How do airplanes fly?

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Contents

List of Figures

Chapter 1

How do airplanes fly? Explanation with video.

Hello friend, welcome back.

In this page, Lets see how do airplanes fly.

As on today, airplane is the fastest vehicle (Fig 1) to transport humans and goods across the globe. Have you ever wondered how does it fly. Lets see.

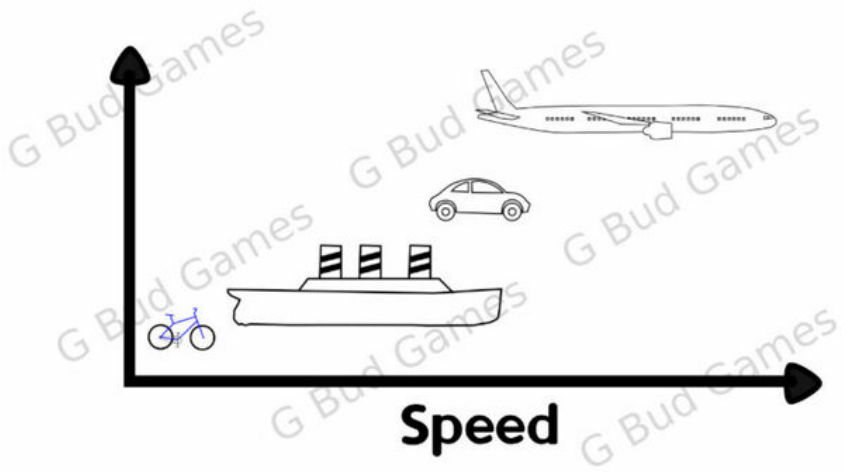

Figure 1.1: Fig. 1 Comparison of speeds between airplane, ship, car and bicycle

1.1 Parts of an airplane

The important parts of an airplane are shown in Fig. 2. They are

1. Body or fuselage

2. Wings
3. Horizontal Tail
4. Vertical tail
5. Engine
6. Landing gear

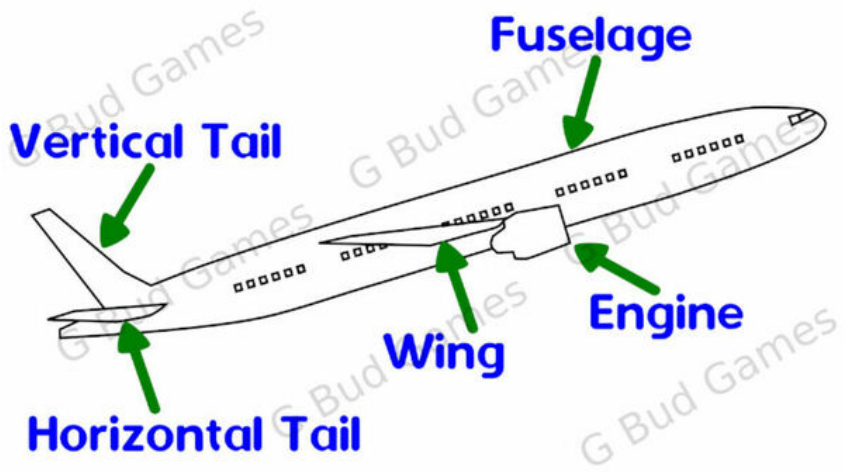

Figure 1.2: Fig. 2 Parts of an airplane

1.2 Lift force of an airplane

In our world, if any object is free, it will try to reach the ground by moving downwards (Fig. 3). This is because of the attractive force exerted by the ground which is called gravitational force. So when the airplane flies, there must be some force which acts against the gravitational force to make it float. That force is called lift force.

