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A Critical Review of Aerodynamic Lift: Widespread Misconceptions and Physical Origins

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Abstract: The science behind how airplanes generate lift remains a topic of ongoing debate and controversy. Over the years, numerous theories, such as the Equal Transit Time Theory, Skipping Stone Theory, and Venturi Effect, have been proposed, yet none fully capture the true mechanism of lift generation. Despite the availability of advanced mathematical models and aerodynamic analyses, confusion persists, even among pilots and aircraft manufacturers, due to the widespread dissemination of misleading explanations. This paper aims to clarify these misconceptions by first examining the flawed theories, then presenting a more accurate and physically grounded explanation of lift, supported by real- world examples and calculations. Understanding the correct principles is crucial for both scientific accuracy and practical application in aviation.

Table of Contents

1. Introduction

Since ancient times, humans have been captivated by the flight of birds, sparking a timeless aspiration to achieve flight. This fascination laid the groundwork for early theoretical and experimental efforts to understand and replicate flight. Notably, Leonardo da Vinci made significant early contributions through his sketches of flapping-wing ornithopters, which, although never realized in his lifetime, represented a foundational step in the evolution of aeronautical engineering. The subsequent transition from flapping to fixed-wing concepts marked a paradigm shift, eventually leading to the development of modern aircraft. Despite the remarkable advancements in aerospace engineering, the fundamental explanation of lift remains a subject of ongoing debate and frequent misunderstanding. Over the years, multiple theories have been proposed to explain how lift is generated. While each theory captures important aspects of the phenomenon, their presentation, often simplified or misrepresented, can be confusing, especially when taught in isolation or without proper context. In many educational settings, particularly at the school level, an oversimplified or even inaccurate version of Bernoulli's principle is frequently taught. Such misconceptions are further amplified by content circulating on social media, educational websites, and even some undergraduate-level textbooks, which either lack a rigorous treatment or rely on flawed analogies. As a result, students and early learners often develop a distorted understanding of the physical mechanisms underlying lift generation. This review paper explores the scientific basis of commonly misunderstood theories of lift and highlights their shortcomings. It then presents the accurate explanation of lift, supported by real-life examples and relevant calculations.

2. Incorrect Theories

While Bernoulli's theorem is frequently invoked to explain the generation of lift on an aerofoil, this approach is often misleading. Bernoulli's equation is fundamentally a statement of the conservation of energy along a streamline, implying an increase in fluid velocity corresponds to a decrease in static pressure, and vice versa. However, this relationship is often misapplied, particularly when used to explain lift in all scenarios involving high-speed airflow. The application of Bernoulli's equation relies on several critical assumptions: (a) the fluid is incompressible, (b) the flow is inviscid (i.e., no friction or viscosity), (c) there is no work being done on or by the fluid, (d) the flow is isolated from any external energy input or extraction, and (e) the analysis is restricted along streamline. In practical aerodynamics, especially in the context of lift generation over an aircraft wing, many of these assumptions break down. Air is a compressible fluid at high speeds, viscous effects such as boundary layer

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development are significant, and aerodynamic forces involve complex work interactions between the air and the wing. Furthermore, the Bernoulli principle is strictly valid only for confined flow systems such as pipes or venturi tubes, where external energy inputs and losses can be minimized or accounted for [1]. In contrast, airflow over an aerofoil occurs in an unconfined, open environment where the pressure of the moving fluid remains equal to the surrounding atmospheric pressure. In such cases, the inverse pressure-velocity relationship predicted by Bernoulli's equation no longer holds rigorously. Several commonly phenomena are often mistakenly explained using Bernoulli principle. Examples include the suspension of a ping pong ball within a vertical stream of air, the lifting of roofs by strong hurricane winds, the curved trajectory of a baseball pitch, Bernoulli strip, etc. Numerous inaccurate theories had been proposed based on Bernoulli's theorem to explain the origin of lift generation.

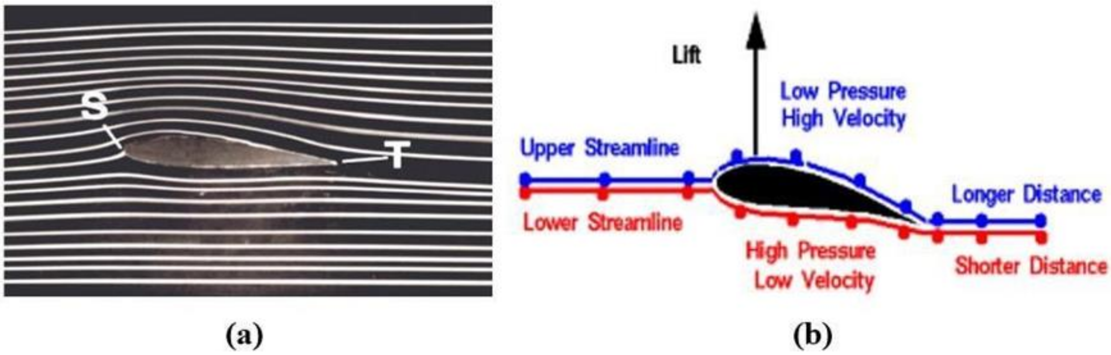

Figure 1: (a) Aerofoil [2] **(b) Equal Transit Theory [3]**

The "Equal Transit Time Theory" [2-4] is a widely cited but fundamentally flawed explanation of aerodynamic lift. This theory posits that because the upper surface of an aerofoil is curved (Fig. 1.a), resulting in a longer path from the leading edge (point S) to the trailing edge (point T), air that split at the leading edge must travel faster over the upper surface than those traveling along the flatter lower surface. The theory suggests that these two streams of air must reunite simultaneously at the trailing edge, a condition often referred to as the equal transit assumption. According to Bernoulli's theorem, this increase in velocity over the upper surface would lead to a corresponding decrease in static pressure. As a result, a pressure difference forms between the upper and lower surfaces of the aerofoil, with higher pressure beneath the wing and lower pressure above it, thereby generating lift (Fig. 1.b).

