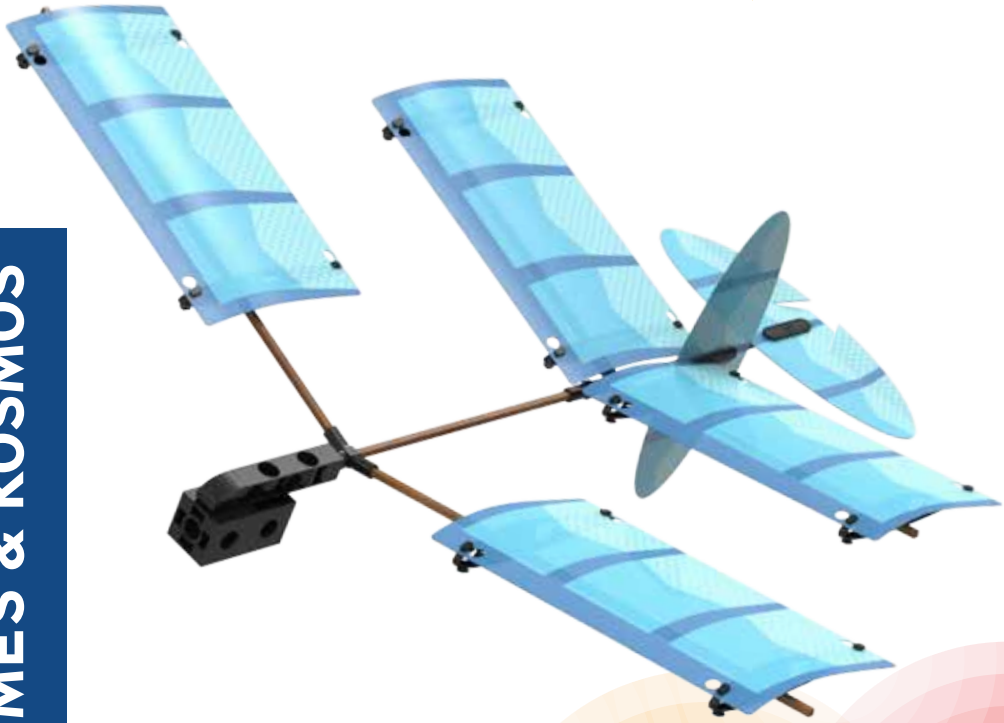
GEEK & CO. SCIENCE!

PROJECT KIT

Ages 8+

ULTRaLiGHT AIRPLANES



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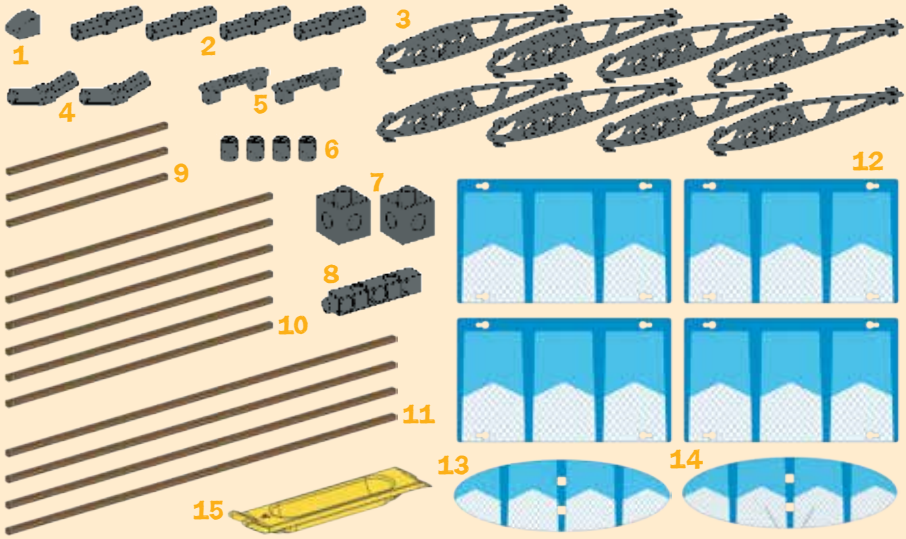
KIT CONTENTS



