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## **BLOODHOUND ALUMINIUM DESERT WHEELS DESIGN & TECHNOLOGY CHALLENGE**

### **– Activity Hints & Tips for Teachers –**

There are seven activities in this challenge. We suggest two options for running these:

- Run through each activity sequentially with the whole class, to simplify comprehension of the task.
- Split your workroom into seven different stations the groups can move between: this can help share out resources such as computers AND allow you to have only a small group working with the aluminium at any time, to allow for closer supervision.

### **Timings**

Tasks such as introducing the task and building the cardboard BLOODHOUND Test Car should take about 20 minutes. Creating the model Hakskeen Pan (desert) could take a short amount of time spread over several days in order to make a sand/soil/water mixture, then let it evaporate to create a desert surface.

The whole task, including creating the poster and editing the video, should take five hours maximum. The groups should decide on their own timings, but regular updates to keep it simple, and to be aware of the time remaining, would help.

We suggest you present the Introduction PowerPoint presentation to everyone first; then the other activities can be done in any order. Creating the poster and video diary can run alongside other activities, with groups revisiting to record what new discoveries they have made after each activity.

### **Activities**

#### **1. Introduction to BLOODHOUND SSC**

##### **Kit:**

Audiovisual set up

BLOODHOUND Desert Wheels Challenge Introduction PowerPoint presentation.

##### **Activity:**

Pupils watch the clip 'Introduction to BLOODHOUND on the PowerPoint introduction, then answer the questions on the next slide to show they understand who their 'user' is.



## 2. Background Research

What are aluminium wheels used for? How are they made? Why is aluminium the best material for the fastest wheel in history?

### Kit:

Library  
Internet  
Experts to interview

### Activity:

Pupils research the material properties of aluminium, how BLOODHOUND SSC's wheels were made, and how articulated wheels are currently being used.

They may start from the sources suggested in the Teachers' pack – videos of the fastest wheels in history ([https://youtu.be/K\\_ImAm1WhcY](https://youtu.be/K_ImAm1WhcY)) and looking at the articulated, all-terrain wheels of the Mars Rover, particularly 'Bruno'.

They should then be encouraged to do their own research, using the library and internet, interviewing any engineers or scientists and asking for advice. We would like to see any sources cited: Harvard referencing is not necessary (!) but a mention of where they found their inspiration is important.

## 3. Build Your BLOODHOUND Test Car

### Kit:

BLOODHOUND Test Car printed on to card for each team  
Garden sticks (1 per team)  
Paper straws or used, washed, plastic straws (1 per team)  
Glue stick  
Scissors  
Paper clips to hold car while drying  
Junior hacksaws can be used to cut the garden sticks to foster another skill, or they may be cut and snapped if time or resources are short.

### Activity:

Pupils should:

- Cut out, hole punch, crease, fold and glue their cardboard test cars into shape
- Measure and cut the wooden garden sticks and straws to size.



## 4. Decide on a Method to Test Your Wheels

### Kit:

Stopwatch  
Calculator  
Ramps  
Tape measure  
Rulers  
Protractor  
Camera

### Activity:

Groups decide on the best way to test their wheels on their Hakskeen Pan model. Like a pilot study, they should try out different ramp heights and angles, different methods of measuring distance, time taken and observing their car (such as using slow motion video). They then show how they keep these variables the same for each test.

Their method should explain how they decided on these variables and why they were the best for their test. For example: "We used a ramp of height 30cm and an angle of 50 degrees – with less angle the wheels wouldn't roll at all, with a shorter slope the car crashed onto the desert surface and stopped."

## 5. Build Your Aluminium Wheels

### Kit:

Aluminium drinks cans  
Scissors  
Bradawl or loose drill bit  
Rough handling gloves

### Activity:

Here the pupils begin to build the wheels from aluminium. It's helpful to have a lot of cans to practice the iterative design process. Encourage pupils and staff to bring cans from home or you may find a local business who can supply these. It would be best to avoid cans that have held alcoholic or energy drinks.

Each child in the group builds a wheel. The group then judges which is the best by rolling them along the desk, or testing the strength, or whatever creative ideas they come up with. Have each child explain their product to the rest of the group and encourage a discussion to decide which is best.

