |
| Stapler | Used to staple soft materials only |
| Hole punch | Used to make small holes in soft materials |
| Ruler | Used to measure any part of your product or additional items |
| Scissors | Used for soft materials only |
| Screwdriver | Used to connect insulated wire in terminal blocks or to bulb holders. |
| Wire strippers | Used to cut or strip insulated wire. |

**Free to use**

The cutting station may be used at any point **BUT** only 3 people will be allowed at this station at any one time. Please take care when using this equipment.

# 5. Suppliers

The suppliers listed were used for the 2018-19 Faraday Challenge Day season. Suppliers are not provided for general items which were sourced at a variety of shops, including Poundland and supermarkets.

|  |  |
| --- | --- |
| **Item** | **Cost** |
| Crocodile leads | Kitronik - [www.kitronik.co.uk/2407-crocodile-leads-pack-of-10.html](https://www.kitronik.co.uk/2407-crocodile-leads-pack-of-10.html) |
| Terminal blocks | Kitronik - [www.kitronik.co.uk/2410-12-way-terminal-block-pack-of-10.html](http://www.kitronik.co.uk/2410-12-way-terminal-block-pack-of-10.html) |
| Piezo buzzer | Kitronik - [www.kitronik.co.uk/c3301-piezo-buzzer-with-drive.html](http://www.kitronik.co.uk/c3301-piezo-buzzer-with-drive.html) |
| LED – red | RS - <https://uk.rs-online.com/web/p/visible-leds/2285988/?sra=pstk> |
| LED – green | RS - <https://uk.rs-online.com/web/p/visible-leds/2471678/?sra=pstk> |
| LED – orange | RS - <https://uk.rs-online.com/web/p/visible-leds/2285994/?sra=pstk> |
| Motor | Kitronik - [www.kitronik.co.uk/c2501-motors-medium-torque.html](http://www.kitronik.co.uk/c2501-motors-medium-torque.html) |
| Solar motor | Kitronik - [www.kitronik.co.uk/2546-low-inertia-solar-motor-1000-rpm.html](http://www.kitronik.co.uk/2546-low-inertia-solar-motor-1000-rpm.html) |
| Servo motor (0 to 90) | Kitronik - https://www.kitronik.co.uk/2565-180-mini-servo.html |
| Servo motor (continuous) | Kitronik - <https://www.kitronik.co.uk/2589-fs90r-360-degree-continuous-rotation-servo.html> |
| Light Dependent Resistor (LDR) | Kitronik - [www.kitronik.co.uk/c3515-standard-ldr.html](http://www.kitronik.co.uk/c3515-standard-ldr.html) |
| Push button switch | Kitronik - [www.kitronik.co.uk/c3401-miniature-push-to-make-switch-red.html](http://www.kitronik.co.uk/c3401-miniature-push-to-make-switch-red.html) |
| Moisture sensor | These were made using small nails and a small rectangle of plywood |
| Servo motor control unit | Can get these from ebay, we used:  UMT media - [www.umtmedia.com/products/multi-servo-tester-3ch-ecs-consistency-speed-controler-power-channels-ccpm-ty?variant=58674806804](http://www.umtmedia.com/products/multi-servo-tester-3ch-ecs-consistency-speed-controler-power-channels-ccpm-ty?variant=58674806804) |
| Motor holder | TTS - [www.tts-group.co.uk/motor-mounting-clips/1003735.html](http://www.tts-group.co.uk/motor-mounting-clips/1003735.html) |
| Gear attachment for motor | TTS - [www.tts-group.co.uk/plastic-gears-for-motor-20pk/1000432.html](http://www.tts-group.co.uk/plastic-gears-for-motor-20pk/1000432.html) |
| Pulley attachment for motor | TTS - [www.tts-group.co.uk/small-plastic-pulleys-10pk/TP-10.html](http://www.tts-group.co.uk/small-plastic-pulleys-10pk/TP-10.html) |
| Solar panel | Kitronik - [www.kitronik.co.uk/3604-30v-100ma-polycrystalline-solar-cell.html](http://www.kitronik.co.uk/3604-30v-100ma-polycrystalline-solar-cell.html) |
| 2AA cells in battery holder | TTS - [www.tts-group.co.uk/2-x-aa-battery-holders-pack/1003710.html](http://www.tts-group.co.uk/2-x-aa-battery-holders-pack/1003710.html) |
| Battery snap | TTS - [www.tts-group.co.uk/electrical-battery-snaps/1003717.html](http://www.tts-group.co.uk/electrical-battery-snaps/1003717.html) |
| 4 AA cells battery holder | Rapid - [www.rapidonline.com/keystone-2478-battery-holder-for-4-x-aa-and-flying-leads-18-3695](http://www.rapidonline.com/keystone-2478-battery-holder-for-4-x-aa-and-flying-leads-18-3695) |
| jumper wires | Kitronik - [www.kitronik.co.uk/c4128-jumper-wires-premium-mf.html](http://www.kitronik.co.uk/c4128-jumper-wires-premium-mf.html) |
| Correx | TTS - [www.tts-group.co.uk/corrugated-plastic-sheets-500-x-500mm/1000487.html](http://www.tts-group.co.uk/corrugated-plastic-sheets-500-x-500mm/1000487.html) |
| Plastic syringes with tube | TTS - [www.tts-group.co.uk/plastic-syringe-packs/1003942.html](http://www.tts-group.co.uk/plastic-syringe-packs/1003942.html)  Tube was bought at fish and aquarium shop |
| Small cog | TTS - [www.tts-group.co.uk/assorted-plastic-gears-60pk/1003641.html](http://www.tts-group.co.uk/assorted-plastic-gears-60pk/1003641.html) |
| Medium cog |
| Large cog |
| Dowel (5mm) | TTS - [www.tts-group.co.uk/wooden-dowel-packs/1000318.html](http://www.tts-group.co.uk/wooden-dowel-packs/1000318.html) |
| Pulley wheel 54cm | TTS - [www.tts-group.co.uk/wooden-pulleys-10pk/1000445.html](http://www.tts-group.co.uk/wooden-pulleys-10pk/1000445.html) |
| Wooden wheel 54cm | TTS - www.tts-group.co.uk/wooden-wheel-packs/1000483.html |
| Plastic reel | TTS - [www.tts-group.co.uk/plastic-cotton-reels/1000429.html](http://www.tts-group.co.uk/plastic-cotton-reels/1000429.html) |
| Polyfoam | Hobbycraft |
| Coloured card | Hobbycraft |