The Equal Transit Theory raises several critical questions that challenge its validity. One major issue is the unclear mechanism it proposes for why airflows from the upper and lower surfaces must reconverge precisely at the trailing edge. Additionally, the theory suggests that increasing the length of the upper surface relative to the lower surface would result in greater lift. Furthermore, if the Equal Transit Theory were accurate, it would be impossible for aircraft to sustain inverted flight or for flat or thin aerofoils to generate lift, both of which are demonstrably false.

Figure 2: Flowing of lines of smoke over aerofoil [2]

Experimental studies, such as those conducted by Professor H. Babinsky [2], provide strong evidence against the theory. In one such visualization using smoke lines (Fig. 2), it was observed that the airflow over the upper surface of an aerofoil reached the trailing edge significantly earlier than the flow along the lower surface. This directly disproves the core assumption of equal transit theory.

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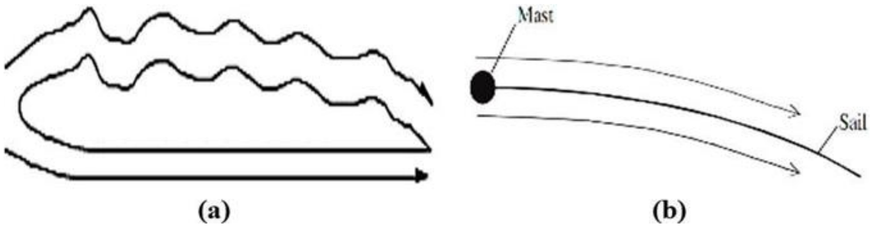

Figure 3: (a) Aerofoil with exaggerated upper surface [5], (b) Flow over sail [2]

If the length of the upper surface were the primary factor in generating lift, then certain shapes with significantly extended upper surfaces (Fig. 3.a) would be expected to produce greater lift. However, in the case of the sail on a sailboat, as seen in Fig. 3.b, the upper and lower surface lengths are equal, yet the sail is still capable of generating lift to propel the boat forward. According to the Equal Transit Theory, the wing of a Cessna 172 aircraft would produce only about 2% of the actual lift observed at a speed of 104 km/h. Based on this theory, a minimum speed of 640 km/h would be required for the aircraft to generate sufficient lift. However, the Cessna 172 has a maximum cruising speed of just 226 km/h [6].

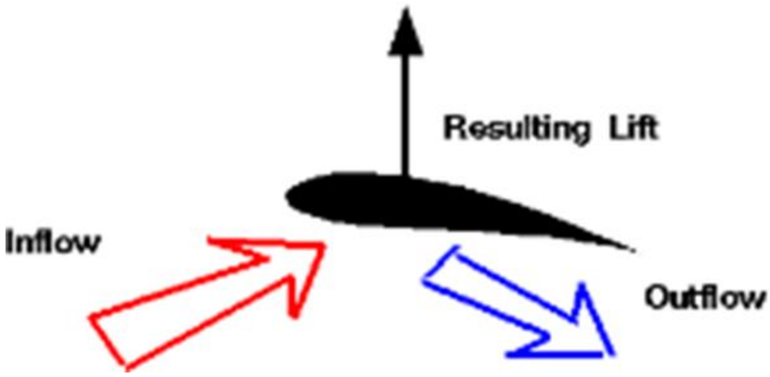

Figure 4: Skipping Stone Theory [7]

Another debated concept, often referred to as the "Skipping Stones Theory," suggests that lift is generated as a reaction force resulting from air striking the lower surface of an aerofoil set at a positive angle of attack (Fig. 4). At high altitudes where the density of air is lower, the reduced impact of individual air molecules diminishes the validity of such a theory, especially for large aircraft. Additionally, when a wing operates at a negative angle of attack, air molecules tend to impact the upper surface continuously, potentially leading to aerodynamic instability and loss of lift. Hence, the Skipping Stones Theory fails to accurately explain lift generation under real- world flight conditions.

