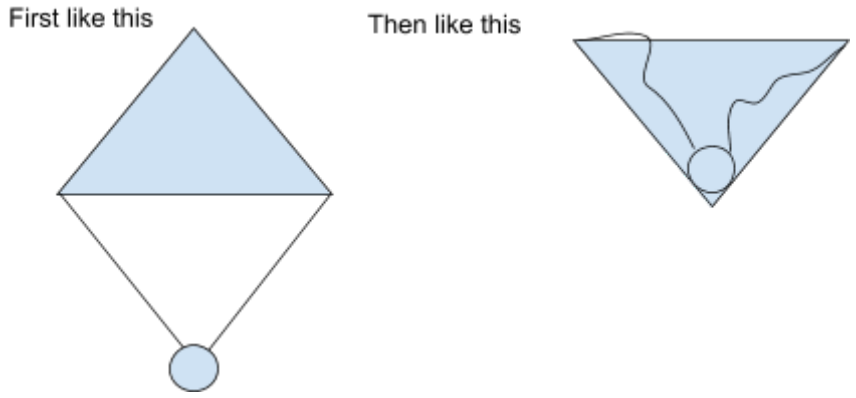
Jeremy Thomas, Abingdon Science Partnership Coordinator
Holly Irving, Science Coordinator, Caldecott Primary School
March 2020

Happy Landings Investigation Lesson Plan

Resources Needed:



Digital timer such as stop clock; digital watch; phone or iPad clock
Tape/metre rulers
Scissors
Plasticine (and weighing scales if available)
Cotton thread
Sticky tape (and glue if available)

Printing/copying:

Class set of the pupil worksheet for older pupils
2xPaper cone templates per pair/group

Starter:

Use photographs from the Presentation document to discuss air resistance (or drag) and streamlining
Suggest/discuss occupations and situations where air resistance is useful or a nuisance using examples from the Support Information below.

Method:

- Hand out the pupil worksheets
- Hand out cone templates when pupils have designed their preferred method
- Pupils follow instructions on the worksheet, including analysis and conclusions

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Outcomes:

All pupils should be able to:

- Discuss results using verbal discussion, measurements and charts - what made the cone fall faster or slower?
- Use the phrase 'air resistance' accurately in the correct context as a force resulting from an object *moving* through the air and pushing air particles out of it way
- Elicit factors affecting the amount of air resistance, such as shape; area; speed (and how dense the air or other gas is)

Challenge and next steps:

- Write a report or design a wall poster to display your findings
- Study the photographs on the Support Information sheet - create and test if possible an alternative design or do an extension investigation e.g. how to keep an object, such as a seed or parachute, in the air as long as possible; how to make a planetary probe land as gently as possible
- Test a range of different cone/parachute diameters and look for continuous relationships between variables

Support Information for Teachers

Who needs to know about air resistance? (Sometimes called drag)

- **Architects – to design buildings to allow air to flow around them**
- **Engineers – to use aerodynamic shapes in buildings, bridges, vehicles, wind turbines, wings etc.**
- **Materials/textiles scientists - parachutes need to be strong, flexible but also porous or they would tear at high speeds**
- **Sports people - cyclists, F1 teams, skiers, speed skaters…**
- **Animals - peregrine falcons diving; dolphins (although this is water resistance)**
- **Think of all the places it would HELP to have low air resistance:**
    - **Rockets; vehicles; racing bikes; aircraft; cycle helmets; darts; javelins...**
- **Think of all the places where it would HELP to have high air resistance:**
    - **Parachutes; wind breaks sails; windmill; kite...**

Home Project:

Find all the different sorts of balls you have at home. Ask someone in your family to help you. Time how long each ball takes to hit the floor when it is dropped from the same height. Write a report, maybe with some photos, about your results. Try to explain how the size and shape of the ball affects the time and if this would help you work out which one should travel fastest through the air.
MAKE SURE YOU DO THIS INVESTIGATION IN A SAFE PLACE AND THAT AN ADULT IS SUPERVISING YOU. ONLY CLIMB ON THINGS TO DROP THE BALLS IS THEY SAY IT IS SAFE TO DO SO.