**6. Schedule for the day**

|  |  |
| --- | --- |
| **08:00** | Challenge Leader arrives to set up |
| **09:15** | Register your team (All visiting schools should have arrived by this point) |
| **09:30** | Welcome and introduction |
| **09:50** | **Project brief:** Introduction to the Faraday Challenge |
| **10:10** | **Planning:** Identifying the problems and generating initial ideas |
| **10:25** | **Team role selection:** team decides on which roles they need |
| **10:30** | **Engineering apprenticeship:** teams complete a short engineering task⚠ |
| **10:40** | **Development** ⚠   * Shop opens * Agree on final product designs |
| **11:00** | **Break** |
| **11:10** | **Development continues** ⚠   * Continue to design and modify where necessary * Record progress in event log |
| **12:20** | Teams are briefed on the content of the presentation |
| **12:30** | **Lunch** – Tools down |
| **13:00** | **Development: Final preparations** ⚠   * Finalise product * Prepare presentation with notes |
| **13:30** | * Shop closes * Submit accounting sheet to the Shop keeper * Practise presentation |
| **13:50** | **Presentation** ⚠   * Teams present their designs to the judge(s) |
| **14:45** | Award ceremony with final feedback and evaluation of the day |
| **15:00** | Engineering teams depart |
| **15:45** | Challenge Leader departs by this point (actual time depends on pack up requirements) |