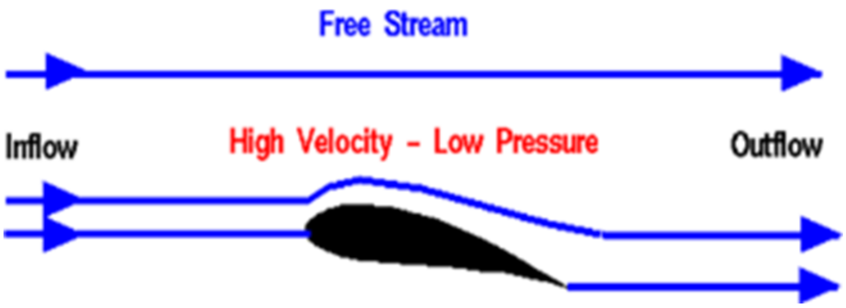

Figure 5: Venturi Theory [8]

The "Venturi Theory" [8] proposes that the curvature of the upper surface of an aerofoil behaves like a Venturi nozzle, causing the airflow to accelerate over this region (Fig. 5). According to Bernoulli’s principle, this acceleration results in a pressure drop over the upper surface, thereby generating lift due to the pressure difference between the upper and lower surfaces. While this explanation holds in certain simplified cases, it fails to account for lift generation in configurations involving flat plates, which lack the converging-diverging geometry characteristic of a Venturi channel. Moreover, the theory does not provide a satisfactory explanation for lift observed at negative angles of attack, where airflow behaviour and pressure distribution deviate significantly from the assumptions of the Venturi effect. Consequently, while the Venturi Theory offers partial insight into the lift mechanism, it is inadequate for explaining the complete aerodynamic behavior of airfoils across different conditions.

3. Significance of Coanda Effect

The Coanda Effect [9], discovered by Romanian inventor Henri Coanda, describes the behaviour of a fluid jet as it flows along a curved surface. Coanda observed that when a fluid stream encounters a nearby curved object, it tends to stay attached to the surface rather than moving away in a straight path. He later applied this principle in designing and patenting an innovative propulsion system. This phenomenon where the fluid clings to and follows the contour of a curved surface, is known as the Coanda Effect. A common illustration of this can be seen when a stream of water strikes the curve wall of glass (Fig. 6, left); instead of bouncing off, the water wraps around the convex side of the glass [10]. Another everyday example [5] is flowing of water stream along the convex side of spoon (Fig. 6, right). These simple observations highlight how fluid flow can be influenced by the geometry of nearby surfaces.

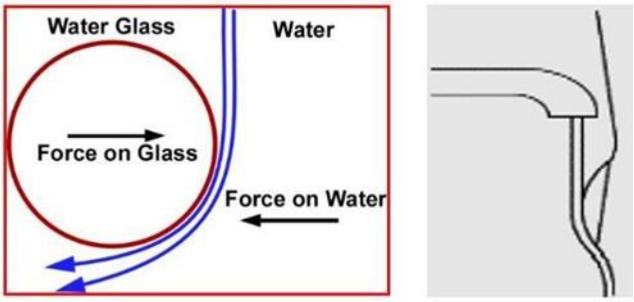

Figure 6: Coanda Effects

A Coanda Flying Saucer [11] is a unique type of UAV (Fig. 7.a, 7.b) that takes advantage of the Coanda effect, where a jet of air naturally clings to and follows the contours of a curved surface. In this design, the saucer-like shape with its smooth, rounded edges is specifically intended to enhance this effect. As air is expelled over the curved surface, it adheres to the structure and bends downward, which, according to Newton's third law, generates an upward reactive force, producing lift. This approach can potentially allow the craft to perform vertical take-off and landing (VTOL), making it suitable for compact or unconventional flight operations.

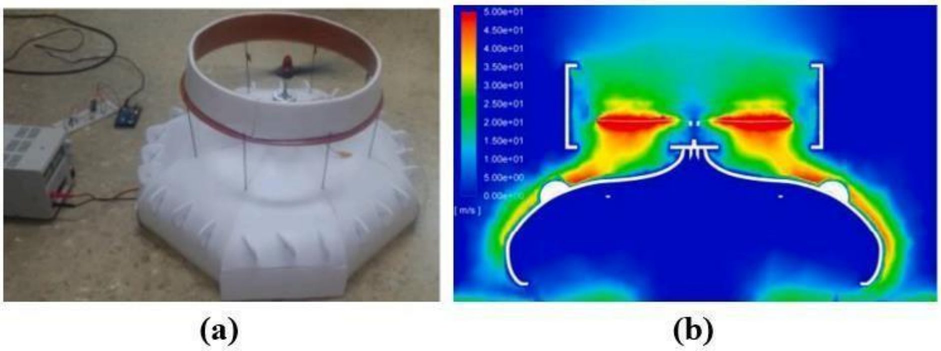

Figure 7: (a) Prototype of Flying Saucer, (b) CFD analysis of airflow over Flying Saucer

Due to the viscous nature of the fluid, a thin layer of water adheres to the surface of the glass. Immediately above this stationary layer, adjacent fluid layers progressively accelerate until the free stream velocity is achieved. This velocity gradient within the boundary layer generates a shear force, which contributes to the fluid's tendency to remain attached and follow the curved surface.

4. Pressure Distribution Over Aerofoil

During the generation of lift by an aerofoil, a pressure difference develops between its upper and lower surfaces. Typically, the pressure on the lower surface is higher, while the pressure on the upper surface is lower. This pressure differential results in an upward lifting force. Although this distribution is often explained by Bernoulli's theorem, the theorem is not applicable across the aerofoil.