1	Nose piece (1)
2	Straight connectors (4)
3	Airfoil ribs (8)
4	150-degree connectors (2)
5	Stabilizer connectors (2)
6	Dowel holder pegs (4)
7	Cube pieces (2)
8	5-hole dual rod (1)
9	Bamboo dowel, 90 mm (3) 1
10	Bamboo dowel, 150 mm (6) 2
11	Bamboo dowel, 220 mm (4) 3
12	Wing surface plastic film (4)
13	Vertical stabilizer film (1)
14	Horizontal stabilizer film (1)
15	Part separator tool (1)

YOU WILL ALSO NEED: *A "test flying" area at least 10 meters (about 30 feet) long, preferably with a grassy or smooth surface for a safe landing*

Hey Glider Geeks!

Ready to learn how airplanes work by building awesome flying gliders? With this kit, you can build five different glider models and test them to learn how they fly. You can try all sorts of wing positions and angles. You can even design your own gliders! You'll learn how wings generate lift and how the shape and configuration of the wings affect the plane's flying performance. Spanner the Geeker will be your guide!

PART 2

TAKING IT TO THE SKIES

How to launch and test the gliders

After you have built a model, follow these instructions to fly it.

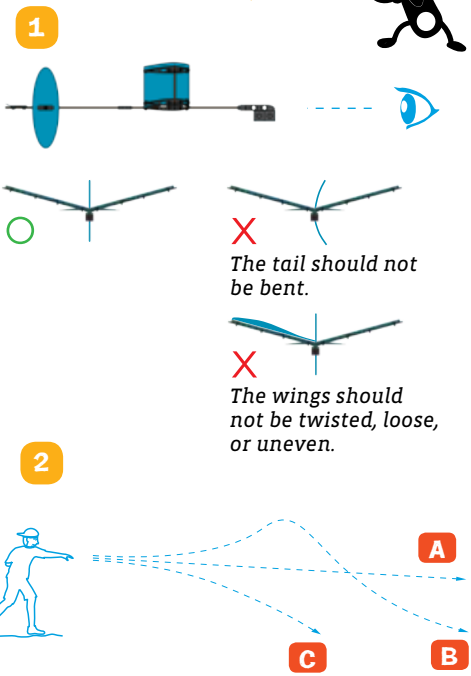
Here's how:

1. Inspect the model. Look at the model head on. Make sure all components are securely assembled, nothing is twisting, and the two sides are perfectly symmetrical.

2. Take the model to an open space with a 10-meter-long "test flying" area. Grass or smooth flooring is preferable to keep your model safest upon landing.

3. Hold the model by the middle fuselage dowel. Throw it forward with a smooth flick of the wrist. **A** If the model flies straight forward on the first try, you don't need to adjust it. **B** If the model flies up and then falls down, it is too light in the front: move the main wing toward the tail. **C** If the model flies downward too fast, it is too heavy in the front: move the wing toward the nose.

4. Make adjustments until you get it to fly nicely!

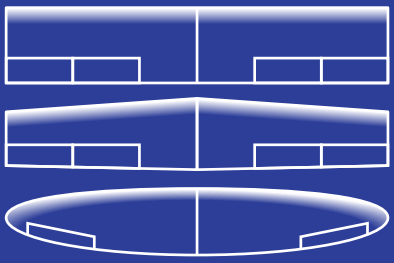


GEEK OUT!

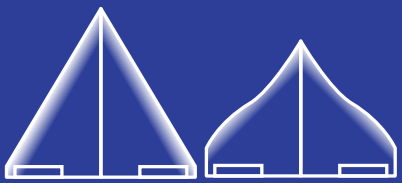
ALL ABOUT WING DESIGN

The effectiveness of a wing depends on many factors including its shape, area, the shape of its airfoil, its angle of attack, special features (like spoilers, flaps, slats, ailerons), the speed of the plane, the weight of the plane, and the density of the air (the altitude of the plane). Here are five wing designs.