**7. Host school – Room/hall layout**

**Notes:**

* Each team table will need 6 chairs and be large enough for 6 students to work comfortably. The judges’ table and shop will each need 2 chairs.
* Table positions do not need to be exact and can be arranged to best accommodate the shape and size of the venue. If you are running the Challenge Day for just your school, you may choose not to have a teachers’ team table.
* We strongly recommend you cover the cutting station with cutting mats or a board to protect the surface.

**BACK**

**Cutting station (with cover/cutting mats)**

**Shop (at least 3 m x 0.5 m)**

**Team 7 Teachers**

**Team 3**

**Team 4**

**Team 5**

**Team 2**

**Presentation table**

**Refreshments Table**

**Team 1**

**Team 6**

**Judge’s table**

**FRONT – Projection screen**

**8. Marksheet (overview)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Assessment Criteria | | Team | Team | Team | Team | Team | Team | Team |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Planning | 13 |  |  |  |  |  |  |  |
|
| Development of product\* | 20 |  |  |  |  |  |  |  |
|
| Use of budget | 8 |  |  |  |  |  |  |  |
|
| The product\* | 30 |  |  |  |  |  |  |  |
|
| The presentation | 15 |  |  |  |  |  |  |  |
| Teamwork\* | 14 |  |  |  |  |  |  |  |
|
| **Total score** | **100** |  |  |  |  |  |  |  |
| **Leader decider** (see \* for priority scores) |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| **Team** | **School/Team name** | | | | | | | | |
| 1 |  | | | | | | | | |
| 2 |  | | | | | | | | |
| 3 |  | | | | | | | | |
| 4 |  | | | | | | | | |
| 5 |  | | | | | | | | |
| 6 |  | | | | | | | | |
| 7 |  | | | | | | | | |

# 9. Assessment information and criteria

|  |  |
| --- | --- |
| Criteria | Marks |
| 1. Planning | 13 marks |
| 1. Development of product | 20 marks |
| 1. Use of budget | 8 marks |
| 1. The product | 30 marks |
| 1. The presentation | 15 marks |
| 1. Teamwork | 14 marks |
| **Total** | **100 marks** |

1. **Planning (13 marks)**

Using the planning section of the Planning and Event Log, marks will be awarded as follows:

* Did they explain how their ideas might help Airbus in their mission to support people in need? ***(3 marks)***
* Does the planning diagram detail how the prototype will be constructed? (***5 marks)***
* Have the electronics for the prototype been detailed? ***(5 marks)***

1. **Development of product (20 marks)**

Using the Engineering Event Log and observations of the team, marks will be awarded as follows:

* Event log 1 - Have they provided an accurate and informative record of development beyond a simple description including any problems and solutions? ***(4 marks)***
* Event log 2 - Have they provided an accurate and informative record of development beyond a simple description including any problems and solutions? ***(4 marks)***
* Event log 3 - Have they provided an accurate and informative record of development beyond a simple description including any problems and solutions? ***(4 marks)***
* Are the priorities identified for the last 30 minutes realistic and appropriate?

***(4 marks)***

* Did the team work largely independently? ***(4 marks)***

1. **Use of budget (8 marks)**

Using the accountancy sheet and the prototype, marks will be awarded as follows:

* Was there an accurate record of spending? ***(3 marks)***
* Was the budget used effectively? ***(5 marks)***

**4. The product (30 marks)**

Using the presentation of your prototype and what we have seen during the development period, marks will be awarded for:

* Did their prototype provide a realistic solution to the brief from Airbus? ***(4 marks)***
* Was the choice of electronic components appropriate for their intended design?