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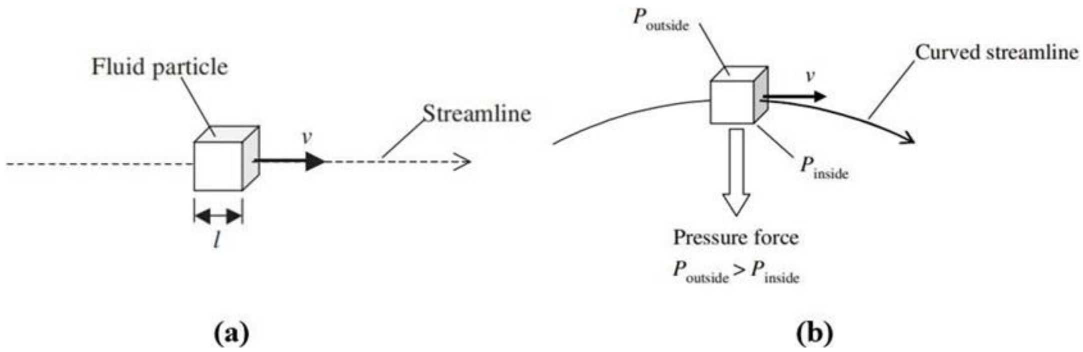

Figure 8: (a) Fluid segment along straight streamline [2], (b) Fluid segment along curved streamline [2]

A moving fluid segment along the straight streamline, shown in Fig. 8.a. will gain speed if a force will be felt by the segment in the right direction if the pressure at the front side is less than the pressure at the rear side. The velocity of the fluid segment will be reduced if the pressure on the front side is greater than the rear side of the segment along the streamline. Now, the fluid segment moves at a constant speed along a curved streamline as shown in Fig. 8.b. To maintain the path of curved streamline, a centripetal force has to be acted on the segment. So, pressure will be definitely varied across the streamlines. L. Euler gave an equation regarding on pressure gradient across streamline (Fig. 9) for curved streamline [2],

$$\frac{\partial p}{\partial n} = \frac{\rho V^2}{R}$$

Where, n = coordinates in the vertical direction of streamline, R = radius of curvature of streamline, V = constant velocity, and ρ = density of air. The more curved the streamline (i.e. smaller radius of curvature), $\partial p/\partial n > 0$ across streamline. The greater pressure gradient is needed to keep the fluid on that curved path. It is noticed from the equation that if, $R \rightarrow \infty$ (straight streamline) then $\partial p/\partial n = 0$, that means there is no pressure variation across straight streamlines.

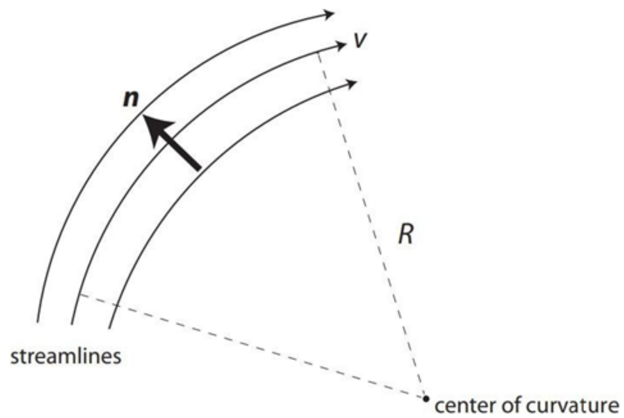

Figure 9: Curved streamlines with different radius of curvature [12]

To further analyze the pressure distribution, the streamline pattern around a curved plate is considered, as illustrated in Fig. 10. At a sufficient distance from the aerofoil, the flow remains undisturbed, characterized by straight streamlines and ambient atmospheric pressure (Patm). To assess the pressure distribution, we examine the flow behaviour along lines normal to the local streamline direction. Beginning at point A, where the streamlines are straight, there exists no pressure gradient in the direction normal to the flow. However, as we move closer to the aerofoil along this path, the streamlines exhibit increasing curvature. A pressure gradient must exist across curved streamlines. In this case, the curvature implies a decrease in pressure as we descend toward the aerofoil surface, resulting in a pressure at point B that is lower than atmospheric pressure. A similar analysis can be applied from point C to point D on the lower surface of the aerofoil. As we approach the surface, the streamlines again curve, but in the opposite direction. This results in an increase in pressure toward the surface, making the pressure at point D greater than that at C and greater than atmospheric pressure. This analysis elucidates the fundamental principle responsible for the pressure distribution around a lifting aerofoil.

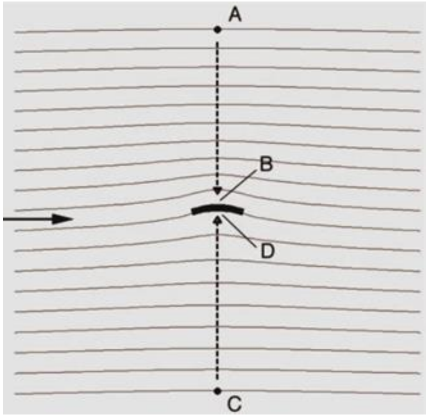

Figure 10: Flow over curved surface [2]

The commonly held notion that the airflow over the upper surface of an aerofoil reaches the trailing edge earlier than that along the lower surface cannot be accurately explained using Bernoulli's theorem. To investigate this phenomenon in detail, a computational fluid dynamics (CFD) analysis was conducted to study the pressure distribution around an aerofoil. The analysis revealed the presence of three primary regions of streamline curvature.

