

# THEORIES OF LIFT



## THE GREAT LIFT CONTROVERSY

Name \_\_\_\_\_

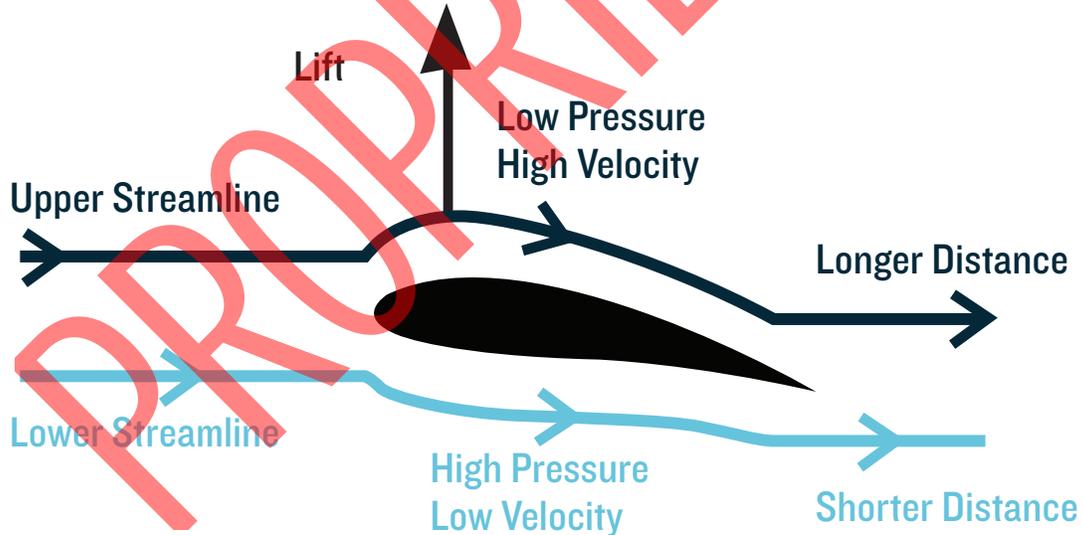
Class \_\_\_\_\_

*You are a scientist attending an international conference on aerodynamics. The purpose of the conference is to establish once and for all the accepted theory on how lift is produced. Your job is to convince the participants that your theory of lift production is the correct one.*

*Once the presentations are complete, you will vote on the theory you think is correct.*

### 1. LONGER PATH or EQUAL TRANSIT TIME THEORY

When air molecules are split at the leading edge of an airfoil, they must meet up at that trailing edge. Air flowing over the top of the wing has to cover a greater distance than the air on the bottom. Therefore, it has to go faster to rejoin the slipstream, thus creating a low pressure on the top of the wing. The difference in pressure creates lift.



“Longer Path” or “Equal Transit” Theory



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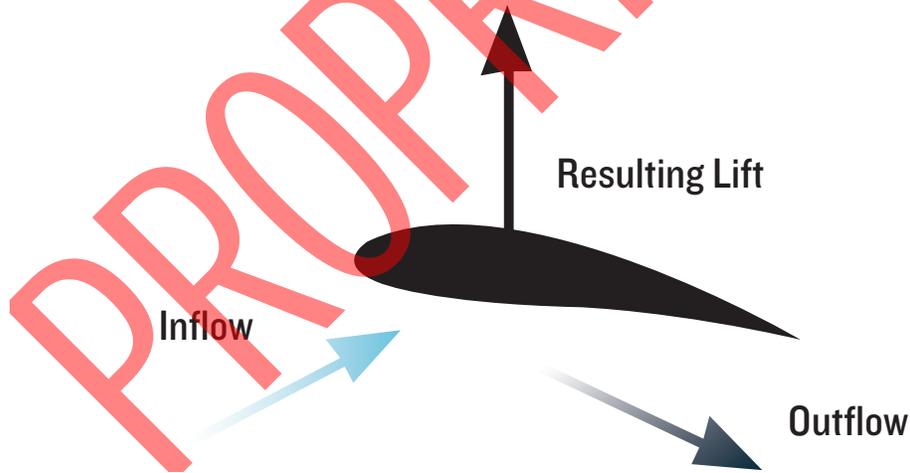
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### 2. SKIPPING STONE THEORY

Lift is the result of a simple action-reaction as air molecules strike the bottom of the airfoil. Like putting your hand out of the car window while it is moving, the impact of the air striking the lower surface of the wing pushes the wing upward, creating lift. This theory holds that the lower surface of the wing is what creates lift, and the upper surface contributes little to no lift since it is out of the direct airflow. Because this is similar to the way in which a flat rock thrown at a shallow angle skips across a body of water, it is called the “Skipping Stone” theory of lift.