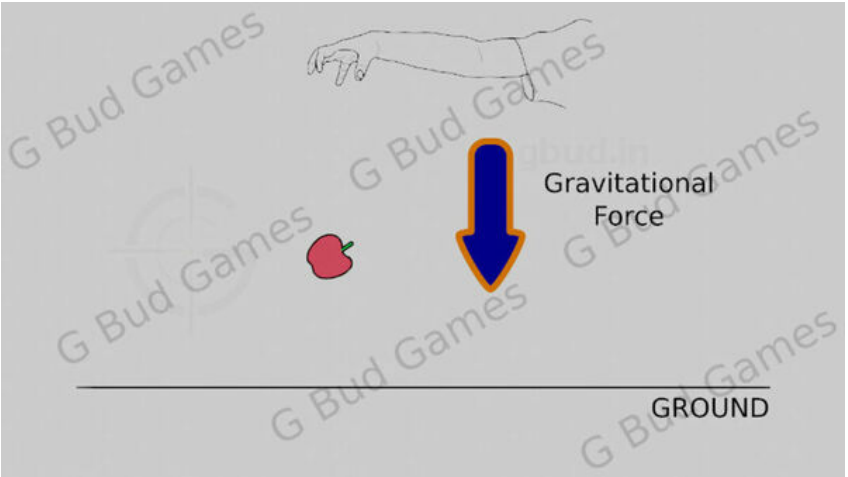

Figure 1.3: Fig. 3 Effect of gravitational force

1.3 How lift is generated in airplane.

In airplane, wings are the primary lifting surfaces. The difference in pressure between upper and lower surfaces of the wing creates the lift force. The pressure on the upper surface is lesser than the pressure on the lower surface. The net force will act in the vertical direction (Fig. 4). This force is called lift. When the lift force is greater than the weight of the airplane, the airplane will float in the air or go upwards. The pressure difference is created by the flow of air over upper and lower surface of wing.

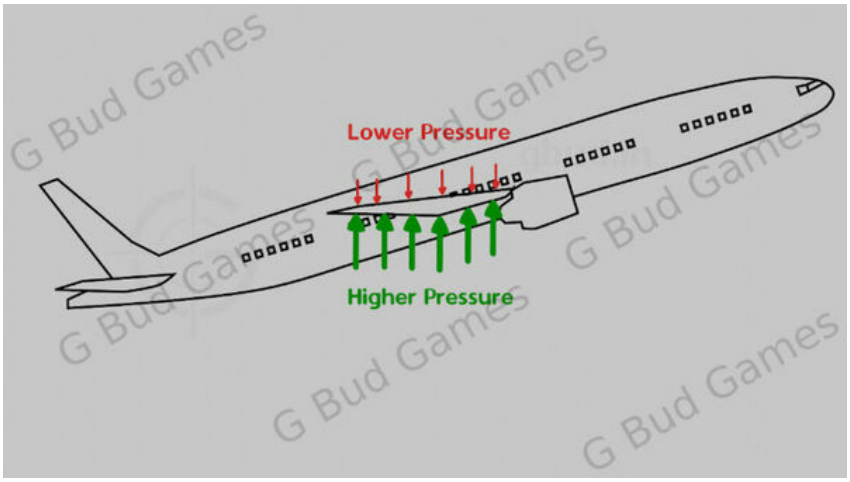

Figure 1.4: Fig. 4 How lift is generated in airplane

1.4 Thrust of an airplane

Now you know how the airplane is floating in the air. How does it move forward. Lets take an example of a bicycle. By pushing the pedal down you are giving a force which moves the bicycle forward. Similarly, the engines of the airplane provide a force to push the airplane forward. This force is called thrust of the airplane.

Figure 1.5: Play free kids games. No need to install any app and no login is required

1.5 Drag of an airplane

Take the example of bicycle again. When you are going in a bicycle, when there is no wind, you would feel easier to push the bicycle. When there is a strong wind, you would feel difficult to pedal. It is because a force is acting against your movement. This force is called drag. Similarly, any object moving in the air will experience drag. The drag will act in the direction opposite to the movement of the airplane.

