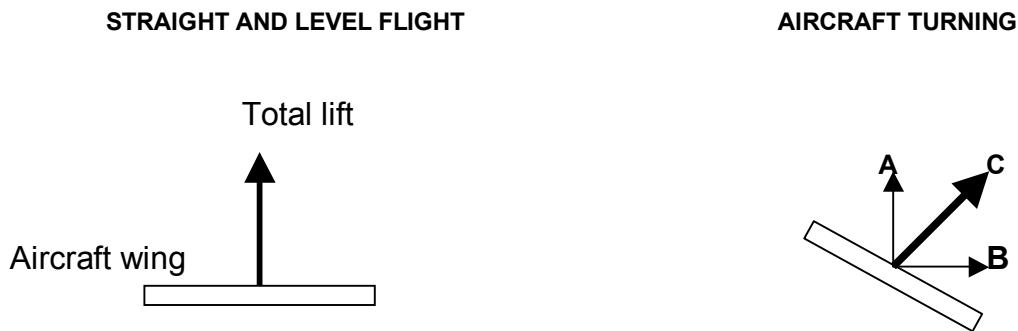


Steep Turns Explanation

The aircraft is in a turn to the right. As you know from the reading, there are six forces acting on the aircraft. We can put these six forces into two categories: the lift components and the load components. The lift components are the vertical component of lift, the horizontal component of lift, and the total lift. It is important to remember that all three are present at all times, even in level flight (some of them are just at zero). Remember that the horizontal component of lift is at zero when the aircraft is straight and level. This is key to my explanation.

Lift Components: The lift components will change when the aircraft is in a turn.



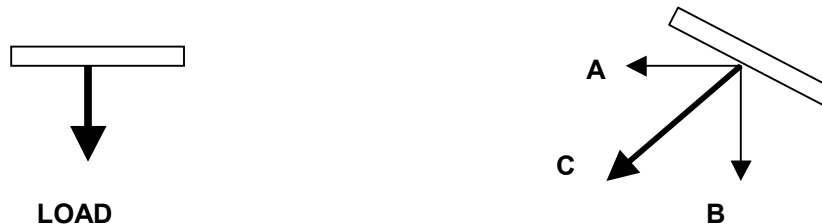
When the aircraft is straight and level, there is only one lift component: the total lift. When the aircraft is turning, the lift breaks into two components: the vertical component of lift and the horizontal component of lift (centrifugal force). The two combined make up the total lift, which will always be perpendicular to the wing. As the aircraft turns, the vertical component of lift must equal the total lift when the aircraft is straight and level in order to hold altitude.

A. Vertical Component of Lift: The vertical component of lift is always going to point straight up. This is the component that will keep the aircraft level in a turning aircraft. If this component is greater than the weight, then the aircraft will climb. If this component is less than the weight, then the aircraft will descend.

B. Horizontal Component of Lift: This is the component that makes the aircraft turn. The greater the horizontal component of lift, the greater the bank angle and the quicker the airplane will turn.

C. Total Lift: The total lift is the combination of the two. In order to keep an aircraft level at altitude, the total component of lift will increase beyond the total lift of the aircraft in straight and level flight. The vertical component of lift will equal the weight, and the horizontal component will make the airplane turn.

Weight Components: Now we get into a discussion where I change the traditional wording of the forces acting on the bottom side the aircraft. If you notice in the book, the word “weight” is used, and then “load” is used. When I talked about the four forces acting on an aircraft, they use weight. I would like to substitute load for weight because the weight of an aircraft does not change, but the load does. This is where we come up with load factor. In the diagram below, I have labeled the force perpendicular to the wing as the load. This force will always act opposite the total lift.



A. Centrifugal Force: The centrifugal force is the force that acts against the centripetal force when the aircraft is turning. This force will push you toward the outside of the turn. The steeper the bank angle, the more this force will increase.

B. Weight: This is the force of gravity acting on the mass of the aircraft. This force will always act directly toward the earth. The weight will always oppose the vertical component of lift. The weight of the aircraft will not change in

the turn; it will be the same as it was when the aircraft was in straight and level flight.

C. Load This is the combination of the weight and the centrifugal force. This is the force we want to minimize.

Purpose: The purpose of this discussion is to inform you that you do not want to increase the load factor by pulling back on the control column to keep the nose on the horizon. You want to change the vertical component of lift. This will make the maneuver much smoother, and you will notice that your airspeed will not change that much.