



SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution)
COIMBATORE-35
DEPARTMENT OF AEROSPACE ENGINEERING
Unit -1 History of Flight



Biplanes

A **biplane** is a fixed-wing aircraft with two main wings stacked one above the other. The first powered, controlled aeroplane to fly, the Wright Flyer, used a biplane wing arrangement, as did many aircraft in the early years of aviation. While a biplane wing structure has a structural advantage over a monoplane, it produces more drag than a monoplane wing. Improved structural techniques, better materials and higher speeds made the biplane configuration obsolete for most purposes by the late 1930s.

Biplanes offer several advantages over conventional cantilever monoplane designs: they permit lighter wing structures, low wing loading and smaller span for a given wing area. However, interference between the airflow over each wing increases drag substantially, and biplanes generally need extensive bracing, which causes additional drag.

Biplanes are distinguished from tandem wing arrangements, where the wings are placed forward and aft, instead of above and below.

The term is also occasionally used in biology, to describe the wings of some flying animals.

Characteristics[edit]



1920s biplane hang glider

In a biplane aircraft, two wings are placed one above the other. Each provides part of the lift, although they are not able to produce twice as much lift as a single wing of similar size and shape because the upper and the lower are working on nearly the same portion of the atmosphere and thus interfere with each other's behaviour. In a biplane configuration with no stagger from the upper wing to the lower wing, the lift coefficient is reduced by 10 to 15 percent compared to that of a monoplane using the same airfoil and aspect ratio



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The Gloster Gladiator, A WWII Fighter bi-plane

The lower wing is usually attached to the fuselage, while the upper wing is raised above the fuselage with an arrangement of cabane struts, although other arrangements have been used. Either or both of the main wings can support ailerons, while flaps are more usually positioned on the lower wing. Bracing is nearly always added between the upper and lower wings, in the form of interplane struts positioned symmetrically on either side of the fuselage and bracing wires to keep the structure from flexing, where the wings are not themselves cantilever structures.

Advantages and disadvantages[edit]



Soviet Antonov An-2 biplane from the 1940s

The primary advantage of the biplane over a monoplane is its ability to combine greater stiffness with lower weight. Stiffness requires structural depth and where early monoplanes had to have this provided with external bracing, the biplane naturally has a deep structure and is therefore easier to make both light and strong. Rigging wires on non-cantilevered monoplanes are at a much sharper angle, thus providing less tension to ensure stiffness of the outer wing. On a biplane, since the angles are closer to the ideal of being in direct line with the forces being opposed, the overall structure can then be made stiffer. Because of the reduced stiffness, wire braced monoplanes often had multiple sets of flying and landing wires where a biplane could easily be built with one bay, with one set of landing and flying wires. The extra drag from the wires was not enough to offset the aerodynamic disadvantages from having two airfoils interfering with each other however. Strut braced monoplanes were tried but none of them were successful, not least due to the drag from the number of struts used