Cargo Drop

AIRBUS MILITARY A400M

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What do you need to know?

**Organisers’ notes**

This activity will help pupils to understand the principles of forces and motion as well as give them an appreciation of how to combine materials to protect an object or strengthen a structure.

**Guidance**

- Read through the instructions and familiarise yourself with the procedure.
- Do a test run yourself, so you know how to help others make their own model.
- Use the discussion topics below to introduce, summarise and provide context to the activity.
- Make sure that students have had sufficient time to read and understand the directions.
- Assign individual roles to group members to ensure all students get equally involved in the task, roles could include: team leader, financial officer, design engineer, manufacturing engineer.
- You may want to have a measureable outcome, e.g. start with 10 points, after testing points are deducted for going over budget, losing cargo or damaging cargo or packaging. This will give a clear winning design at the end of the activity.
- Teams could be awarded bonus points if their design uses recyclable materials, if made available.

**Discussion topics**

- What are the benefits of delivering humanitarian aid by air?
- How do you think engineers help in a disaster zone?
- Why is it important to protect the food aid packages?
- How many different ways could you protect the food packages from impact?
- How could you reinforce the materials to make them stronger?

**Curriculum links**

| KS4 | (Forces and motion) |
| KS3 SC 1.1 | (Scientific thinking) |
| KS3 SC 1.2 | (Application and implication of science) |
| KS3 SC 2.1 | (Practical enquiry) |
| KS3 SC 2.2 a, b | (Critical understanding of evidence) |
| KS3 Ma 2.3 a-e | (Interpret and evaluate) |
| KS3 D&T 1.1b | (Apply knowledge to design products) |

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**Find out more about careers in engineering**

Tomorrow’s Engineers provides engineering careers materials for young people aged 11-14, and other resources for teachers. For more information visit the [Tomorrow’s Engineers](http://www.tomorrowsengineers.org.uk) website.

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What do you need to know?

Get involved

More engineering challenges…
Disaster response: how do engineers save lives in the aftermath of a natural disaster? The Royal Academy of Engineering has produced a great resource for schools and presents a set of STEM challenges in the context of the aftermath of a natural disaster.

Further reading and resources…
To find out about the future of air travel and Airbus vision look at their fantastic video and other resources online at the Future by Airbus.

If you want to find out more about careers in aerospace you can find out more at Careers in aerospace, a website for young people interested in aviation, space and defence.

Tomorrow’s Engineers
Take the Whose Crew Are You? Quiz to find out which crew you are in! An aeronautical engineer is part of the Tomorrow’s Engineers travel crew.

There are many different types of engineers that play crucial roles in disaster zones. For example, materials engineers – part of our ideas crew – might help develop robust yet lightweight packaging for emergency food drops, and structural engineers – part of our construction crew – might be tasked with testing the safety of any remaining buildings and structures, as well as making recommendations for sturdier structures to be built.

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Are you ready for an engineering challenge?

Cargo Drop

One of the roles of the Airbus A400M military transporter is to drop cargo from an altitude to a target on the ground. The types of cargo include military goods such as equipment and supplies; and humanitarian aid including food and medical supplies.

With the cargo being dropped from a height, it must be protected to ensure the cargo lands undamaged, often achieved by using a parachute or physical protection.

Your task is to design and make a model of a solution to protect the cargo during the drop – as a member of the design team for a humanitarian aid organisation. You are tasked with getting aid to a remote village cut off by road.

Get involved…

Emergency aid or humanitarian aid is rapid assistance given to people in immediate distress by individuals, organisations, or governments to relieve suffering, during and after man-made emergencies (such as wars), and natural disasters at home or internationally.

Engineers are involved in aid operations in various ways. Airbus engineers design and manufacture the aircraft to transport the aid.

The A400M is the most versatile airlifter currently available, responding to the most varied needs of world air forces and other organisations. It can perform three very different types of duties: it is able to perform tactical missions, directly at the point of need as well as long range strategic/logistic missions. It can also serve as an air-to-air refueling “tanker”. It is the ideal airlifter to fulfill the most varied requirements of any nation around the globe in terms of military and humanitarian missions. Hundreds of engineers were involved in the design and manufacture of this aircraft.

Organisations like Engineers against poverty work with small-to-large engineering companies to help improve town and city infrastructure, which helps reduce poverty directly by improving the access of poor people to services such as clean water and sanitation, health and education and by protecting them against humanitarian disasters.

Engineers also help to rebuild towns and cities that have been affected by man-made emergencies or natural disasters. The future of travel, a need to increase food production as the world’s population increases and an ageing infrastructure are all global issues. Engineers can help to solve them.

Find out how you can become an engineer

If you have enjoyed this activity and would like to find out more about careers in engineering, Tomorrow’s Engineers can help.

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Get engineering...

**Activity materials list**

- A3 paper for sketching and planning your design
- A4 card
- String/cotton
- Sticky tape
- Elastic bands
- Sponge
- Cotton wool
- Silk or polyester fabric
- Balloons
- Scissors
- Large pieces of tissue paper
- Rice, pasta shapes and lentils
- Measuring tape or 2-metre ruler
- Weighing scales

**Instructions**

**Design and build a solution to protect the cargo using the materials provided.**

In this case the cargo is a fragile package of food aid, which will be dropped from a height of 2 meters. First make your food package; measure out 25 grams of each food stuff and wrap them individually in one layer of tissue paper (secure with one piece of sticky tape) so you can test your solution.

**Now you need to think about your design, you should consider the following:**

- The cargo and its packaging must remain undamaged after landing.
- The cargo will be placed in your solution immediately before the test and therefore cannot be taped in.
- The design must be cost effective and re-usable.
- You have a target budget of £25.

**Plan your design by using the least amount of materials possible.**

Sketch out some possible solutions before purchasing your materials. All the resources have a cost or purchase price, as agreed with your activity organiser or by using the table overleaf. You must purchase your materials before you can build your design. The challenge is to think of the best solution whilst ensuring it is cost-effective.

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Cargo Drop

Get engineering...
Instructions continued...

<table>
<thead>
<tr>
<th>Resources Required</th>
<th>Cost per Item</th>
<th>Number of each item required</th>
<th>Total Costs (£ *)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4 Paper</td>
<td>£8.00 (first 4 sheets are free)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>String</td>
<td>£3 per 15cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sticky tape</td>
<td>£3 per 15cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elastic band</td>
<td>£3 each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sponge</td>
<td>£5 per strip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silk or polyester fabric</td>
<td>£5 per piece</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balloon</td>
<td>£5 each</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total cost:

Manufacture your design
Spend the remainder of the time allowed manufacturing your design. You can use your food parcels to test your design.

Testing your design
Your prototype design will be tested at the end of the session, by your organiser. The cargo will be placed in your model immediately before the test, and the design dropped from a height of 2 metres.

Your design will be assessed on the following:
• Cargo package durability during drop
• Cost of materials used
• Originality and aesthetics (how it looks) of final design solution.

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