The most significant curvature is observed along the upper surface, where the flow experiences a sharp deflection. Since the pressure at a distance from the aerofoil remains atmospheric, the high curvature induces a considerable pressure drop as the flow approaches the surface. The second curvature appears on the lower surface near the leading edge. This curvature is relatively minor, and thus the associated pressure reduction is small. The third region of curvature is located near the trailing edge on the lower surface, where the flow curves downward. In this region, moving closer to the aerofoil results in a pressure increase. Additionally, at the leading edge, a stagnation region is formed where the incoming flow directly impinges on the surface, resulting in a local pressure peak, as shown in figure 11.a.

On the upper surface, pressure decreases significantly until approximately the mid-chord, after which it gradually recovers due to the reduced surface curvature near the trailing edge. In contrast, on the lower surface, pressure progressively increases until the aft region, followed by a slight decrease (Fig. 11.b). This pressure distribution results in flow acceleration on the upper surface and deceleration on the lower surface. The upper-surface fluid particles accelerate significantly up to midpoint but after that decelerate, while those on the lower surface are subjected to increasing pressure and thus slow down (Fir. 11.c). Consequently, the particles on the upper surface attain higher velocities and reach the trailing edge earlier, disproving the common misconception that equal travel times are required (Fig. 11.d).

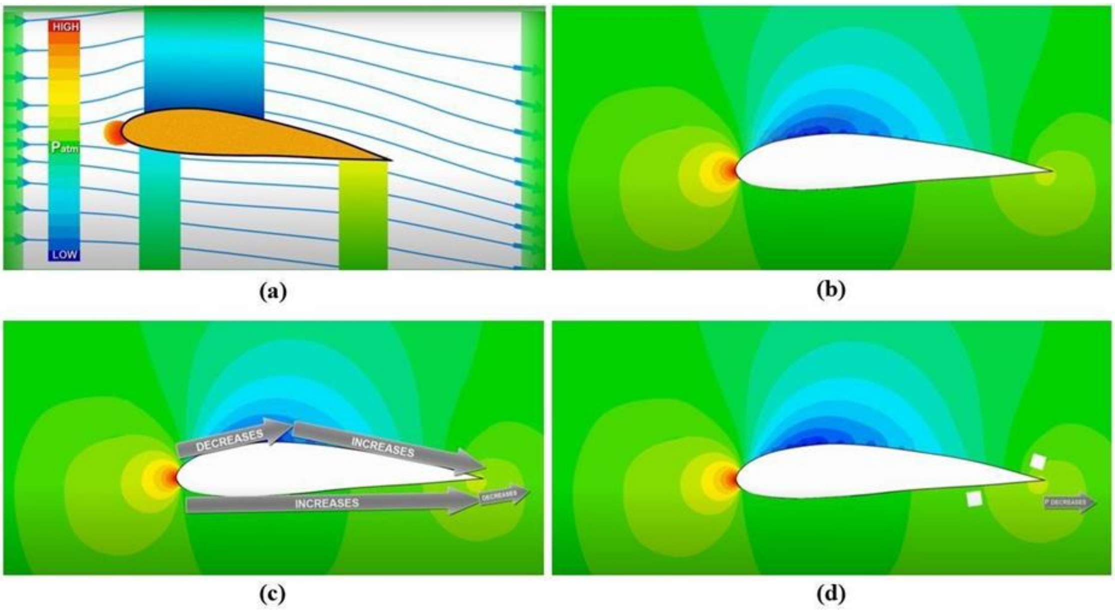

Figure 11: CFD analysis of aerofoil [13]

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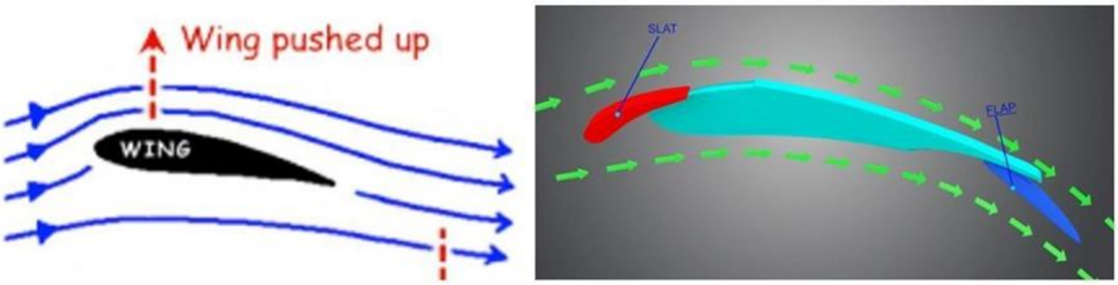
Importantly, the analysis confirms that the pressure distribution governs the velocity field, not the reverse. It is the geometry-induced curvature of the flow that dictates the pressure gradients, highlighting the limitations of relying solely on Bernoulli's principle.

5. Explanation of Lift Generation and Calculation of Lift

The generation of lift is explained by Newton's Laws of Motion, not Bernoulli's Theorem. When a wing moves in the air, the air on the lower surface is forcefully pushed by the wing in the downward direction. On the upper surface, the air follows the curvature of the aerofoil because of the Coanda effect, and it is pulled in a downward direction. The air on both surfaces is deflected in the downward direction by the wing. This is called downwash. According to Newton's Third Law, the air also exerts a reaction force on the wing in the upward direction as shown in figure 12.a. Lift force is the normal component of that upward reaction force.