**“Skipping Stone” Theory**



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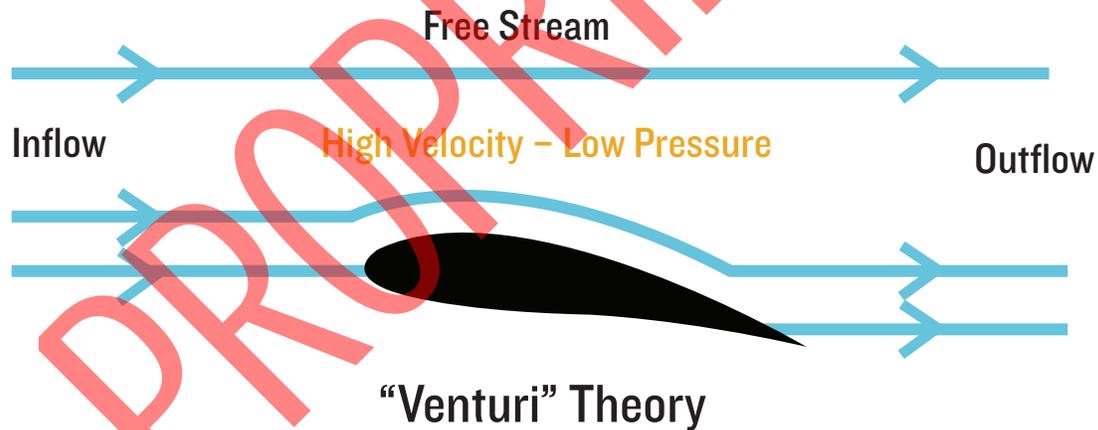
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### 3. VENTURI THEORY

Bernoulli found that when a fluid goes through a pipe that is squeezed in the middle (known as a Venturi), the fluid's velocity increases and its pressure decreases. The upper surface of the airfoil acts like a Venturi nozzle constricting the airflow. The airflows speed up, which according to Bernoulli, causes a decrease in pressure on the upper surface, creating lift. Since the airflow is not restricted below the wing, the pressure is not affected and does little to create lift.





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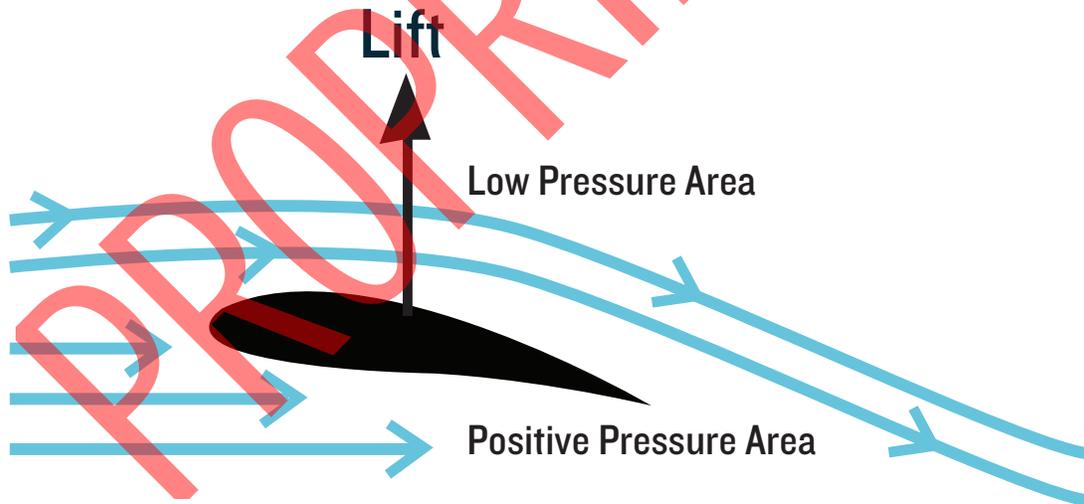
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### 4. BERNOULLI'S PRINCIPLE

Increased speed of a gas causes a decrease in pressure. Therefore, the faster the air moves, the lower the pressure. When an airfoil moves through the air, it splits the airflow above and below its surfaces. The air that flows above the airfoil increases in speed and a low pressure area is created above the wing. The air that goes below the wing decreases in speed and a high pressure area is created. The high pressure below the wing exerts an upward force toward the low pressure area above the wing. This overall reaction creates lift.





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### 5. NEWTONIAN THEORY

An airfoil creates lift by pushing air downwards. This theory relies on Newton's Third Law of Motion, that for every action there is an equal and opposite reaction. The airflow both above and below an airfoil is deflected or bent downwards, creating an upwards force, which is lift.