1.6 Major forces acting on the airplane

Now you know four major forces acting on the airplane (Fig. 5)

They are

1. lift
2. Weight
3. Thrust
4. Drag

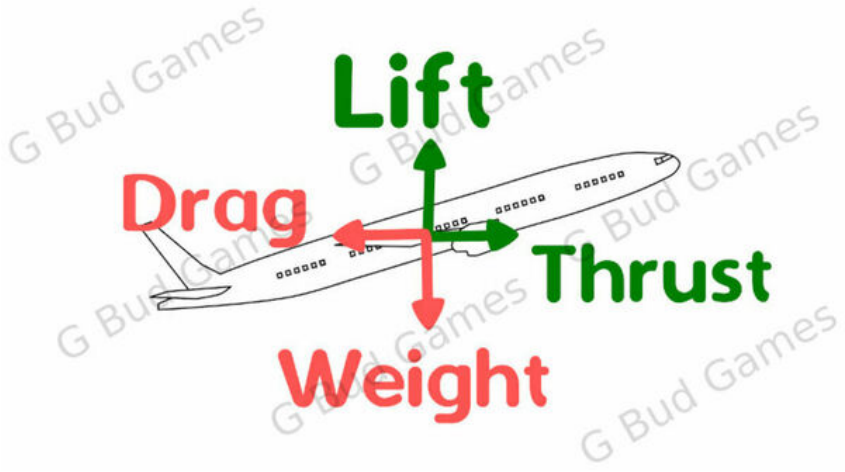

Figure 1.6: Fig. 5 Major forces acting on the airplane

When the lift is greater than the weight, the airplane will float. When the thrust is greater than the drag, it will move forward. Now you know how the airplane flies.

1.7 Control surfaces of an airplane

To turn the airplane different control surfaces (Fig. 6) are used.

They are

1. Elevator
2. Rudder
3. Ailerons

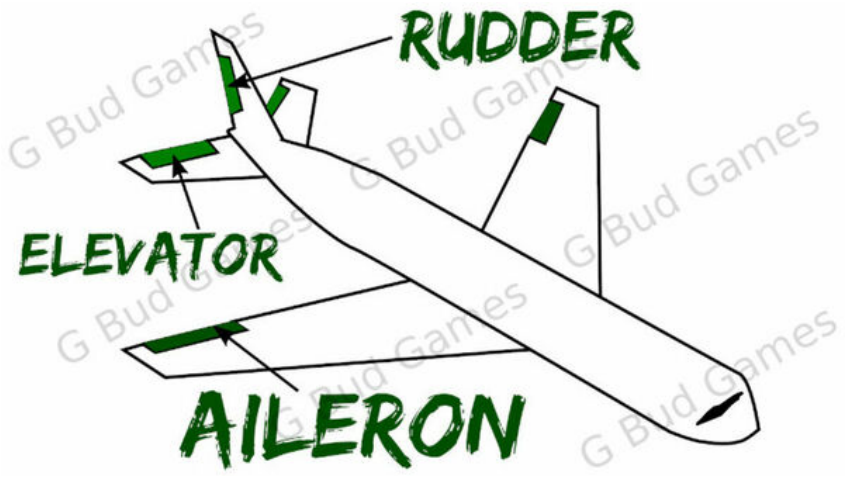

Figure 1.7: Fig. 6 Control surfaces of an airplane

1.8 Pitching and yawing of an airplane

To turn up and down, which is called pitching of an airplane, the tail is used. When the control surface at the horizontal tail which is called elevator is deflected upwards, the airplane will pitch up. When the elevator is deflected down, the airplane will pitch down. Similarly, to turn left or right which is called yawing of an airplane, the control surface on the vertical tail which is called rudder is used. When the rudder is turned toward the right or starboard side, the airplane will turn toward right. When the rudder is deflected toward left or port side of the airplane, the airplane will turn left.