They will then make a set of four identical wheels, with advice and instructions from the winning designer.



This set would then be attached to the test car, run down their track and the run analysed. They then return to the build table to make improvements on their design; then test and analyse again. The best engineers will be those that are tenacious and resilient, trying out lots of different prototypes thoughtfully, and can explain eloquently why they made those improvements.

All parts of the wheel need to be made from aluminium, so they need to think about creating a hub to hold their wheel securely on the wooden axle.

### Safety Notes:

- **Wear cut-resistant gloves.**
- Crease the side of the can and nip into this edge, rather than stabbing, to create the first hole.
- Snip off sharp or rough edges.
- To create a hole, use a bradawl, screwing into the aluminium by hand against a wooden block. A similar effect can be attained by using a metalwork drill bit, screwing it by hand.
- Clear debris from the desk with a dustpan and brush, ensuring gloves are worn to tidy up.



See the notes in the teacher pack on hints and tips for working with aluminium.

## 6. Create a Model Hakskeen Pan

### **Kit:**

Sand, sandpaper, stones, soil  
Water  
Trays  
Outdoor space

### **Activity:**

Pupils research Hakskeen Pan – the area in the desert in South Africa where BLOODHOUND SSC will run. There are lots of helpful links and videos on our website; for example:

<http://www.bloodhoundssc.com/project/adventure/desert-race-track/hakskeen-pan>

They should discover it is a dry lakebed and a relatively hard surface, rather than the soft sand that may be imagined in a desert.

They need to recreate a surface as close to this as possible – that could involve exploring the school grounds to find a dry, hard soil surface, or simulating this in the classroom with sandpaper or other materials. A more effective way would be to trial different mixtures of sand, soil, small stones and water, then let the water evaporate. This leaves a cracked, surface just like Hakskeen Pan. We're looking for creativity and innovative ideas here.

They can then run their car down a ramp and onto this surface to measure how fast their wheels travel across an authentic surface.



## 7. Share Your Discovery – Poster and Video Diary

### Kit:

Camera  
Poster paper  
Pens, pencils  
Computer, printer

### Activity:

Each group should come up with an A1-sized poster (this could be four A3 sections) to describe the discoveries they came across in their design challenge. They should revisit the poster throughout the process, adding details after each activity.

They should include a mixture of hand- and computer-drawn diagrams, graphs and photos. When the school has decided on the best group to put forward for the competition, this poster then needs to be photographed in high resolution, in sections if necessary, and sent in to the BLOODHOUND team for judging. The video clip must be uploaded onto the BLOODHOUND website.

The video diary is a good way to collect more evidence of the young people's work, particularly of their independent thought processes and design decisions. Creating and editing the video down to 3 minutes provides more learning opportunities.

They could use the template on the next page to aid structuring their poster. Feel free to look at the mark scheme to advise them on what they could do to improve their work, such as by asking the questions. A simpler poster worked on with little support will score higher than a complex piece of work with lots of help.

### Tips for the Video Diary:

The video diary should be a maximum of 3 minutes long.

Pupils come up with questions relating to how they decided on the best wheels, They interview each other, filming the responses. Give some advice on open questions and using keywords to describe what they've found out. Their audience is a member of the BLOODHOUND Team – they need to brief them on what the wheels for a World Land Speed Record Car should look like and explain how they made their discoveries.

The children's faces are not necessary in the film. They could consider role play using costumes. Sock puppets work particularly well to avoid a lack of photo permission or nervousness, but avoid any emphasis skewing them towards making up characters and away from a scientific description.



## Ideas for Structuring a Poster

### **User**

Background information on BLOODHOUND SSC

### **Purpose**

Why are they building aluminium wheels?

### **Innovation**

Where did they get the ideas for their designs?

### **Functionality**

How they tested their wheels to ensure they were the fastest possible.

### **Design Decisions**

How their designs changed through the challenge and why they made those changes.

### **Authenticity**

How did they make their test track like the real Hakskeen Pan?  
How could their ideas be translated into an actual World Land Speed Record car?