During take-off and landing, the velocity of aircrafts becomes slow. To generate enough lift, the flap and slat are extended which increases curvature of the wing and the air is deflected more due to the flap and slat extension.

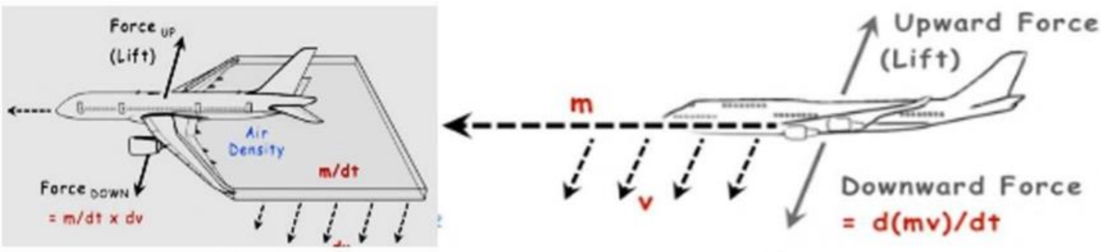


(a) (b)

Figure 12: (a) Air flow over wing [14], (b) Air flow over wing with extended flap and slat [15]

There are two approaches to calculating the lift, (a) the Mass Flow Rate approach and (b) the Momentum Theory approach [14]. Both approaches give the same result, but both are represented differently. When the wing moves through the air, the wing diverts the mass of air

(m) for every second by accelerating at a high velocity (v) in the downward direction to produce a downward force equal to ma = m/dt × dv. The normal component of upward rection i.e. lift is exactly equal and opposite to downward force.



(a) (b)

Figure 13: (a) Mass flow rate approach [14], (b) Momentum theory approach [14]

When aircraft flies through the air, the high-velocity air is diverted in a downward direction due to the transfer of momentum (mv) and kinetic energy of the wing to the air. The normal component of the upward reactive force is the lift force which is equal to ma = d(mv)/dt [14]. So, the two equations are: Lift = ma = m/dt × dv (Mass flow rate approach) & Lift = ma = d(mv)/dt (Momentum Theory approach). Newton's Second Law is the foundation for these two equations. A popular equation of lift is presented in various textbooks, Lift = 0.5 × (Density of Air) × (Aircraft Velocity)2 × (Wing area) × (Lift Coefficient). This equation only talks about which parameters affect the lift. But Newton's law explained the cause behind the lift.

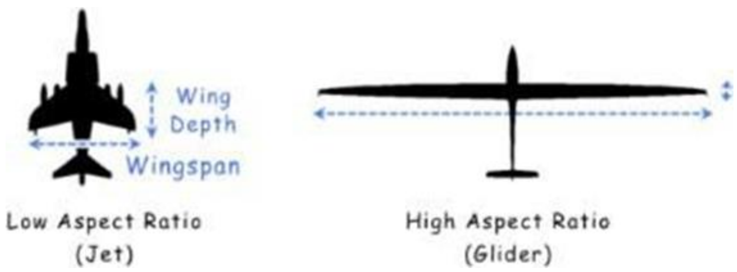


Fig. 14: Wingspan and Wing depth of Harrier and Glider [16]

N. Landell-Mills [16] demonstrated different experimental data of Harrier and glider. At a cruising speed of 798 km/hr and 250 km/hr, the produced lift of Harrier AV-8B (wingspan – 9.4 m, wing area – 22.6 m^2 and wing depth – 2.4 m) and Glider (wingspan – 30 m, wing area – 22.6 m2 and wing depth – 0.8 m) are 10000 N and 800 N respectively. So, the lift of Harrier is 12.5 times greater than the lift of Glider. Glider and Harrier deflect 1250 kg of air per second at a velocity of 0.64 m/s and 8 m/s respectively. When Glider moves through the air, the low momentum and high aspect ratio wings of the Glider come in contact with the bulk mass of air and deflect it at low velocity to produce the lift. The low aspect ratio and higher depth wing of Harrier deflect the air in a downward direction at a very high velocity due to the high momentum of the aircraft to generate the lift as shown in figure 15.a.

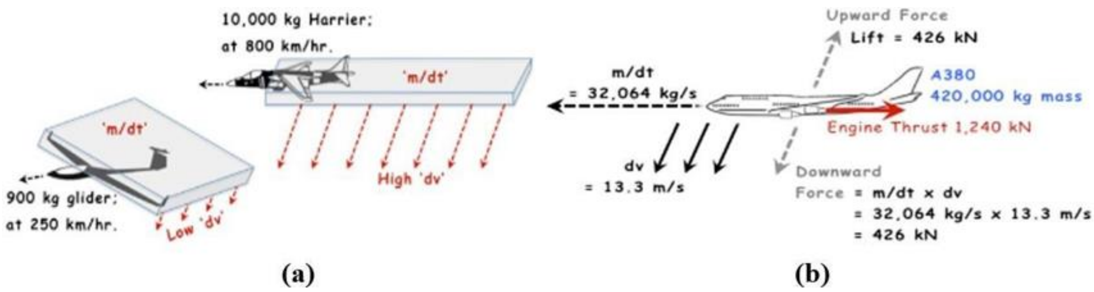


Fig. 15: (a) Harrier and Glider [16], (b) Lift calculation of Airbus A-380 [14]