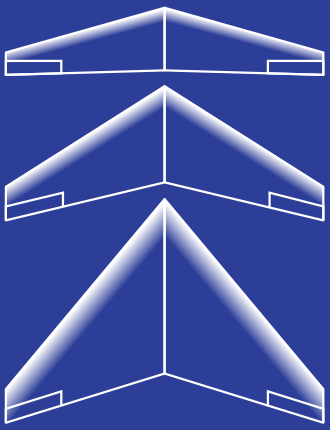
1. Straight wings are stable, good for low-speed and smooth flying, inexpensive, and lightweight. However, they create a lot of drag.



2. Delta wings come in two types: A simple delta wing is a triangle with straight edges. A complex delta wing is a triangle with curved edges. They are used in very high-speed jets, like the supersonic transport Concorde.

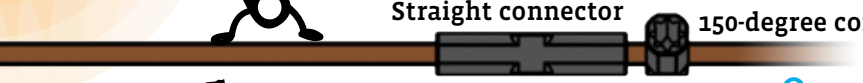


3. Sweepback wings are used for most high-speed aircraft. They create less drag but are less stable at low speeds. The wings on commercial jets have a lower sweep than those on high-speed fighters.



4. Forward-sweep wings are very experimental, very unstable, and not used in mass produced airplanes.

5. Swing-wings are wings that swing backward from a straight wing at low speed to a sweepback wing at high speed. They take advantage of the benefits of both types of wings.

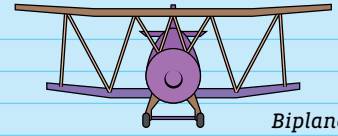


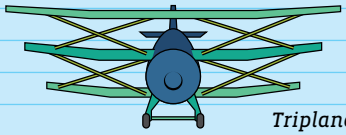
GEEK OUT!

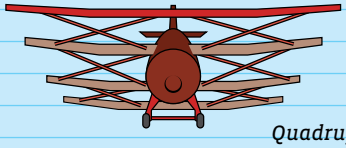
WINGS GALORE: MULTIPLANES

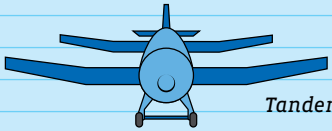
Airplanes have been designed with many numbers of wings. Each wing is actually called a **plane**. **Monoplanes** have one wing plane. **Biplanes** have two wing planes stacked vertically; **triplanes** have three; **quadruplanes** have four; and airplanes have even been designed with as many as 200 planes! **Tandem winged** planes have two wing planes, but they are positioned horizontally, not vertically.

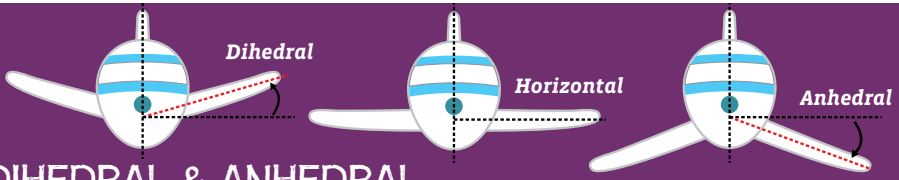
The benefit of adding more wing planes is that each plane adds to the total lift. However, each plane also adds to the weight and drag, and each plane interferes with the other planes. As planes got faster and faster, the monoplane design was favored.


Biplane


Triplane


Quadruplane


Tandem wing



DIHEDRAL & ANHEDRAL

The angle of the wing relative to the horizontal is called the **dihedral** (if it's above the horizontal) or the **anhedral** (if it's below the horizontal). By angling the wings in this way, the airplane's stability against rolling sideways improves tremendously.