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| **Cabin mood lighting** | | | |
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| Using colour-changing LEDs for mood lighting within an aircraft cabin | | | |
| **Subject(s):** Design and Technology, Engineering  **Approx time:** 45-60 minutes |  | | **Key words / Topics:**   * circuit assembly * components * future flight * light emitting diodes (LEDs) * power supplies * resistors * soldering * switches * wiring |
| **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: ⚠ | | | |
| **Suggested Learning Outcomes** |  | |  |
| * To be able to make a colour changing mood light to help people relax in an aircraft cabin * To be able to fit and solder components to a PCB * To be able to test the mood lighting circuit to check how well it works | | | |
| **Introduction** |  | |  |
| This is one of a series of resources designed to allow learners to use the theme of the future of flight to develop their knowledge and skills in Design & Technology and Engineering. This resource focusses on making and testing a mood lighting circuit for an aircraft cabin that cycles through a range of different colours.  Flying long distances can be stressful for some people. The light level and colours in an environment can have an effect on the feelings of the people present. Can you make a colour-changing mood light that would help them to relax whilst in the cabin? | | | |
| **Purpose of this activity**  In this activity learners will make use of the theme of the future of flight to make a mood lighting circuit that can help passengers to relax whilst inside an aircraft cabin. They will then test their circuit to see if it works.  This activity could be used as a main lesson activity to teach about soldering, assembling circuits and the function of components or to support learning about colour and how it changes our response to products. It could also be used as part of a wider scheme of learning to support focussed practical skills within Design and Technology and Engineering, or about engineering career opportunities within the aviation sector. | | | |
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| **Activity** |  | | **Teacher notes** |
| **Introduction, brief and safety (10 minutes)**  Teacher to explain the task to learners, introduce the brief using the presentation.  Teacher to hand out the tools, equipment and components required. Teacher to explain potential safety issues when using soldering equipment.  **Making the mood light circuit (30-45 minutes)**  Teacher to demonstrate steps shown below and on the presentation. Learners to then follow these steps to assemble their own mood lighting circuit.   * Step 1 – Mount the switch on the plastic side of the PCB. Push down as far as it will go. Solder the switch legs to the pads on the track side of the PCB. ⚠ * Step 2 - Mount the resistor on the plastic side of the PCB. Solder the resistor legs to the pads on the track side of the PCB. Use wire cutters to cut away any excess wire. ⚠ * Step 3 - Mount and solder the LED to the PCB. Make sure that the round and flat sides match the markings on the board! Snip the ends when soldered. ⚠ * Step 4 - Mount and solder the power wires to the PCB. The red wire goes to ‘+’ and the black wire goes to ‘-’. Place the wires through the strain holes before soldering. Snip the ends when soldered. ⚠   A finished example is shown on slide 9 of the teacher presentation.  **Testing the mood light circuit (5 minutes)**  Learners to attach the power supply and turn on the switch to test the circuit. The LED should cycle through different colours at intervals of a few seconds.  What went well when making the light? How could it be improved? Which colours would be the most relaxing and soothing for use in the cabin? |  | | **Resources**  Lead free solder should be used for safety. If permanent fume extraction is not present in the room then portable extraction units will be needed. Safety glasses should be worn during all soldering and wiring activities.  The circuit board used in this example is the Kitronik mood light PCB, available here: <https://kitronik.co.uk/products/2131-colour-changing-usb-lamp-kit>  Alternatively a custom made PCB could be produced, or stripboard could be used.  **Making**  The switch should be mounted as flat as possible on the plastic side of the PCB.  Demonstrate safe use of soldering equipment prior to learners attempting this step. A visualiser or small webcam linked to a projector screen would help with this. Safety glasses should be worn at all times. All soldering should be done on a mat or board to avoid damage to desks. A sponge should be used to regularly clean the soldering iron tip. The iron should be placed in its stand at all times when not in use.  The resistor should be mounted as flat as possible on the plastic side of the PCB. It is non-polarised so can be mounted either way around.  The LED is a polarised component so must be connected the right way round – as shown on the circuit board markings (flat side at the top).  