1.9 How does the airplane roll

The wing has control surface named ailerons on both left and right wings. When the ailerons are deflected in different direction on both the wings, the airplane will roll based on the deflection. When the aileron is deflected the lift generated by the wing will vary. If the aileron is deflected down, the lift will increase. When it is deflected up, the lift will decrease. With the asymmetric deflection of ailerons in both wings, the lift generated by both the wings will be different. That difference in lift induces a moment about the centerline of the airplane. Moment is nothing but the force multiplied by the distance. The net imbalance in moment will roll the airplane (Fig. 7). To roll in the opposite direction, the direction of aileron deflection should be reversed.

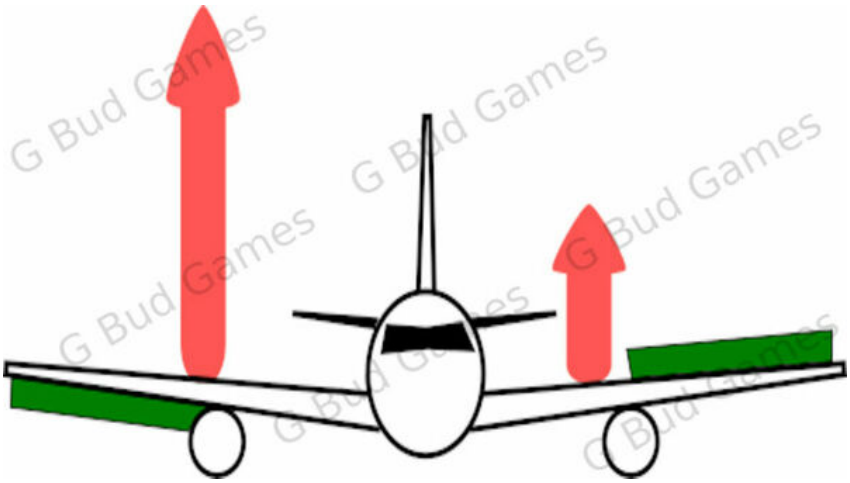

Figure 1.8: Fig. 7 Rolling of an airplane

1.10 How the airplane is controlled

All the control surfaces are controlled by the pilot at the cockpit. Generally there will be a yoke, alternatively known as a control wheel or a control column along with a pair of pedals (Fig. 8). When the yoke is moved forward or backward, the airplane will pitch up or pitch down. When it is turned, the airplane will roll. When the right pedal is pressed, the airplane will turn toward right. When the left pedal is pressed, the airplane will turn toward the left.

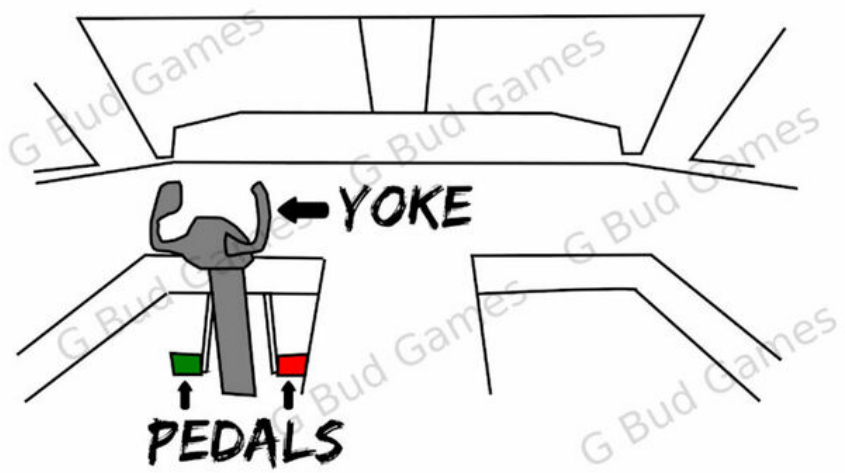

Figure 1.9: Fig. 8 Cockpit control of an airplane

1.11 Summary of How do airplanes fly

This is how the airplane flies. The lift is generated by the pressure difference and the thrust is generated by the engine. Both lift and thrust are used to overcome the weight and drag respectively. Different control surfaces such as aileron, rudder and elevator are used to control the airplane.

I hope this page is useful to you.

Thank you friend.

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