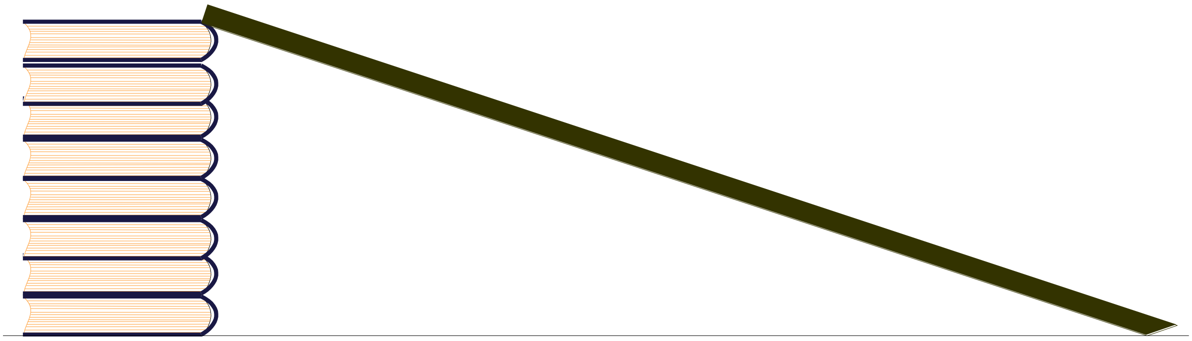
Discovery Sheet

Scientific Discovery

1. Organise yourselves into pairs or more.
2. Build a tower of books 300mm high
3. Place your 900mm board with one edge on the tower to form a ramp.



4. Place the Sears-Haak car on the top of the ramp and let it run as far as it goes until it stops.
5. Measure the 'run' from the bottom of the ramp to the front wheels and mark with masking tape or similar. Make several runs to find the average distance.
6. Take the 80mm Air Brake and slot it into the car making sure that it locates in the lower slot.
7. Repeat the 'run' and mark the finishing point in the same way as before.
8. Complete a series of 'runs' for all sizes of air brake.
9. You may make additional Air Brake cards as an extension activity.
10. Record your findings on the Record Sheet attached.
11. Look for a pattern that relates stopping distance to the size of air brake.
12. Extend the experiment to include time taken to stop.

- **Extend your experiment by making your own air brakes to your own dimensions. Relate this to performance.**
- **Use the grids on the Air Brakes to calculate area.**

Investigation

What I plan to do
What I will keep the same and what I will change
What I expect to happen

Diagram

Recording Sheet

Air Brake size	Distance 1	Distance 2	Distance 3	Average (1+2+3 ÷ 3)
None				
40mm				
60mm				
80mm				

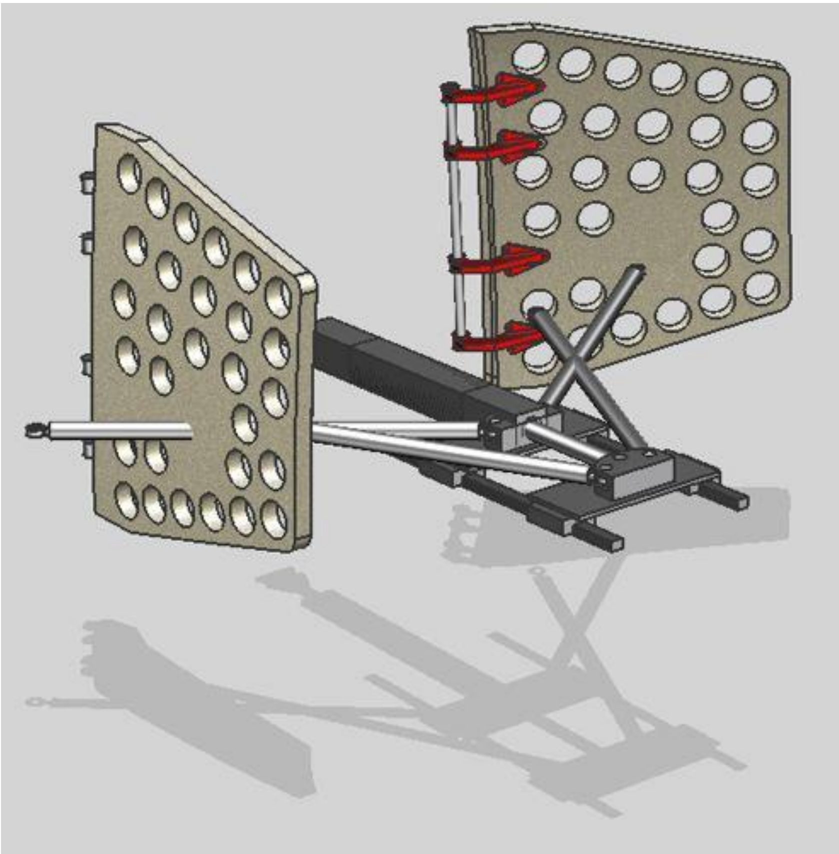
Extension Work & Science Discussion

BLOODHOUND SSC is designed to travel at over 1,000 mph. Its speed will be measured over a mile distance on two consecutive runs in opposite directions. As soon as the car passes through the mile the driver, Andy Green will shut down the rocket and cut the jet engine to idle. BLOODHOUND SSC will slow dramatically for a couple of seconds as the supersonic drag strongly opposes the cars forward motion.

