STEM 4: AIRDROPS
INSTRUCTIONS

DROP ZONES

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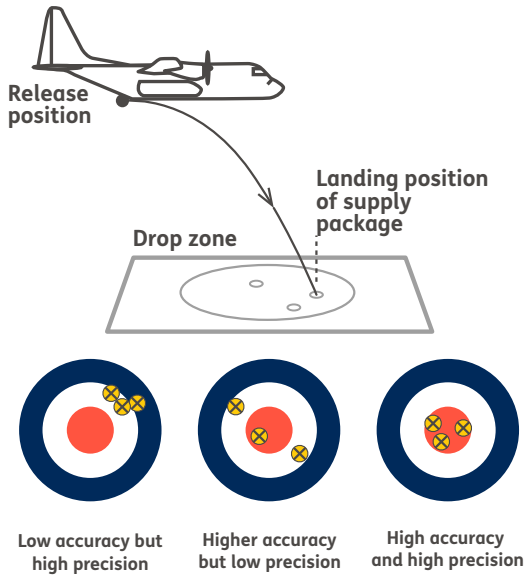
The success of a relief operation depends on the precision and accuracy of delivery. In this activity you will make a model of an airdrop and investigate how the landing positions of supplies dropped from a moving aircraft are grouped.

WHAT YOU'LL NEED

- Long piece of string (this has been set up by your teacher)
- 1 sheet of A4 paper
- 1 sheet of A5 paper
- 1 large sheet of paper
- 7 paperclips
- 90 cm string
- Masking tape or clear sticky tape
- A metre rule or tape measure
- Coloured pens/pencils
- Target Overlay



PRECISION

If several supply packages are dropped, the closeness of the resulting landing positions on the ground is a measure of the precision of the operation, regardless of the position of the cluster on the landing site.

ACCURACY

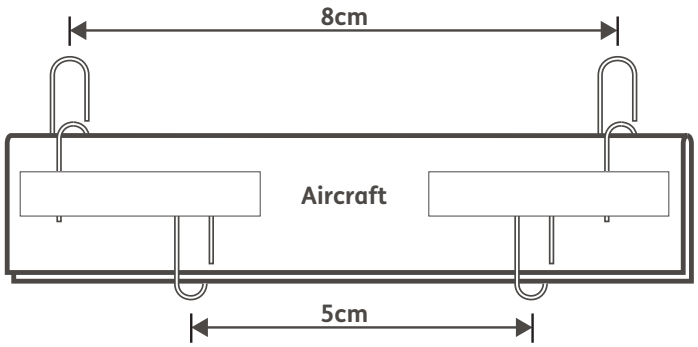
If the landing site has a target at its centre, the accuracy of the operation is shown by the closeness of each landing position to this target.

WHAT YOU NEED TO DO

1. Make an **aircraft** by folding a sheet of A4 paper down to roughly 10cmx2cm. Do not cut the paper.

   Hold the folded paper in place using two paperclips, about 8 cm apart, that stick out from the top of the aircraft. Bend these to make hooks so that your aircraft can be hung from the long string.

   Add another two paperclips, about 5 cm apart that stick out below the aircraft. Use tape to secure the paperclips to the folded paper.



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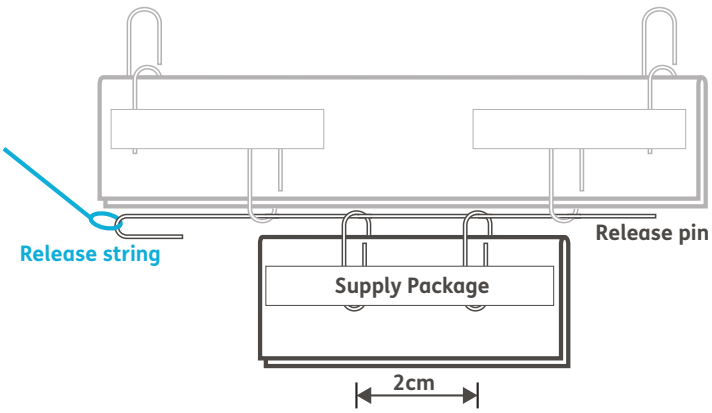
2. Make a **supply package** by folding a sheet of A5 paper down to roughly 5cmx2cm. Hold the folded paper in place by attaching two paperclips, 2cm apart, that stick out from the top of the package. Again secure them in place using tape.
3. Make a **release pin** by straightening another paperclip so that it has only one hook at one end. Tie one end of a 90cm string (the **release string**) to the hooked end of the release pin. Thread the pin through the paperclips below the aircraft and the paperclips on the supply package.



4. **Test your airdrop model** by using the long string as the guide for your aircraft.

(a) Hang the aircraft at the highest point of the long string and check that when you let it go it slides freely down the string.

(b) Return the aircraft to the highest point and use the release pin to hang the supply package from the underside of the aircraft.

(c) Attach the free end of the release string to the same high point as the long string. When the aircraft slides down the string the pin should come out and the supply package should be released while the aircraft is still moving.

(d) Lay a large sheet of paper on the floor to make a drop zone and practise your airdrops. Adjust the position of the drop zone so that the supply package hits the paper each time.

5. Now you are ready to **collect your data**.

(a) Keeping the length of the release string fixed, do ten drops one after the other. Mark the place where the supply package hit the drop zone with a cross each time. Think of a way to identify the landing position consistently – you might decide to mark the leading edge of the supply package each time.

(b) Make the release string 5cm shorter so that it releases the package earlier, and do another ten drops. This time mark the landing places with crosses using a different coloured pen.

(c) Repeat for a release string which is 10 cm shorter than the original – releasing even earlier- and mark landing positions with a third colour. If necessary, add paper to increase the size of the drop zone.

6. **Analyse your results**

(a) To get a measure of the precision of the drops, and therefore the minimum size of drop zone needed for your airdrop, centre the Target Overlay over one colour of crosses. Each cross gets a score depending its distance from the centre of the target. Add all ten scores to get your total score. It's fine to reposition the target to get the maximum possible score from your grouping.

(b) Repeat your analysis for the other two colours. Which length of release string provides the most precision (the largest score)?

(c) What do you think causes the variation of landing position in the direction of the flight path (the longitudinal variation)? What causes the variation left or right of the flightpath (the lateral variation)?

(d) In a real airdrop, what factors do you think the pilot will have to consider, or try to control, in order to increase the precision and accuracy of delivery?