

Gliding – Designing a Wing Spar

Do you know about gliding?

Do you know what a glider can do? It's an awesome way to fly, and glider pilots fly hundreds of kilometres at speeds of over 100kph just using renewable energy from the sun and the wind. But how do we make a glider light but strong enough to withstand the loads on it when it takes off or lands or flies through strong air currents? Most glider wings use a **spar** – a strong central beam the length of the wing to take the loads, which has an aerodynamic form around it. Fibreglass and carbon fibre are often used to make wing spars, however today we'll use another material which is more easily available but has some similar properties – spaghetti! You will carry out a number of tests to see how strong different spars will be using different numbers of spaghetti strands, and you will explore how to make them stronger by **laminating** them. We're going to show you a video telling you what you need to know about gliding and about wing design and then it's over to you for....

Your challenge: to design a wing spar to support a particular load.

Materials needed:

- For the spars: spaghetti, rubber bands, white glue
- For the variable load: paper cup or plastic drinks bottle, string, paperclip and sand or water to load the test rig.
- Test rig: something to form the supports for your wing spar – such as cereal boxes or piles of books - and a set of scales.

Method:

- Make your variable load by cutting down a cup or drinks bottle, supporting it with string in 3 places around the perimeter to keep it stable and using the paperclip to make a hook to suspend the load.
- Build a test rig – two flat topped pillars - to support the spar. Make sure it's tall enough to let the spar flex without the weight touching the desk.
- Glue 5 strands of spaghetti, assemble with rubber bands on the ends and leave to dry while carrying out the rest of the experiment.
- Measure the breaking load of 1, 2 and 5 strands with the ends held with rubber bands and 5 glued strands of spaghetti and record your results in a table. Add the water or sand slowly and make sure you don't spill any!
- Plot a graph of your results and predict what the breaking load of 3 and 4 strands of spaghetti will be. How much stronger do you estimate they would be if you had laminated the spars? Calculate the average results from all the class and see if it changes your predictions.
- If time permits, carry out experiments to verify your predictions for 3 and 4 strand spars.



We hope you have fun designing and testing your wing spars!

See you on an airfield soon!

Find out more about GLIDING at the links below, all types of AVIATION at airleague.co.uk & CAREERS at stem.caa.co.uk/careers-in-aviation-and-aerospace