***(4 marks)***

* Was the choice of materials appropriate for the structure and/or mechanics of their intended design? ***(4 marks)***
* Was the final prototype engineered well with all elements coming together in a well-structured and fit for intended purpose product? ***(6 marks)***
* Did the judge(s) see the electronics and structure work together effectively as intended? ***(6 marks)***
* Did the team push themselves beyond the minimum brief and incorporate at least 2 or more processes? ***(6 marks)***

**5. The presentation (15 marks)**

Using the presentation of your prototype, marks will be awarded as follows:

* Did the team explain how their prototype works, including details of how and why they used the electronics and the mechanics in their design? ***(6 marks)***
* Did the team identify the most challenging engineering aspect they faced during their development and how they overcame this challenge? ***(3 marks)***
* Did the team explain what they did well in their teamwork and what aspects they could have improved? ***(4 marks)***
* Did the team effectively demonstrate their prototype? ***(2 marks)***

1. **Teamwork (14 marks)**

Using the judges’ observations of your team throughout the day, marks will be awarded as follows:

* Did the team work well together with all members engaged in the project and any conflicts successfully resolved? ***(5 marks)***
* Did the team work tidily and safely within the health and safety rules? ***(3 marks)***
* Did the team persevere to resolve issues during the project and work largely independently? ***(6 marks)***

# 10. Risk Assessment

The following risk assessment is given as guidance. It is advised that the school refers to the CLEAPSS Model Risk Assessment Documents for D&T.

|  |  |  |  |
| --- | --- | --- | --- |
| **Risk Assessment and Operating Procedure - IET** | | | |
|  | | | |
| **Activity: Faraday Challenge Days Airbus** | | | |
| **Persons at risk** | Students taking part in the Faraday Challenge Day and adults in the location | | |
| **Maximum Group Size** | 36 students | Recommended Staffing/Student Ratio | 1:6 |
|  | | | |
| **Risk Assessment** | | | |
| **Hazards** | | **Control Measures** | |
| 1. **Use of electrical equipment – risk of electric shock** | | All electrical equipment is low voltage. | |
| 1. **Use of electrical equipment – short circuit causing heating** | | Warn students of the possibility of burns when connecting and disconnecting components. All pupils will receive a briefing about correct use of electrical components. | |
| 1. **Basic use of hand tools (craft knives, screwdrivers, scissors, hole punches, staplers) – risk of cutting or abrasion** | | Warn students of the risks and advise them of safe working practices. Identify member of staff to supervise area. Inform challenge leader if use of knives in school is restricted. | |
| 1. **Use of water with moisture sensors** | | Ensure students test their moisture sensor using the sponge in a box provided rather than directly in any drink or cup of water to avoid spillage on electrical components. | |
| **Location issues** (to be completed by Host School) | |  | |
| Further Action Required: 1. Ensure all persons staffing the Faraday Challenge Days are aware of and competent to comply with this risk assessment and the control measures. | | | |

# Risk Assessment (page 2)

|  |  |
| --- | --- |
| **Working Practice** | |
| **Group structure** | One Faraday Challenge Day Leader and one member of staff from the host school to be present during the whole day to oversee use of equipment and to keep order. Teachers bringing groups from other schools must remain in the room and be responsible for their own students. |
| **Restrictions** | Unknown premises. |
| **Emergency**  **Procedure** | Follow the lead from the Host School.  Faraday Challenge Day Leader to be fully briefed on risk assessment procedure prior to the day or on arrival. |
| **Safeguarding** | The Challenge Leader will carry their DBS and provide it where requested. They will comply with the safeguarding regulations within the school. A representative from the school **MUST** be present in the rooms at all times when students are present. |
| **Safety Equipment** | First aid kit and fire extinguisher (electrical fires) to be provided by Host School. |
| **Name and role of IET Faraday Challenge representative** | Keira Sewell  Challenge Day Leader. |
| **Name and role of school representative** |  |
| **Signature of the school representative** |  |
| **Date of this Review** | June 2018 |