It was also evaluated that Airbus A-380 deflects 32000 kg of air each second at a velocity of 13.3 m/s and generates 426 KN of lift as shown in figure 15.b. A Cessna 172 [6] having a mass of 1045 kg, generates adequate lift by deflecting 5000 kg of air per second which is five times its own mass. The deflection of air in the downward direction is called downwash. Figure 16 provides the evidence supporting the presence of downwash, illustrating the downward deflection of airflow as it interacts with the wing. Wings serve two fundamental aerodynamic functions: capturing airflow and redirecting it downward. The wingspan, along with the wing's angle of attack (AOA) and aerofoil shape, primarily influences the volume of air intercepted. In contrast, the chord length (wing depth), aircraft momentum, and angle of attack predominantly determine the extent to which this airflow is deflected downward.

Fig. 16: Evidence of downwash [17]

An aerodynamic stall occurs when an aircraft's wings fail to generate adequate lift to sustain flight, resulting in a sudden loss of altitude. During a stall, the airflow over the upper surface of the wing exhibits a characteristic pattern. Typically, stalls are induced at low airspeeds and/or high angles of attack (AOA), often accompanied by reduced engine thrust. In the early phase of a stall, flow separation begins near the trailing edge on the upper surface of the wing, particularly close to the wing root. This separation disrupts the laminar flow, initiating turbulence, which in turn leads to a significant reduction in lift, an increase in aerodynamic drag, and a subsequent

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decline in airspeed. The Coanda effect, wherein a fluid stream tends to adhere to a curved surface, plays a crucial role in maintaining attached airflow over the wing. Wind tunnel experiments reveal that the upper airflow is redirected downward along the curved upper surface of the wing due to this effect (Fig. 17.a). However, when the Coanda effect is insufficient to keep the airflow attached, flow separation occurs (Fig. 17.b), resulting in turbulent wake formation and aerodynamic instability.

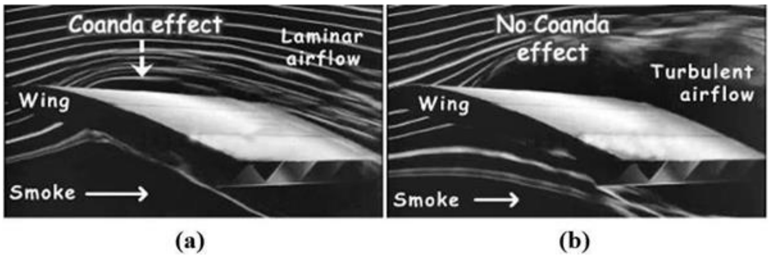

Fig. 17: (a) Laminar airflow over wing, (b) Flow separation [18]

A common misconception in aerodynamics is that higher airspeed inherently results in lower static pressure. This misunderstanding often leads to significant confusion. In reality, unconfined high-velocity airflow, such as that over an aircraft wing, maintains the same static pressure as the surrounding ambient atmosphere. The Bernoulli equation, which establishes a relationship between fluid velocity and pressure, is strictly applicable to streamlined, incompressible flow within a confined system, such as a closed duct or pipe. Therefore, applying Bernoulli's principle directly to the airflow over a wing's surface an unconfined environment is an oversimplification and not theoretically rigorous.

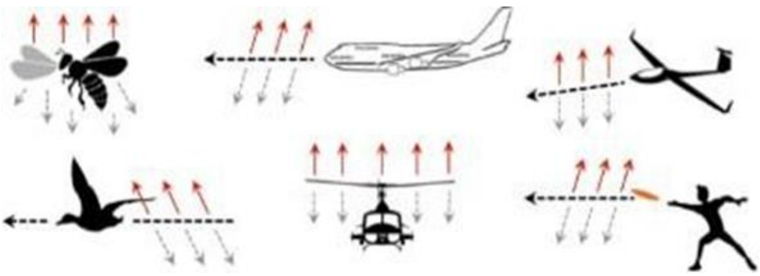

Fig. 18: Universal Theory of lift [14]

The existing body of literature lacks comprehensive explanations that holistically address the mechanisms of lift generation and the corresponding pressure distribution over an aircraft wing. While several prior studies [19–24] have provided partial insights into the fundamentals of lift, they often fall short in delivering an integrated and in-depth analysis of the phenomenon. In contrast, the present study aims to bridge this gap by offering a thorough and systematic explanation of lift generation, supported by detailed discussions on pressure distribution across the wing surface. This paper not only revisits foundational aerodynamic principles but also supplements the theoretical framework with practical, real-life examples that enhance the relevance and applicability of the concepts. The principle of air deflection, which underpins the generation of aerodynamic lift, is not exclusive to conventional aircraft but extends to all forms of flying objects. This mechanism operates on the fundamental aerodynamic principle that lift is produced through the downward deflection of air, resulting in an equal and opposite upward force. As such, this concept represents a universal theory of flight (Fig. 18), applicable across a broad spectrum of aerial systems and even naturally flying organisms such as birds and insects.

