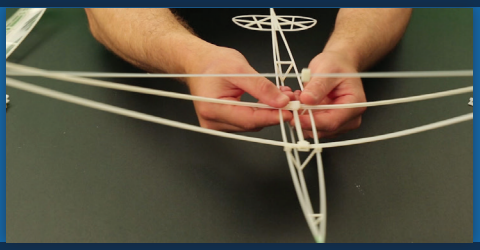
LESSON GUIDE



Designing a Glider

Guiding Design Questions

1. What is the most effective existing design in terms of:
   - Wing aspect ratio?
   - Wing profile?
   - Wing placement (high/low, canard, flying wing)?

   Can you create a more effective design, given the challenge constraints?

2. What are the essential components of a glider in terms of flight? Structural strength?

3. What is the correct balance between strength (for launching, flight and landing/crashing) and weight (for longer flight times)?

4. How can 3D printing technology allow you to create a more effective design (complex shapes and profiles, weight savings by "trimming" non-load bearing areas, rapid prototyping)?

5. What is the best way to divide the glider into parts? In terms of printing time? Maximum content on tray? Strength?

Lesson Guidelines

1. The glider may be composed of several parts, but they must fit within one printer tray.
2. The entire glider must be made of 3D printed material, except for the wing covering and a minimal amount of adhesive.

Tips for Glider Building

1. Different wing profiles are available, as well as a sample asymmetric profile in DXF format. However, for a glider of this size, a flat profile will probably be good enough.

2. Wings can be covered by many foils and films such as cellophane, rice paper, adhesive tape. The lightest option is perhaps food wrap foil adhered with a little instant glue.

3. The glider will usually need a balancing weight to bring the center of gravity to the correct place for level flight. A lump of plasticine can be used for the weight, or 3D printed weights can be used.

Design Tips for 3D Printed Parts Using PolyJet Technology™

1. The minimal wall thickness that can be reliably printed is 0.6mm. For load bearing parts the thickness should be over 2mm.

2. You can print connectors that hold parts together. They can be based on friction, snaps or a little drop of adhesive. As a design rule of thumb, leave a clearance of ~0.1mm between parts.

3. Use fillets. Sharp corners can cause premature failure. Printing a smooth, complex design is just as easy as printing a box.

4. Know the material limitations. Look at the material data sheet. Consider printing a simple model to get the feel in your hand and design accordingly.

5. The most suitable PolyJet material for this challenge is Vero as the models usually include very thin sections, unsuitable for printing with Digital ABS.

6. The built-in function in the CAD software should be used to estimate the glider weight. This can allow you to compare designs before printing. You may need to print a test part to calibrate the density value in the software to get realistic weight estimations.

Optional:

7. Look at the part arrangement on the printer tray and make sure the load bearing faces that will be under tension are printed in Gloss as this will ensure they are as strong as possible. Components that are parallel or nearly parallel to the tray will also be stronger than parts that are vertical.

8. Use mechanical analysis/simulation software to help you reach an optimal design.

9. Print prototypes of your design, test them and improve it accordingly.

10. You can make your design modular. For example, the fuselage will be constant but you can use it to test various wing designs.

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