Drag, or air resistance works in the opposite direction to BLOODHOUND SSC's direction of travel.

- BLOODHOUND SSC's aerodynamic shape has been designed to reduce its drag to a minimum.
- This is needed for the car to exceed 1,000 mph.
- When we need to slow and stop the car, the design is the opposite of what is required.
- Cutting the engines will stop acceleration and the car will lose perhaps 100 mph. It is now travelling at about 900 mph and we have 48 seconds to stop it.
- Disc brakes on a normal (road) car act by clamping pads onto the wheel discs and causing friction.
- The mass and energy of the car is converted by this friction and tyres into heat.
- The car then stops when all the heat is dissipated.
- This works at speeds of up to around 200 mph which in BLOODHOUND SSC terms is *slow speed*.
- If we used disc brakes at 1,000 mph the heat generated would be too much and **parts of the car would melt**.
- We need to look at other options to slow the car rapidly without causing damage to the car or its engines.
- The advanced streamlined properties of the car therefore need to be altered to increase the drag.

- The BLOODHOUND SSC engineers have come up with the idea of *deploying* **air brakes.**
- As the driver, *Andy Green* cuts the engines he will deploy the air brakes which are two doors at the back that open like 'elephants ears.'
- Opening these doors at such great speed requires hydraulic rams operating at a pressure equal to something like 200 times the air pressure around you as you read this.

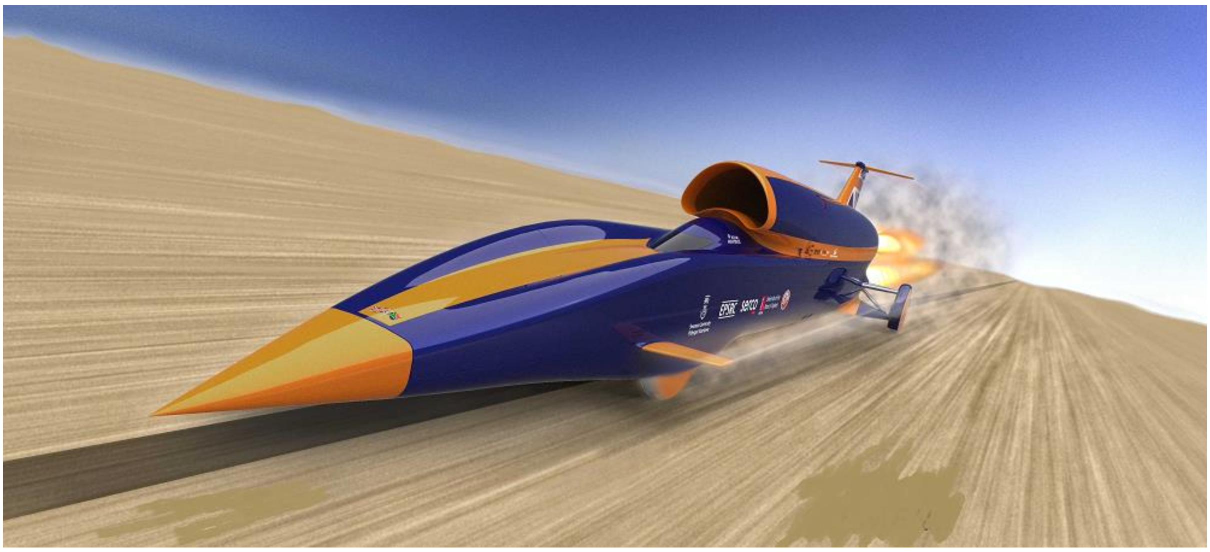


- As these doors open they increase the cross section of the car that meets the powerful air flow opposing the cars movement.

- The car will slow very quickly to 600 mph when parachutes will be deployed to increase the braking power using the rapidly slowing air flow, but that is a different story (see It's a Drag 4).
- You have produced a similar run to BLOODHOUND SSC with your Haak-Sears car.
- You started with a streamlined shape and produced an air brake that changed the shape making its shape rather **blunt** and less **aerodynamic.**
- You tried different sized air brakes, what was their effect?
- Which worked best?

Discuss how you might change your experiment to increase or reduce the drag on your car.

Research BLOODHOUND SSC. Why must we stop the car in such a short space of time and distance? Research these things and present your findings to the class.



Taking these ideas, discuss how you might change your cone to reduce the *drag*. Research BLOODHOUND SSC. Why is it designed with this shape? Research these things and present your findings to the class.

Your notes and ideas...