The power supply wires must be connected as shown or the circuit will not work. Twisting the wires together will make the wiring neater and less likely to break. A 4.5 V power supply is needed – this could be provided via a USB cable or a battery pack (3 x AA batteries).  Remember to disconnect the power supply to save energy when not in use.  **Testing**  It is recommended that the teacher checks the circuit for any errors (such as components the wrong way around or short circuits) before testing, as connecting a USB power supply to a faulty circuit could create safety issues, cause damage to the system providing the USB power, or further damage the constructed mood light circuit itself. If the circuit does not work check for dry joints or short circuits in the soldering, or polarised components that are connected the wrong way round.  When the power supply is connected and the switch turned on, the LED should cycle between a range of different colours. |
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| **Differentiation** |  | |  |
| **Basic** |  | | **Extension** |
| * Pre-cut solder and power supply wires to size. * Pre-mount components to circuit board so that weaker learners can move straight onto soldering them in place. * Provide clips to hold the circuit boards during the soldering activity. |  | | * Use CAD software to design an improved circuit that allows the time that each colour is on for to be adjusted e.g. using a microcontroller. * Design an enclosure for the mood light circuit. |
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| **Resources** |  | | **Required files** icon-docicon-pdficon-ppt |
| * Soldering iron, stand and mat/base * Solder * Mood light circuit board * 4.5 V power supply e.g. a USB cable * Slide switch * 5 mm colour changing LED * Protective resistor for the LED |  | | Presentation – Cabin mood lighting |
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| **Additional websites** | | | |
| * **YouTube – Norwegian 787 Dreamliner mood lighting:** Video showing the mood lighting in the cabin of a Boeing 787 Dreamliner. <https://www.youtube.com/watch?v=LKp4jv-pwD8> * **Rapid Electronics – Mood light kit PCB:** Link to order the Kitronik mood light PCB kit. <https://kitronik.co.uk/products/2131-colour-changing-usb-lamp-kit> * **Simple Flying:** Article and video discussing the future of mood lighting in aircraft. <https://simpleflying.com/aircraft-ceilings-illumination/> | | | |
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| **Related activities (to build a full lesson)** |  | |  |
| **Starters** (Options)   * Research components to be used and discuss their function in the circuit. * Draw a schematic and wiring diagram for the circuit. * Discuss how the colour of a room or object changes our perception of it and feelings when experiencing it. | | **Plenary**   * Self and peer assess quality of fitting, soldering and wiring for each circuit board produced. | |
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| **The Engineering Context** film | | | |
| * The future of flight is a great context to explore the opportunities that working in the aeronautical engineering industry presents! For example, designing, making and maintaining aircraft and all their different parts. * Electrical and electronic engineers need to have basic skills in circuit construction, including soldering components to, wiring and testing electronic PCBs. | | | |

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| **Curriculum links** | |
| **England: National Curriculum**  Design & Technology   * KS3 2a, 2b, 4c   **GCSE D&T**  AQA D&T   * 3.1.2, 3.1.4, 3.2.5, 3.2.8, 3.3.6, 3.3.10, 3.3.11   Edexcel D&T   * 1.3.2, 1.3.3, 1.6.1, 1.6.2, 1.6.3, 5.1.1, 5.2.1, 5.2.2, 5.2.3, 5.5.1, 5.6.1, 5.7.1, 5.7.3, 5.8.1   Eduqas D&T   * Core: 3, 5 * Electronic systems: 1, 2, 6   OCR D&T   * 1.1a, 5.4a, 6.4a, 6.4b, 7.2a | **Northern Ireland Curriculum**  Technology & Design   * KS3 Manufacturing - selecting and using materials fit for purpose; safe use of a range of tools and processes appropriate to materials, demonstrating accuracy and quality of outcome * KS3 Control – incorporate control systems, such as mechanical,   electronic or computer-based, in products and understand how these can be employed to achieve desired  effects   * KS3 Objective 1 - Abide by health and safety rules when using tools, machines and equipment * KS3 Learning outcomes - demonstrate practical skills in the safe use of a range of tools, machines and equipment. |
| **England: GCSE Engineering**   * 3.2.5, 3.3.2, 3.3.3, 3.4.2, 3.6   **Scotland: Curriculum for Excellence**  Technologies   * TCH 3-09a TCH 3-12a * TCH 4-12a | **Wales: National Curriculum**  Design and Technology   * KS3 Skills: Making 1, 2, 3 * KS3 Systems: 16, 18 |

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| **Assessment opportunities** |
| * Informal teacher assessment of practical skills through observation of learners. * Formal teacher assessment of the completed mood light circuit. * Self/peer assessment of soldering and wiring skills used. |