6. Conclusions

The generation of lift, a phenomenon central to all forms of flight, has long been clouded by misconceptions and oversimplified explanations. Traditional teachings, especially those based on flawed interpretations of Bernoulli's theorem and the Equal Transit Time theory, have contributed to widespread misunderstanding among students, educators, and even within parts of the scientific community. This review critically examined these incorrect theories and demonstrated their limitations through theoretical reasoning, experimental data, and computational fluid dynamics (CFD) simulations. The paper underscores that lift is most accurately understood through Newton's laws of motion, in conjunction with a detailed analysis of pressure distribution caused by streamline curvature. The deflection of air, both above and below the wing, is the primary mechanism of lift, governed by the wing's geometry, angle of attack, and the surrounding flow conditions. Examples from actual aircraft, such as the Harrier, Glider, and Airbus A380, were used to demonstrate how different designs influence lift through varied air deflection mechanisms. This framework extends not only to fixed-wing aircraft but also to biological flying creatures, making it truly universal. By doing so, it contributes a more complete and accessible perspective on wing aerodynamics that can benefit both academic researchers and practitioners in the field of aerospace engineering. This study presents a comprehensive, experimentally validated, and physically consistent understanding of aerodynamic lift.

7. References

[1] Understanding Flight. (n.d.). Misconception 1. Accessed from https://www.understandingflight.com/misconceptioin-1/ on December 30, 2025.
[2] Babinsky, H. (2003). How do wings work? Physics Education, 38, 497.
[3] NASA Glenn Research Center. (n.d.). Accessed from https://www.grc.nasa.gov/www/k-12/VirtualAero/BottleRocket/airplane/wrong1.html on December 30, 2025.
[4] Bastianello, F. (2013). Lift generation: Some misconceptions and truths about lift. Young Scientists Journal. https://doi.org/10.4103/0974-6102.1076125
[5] Karmak.org. (2003, February). Coanda effect. Accessed from https://www.karmak.org/archive/2003/02/coanda_effect.html on December 30, 2025.
[6] Anderson, D. F., & Eberhardt, S. (n.d.). Understanding flight. McGraw Hill.
[7] NASA Glenn Research Center. (n.d.). Foilw2. Accessed from https://www1.grc.nasa.gov/beginners-guide-to-aeronautics/foilw2/ on December 30, 2025.
[8] NASA Glenn Research Center. (n.d.). Venturi theory. Accessed from https://www1.grc.nasa.gov/beginners-guide-to-aeronautics/venturi-theory/ on December 30, 2025.
[9] Crivoi, O., & Doroftei, I. (2016). Some experimental results on Coanda effect with application to a flying vehicle. IOP Conference Series: Materials Science and Engineering, 147(1), Article 012082. https://doi.org/10.1088/1757-899X/147/1/012082.
[10] Understanding Flight. (n.d.). Bernoulli and Coanda effect. Accessed from https://www.understandingflight.com/bernoulii-and-coanda-effect/#Coanda%20Effect on December 30, 2025.
[11] Mateo Sanguino, T. de J., & Lozano Domínguez, J. M. (2024). Design and stabilization of a Coandă effect-based UAV: Comparative study between fuzzy logic and PID control approaches. Robotics and Autonomous Systems. https://doi.org/10.1016/j.robot.2024.104662.
[12] Jenkins, A. (2014). Irreversibility in an ideal fluid. American Journal of Physics. https://doi.org/10.1119/1.4890941.
[13] Lesics. (n.d.). Why is the top flow faster over an airfoil? Accessed from https://www.lesics.com/why-is-the-top-flow-faster-over-an-airfoil.html on December 30, 2025.
[14] Landell-Mills, N. (n.d.). How airplanes generate lift is disputed (Newton v. Fluid Mechanics). https://doi.org/10.13140/RG.2.2.34380.36487.
[15] Lesics. (n.d.). How do airplanes fly? Accessed from https://www.lesics.com/how-do-airplanes-fly.html on December 30, 2025.
[16] Landell-Mills, N. (n.d.). How aircraft momentum affects lift generation. https://doi.org/10.13140/RG.2.2.20536.70409
[17] Landell-Mills, N. (2017). Calculation of the air displaced by a wing. Journal of Aeronautics and Aerospace Engineering. https://doi.org/10.4172/2168-9792.1000204.
[18] Landell-Mills, N. (2022). An alternative explanation of stalls. https://www.researchgate.net/publication/359337800_An_alternative_explanation_of_stalls.
[19] Hoffren, J. (2012). Quest for an improved explanation of lift. AIAA Journal. https://doi.org/10.2514/6.2001-872.
[20] Weltner, K. (1987). A comparison of explanations of aerodynamical lifting force. American Journal of Physics. https://doi.org/10.1119/1.14960.
[21] Singh, N., Sasikumar Raja, K., & Janardhan, P. (2018). Clearing certain misconception in the common explanations of the aerodynamic lift. arXiv. https://doi.org/10.48550/arXiv.1810.11461.
[22] Eastlake, C. N. (2002). An aerodynamicist's view of lift, Bernoulli and Newton. The Physics Teacher. https://doi.org/10.1119/1.1466553.
[23] Wu, J. Z., Zhu, J. Y., Zou, S. F., & Liu, L. Q. (2015). The origin of lift revisited: I. A complete physical theory. 45th AIAA Fluid Dynamics Conference. https://doi.org/10.2514/6.2015-2302.
[24] Toe, C., & Angel, J. S. (2022). Analysis of existing physical theories explaining aerodynamic lift production by an airplane. Journal of Student Research, 11(4). https://doi.org/10.47611/jsrhs.v11i4.3558.

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