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# flying-disc- aerodynamics-and- advancing-lift- devices-through- electrostatic

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# Unraveling the Aerodynamics: Understanding Lift in Flying Discs and Frisbees

## Introduction

The simple act of throwing a Frisbee or flying disc offers a fascinating glimpse into the world of aerodynamics. While it may seem like just a leisure activity, the principles governing the flight of these discs are complex and intriguing. This article explores the concept of lift from the perspective of a flying disc, shedding light on the physics behind its seemingly effortless glide through the air.

## The Physics of Flying Discs

### Basic Aerodynamics

To understand how a Frisbee flies, one must first grasp the basic principles of aerodynamics, particularly lift. Lift is the force that directly opposes the weight of any object in flight and is crucial for achieving and maintaining altitude.

### Shape and Design

A Frisbee is not just a flat, circular object; it's a carefully designed aerodynamic device. The disc's shape, with its curved top and flat bottom, is essential for its flight characteristics. This design creates an airfoil, much like an airplane wing.

### How Lift is Generated

#### Airfoil Effect

As a Frisbee moves through the air, air flows faster over the top surface than the bottom. This difference in speed creates a pressure difference – lower pressure on top and higher pressure below – resulting in an upward lift force.

#### Angle of Attack

The angle at which the disc is thrown, known as the angle of attack, also plays a critical role. A greater angle of attack typically increases lift, but only up to a point. Beyond a certain angle, the disc can stall and lose lift, leading to a rapid descent.

## Stability and Control

### Spin Stabilization

The spin of a Frisbee is crucial for its stable flight. Gyroscopic stability, imparted by the spin, keeps the disc oriented and prevents it from tumbling mid-air.

### Design Variations

Different designs and weights of discs can alter flight characteristics. For instance, heavier discs may fly straighter but require more force, while lighter discs are more susceptible to being affected by wind.

## Practical Applications and Implications

### Sports and Recreation

Understanding the aerodynamics of flying discs has led to the development of various types of Frisbees for specific sports, such as Ultimate Frisbee and disc golf, each designed for specific flight patterns and distances.

### Educational Tool

Frisbees serve as an excellent educational tool to teach principles of physics and aerodynamics in a practical and engaging manner.

### Aerodynamic Research

The study of flying discs has contributed to aerodynamic research, providing insights into fluid dynamics and airfoil behavior in non-traditional shapes.

## Conclusion

The flying disc or Frisbee is more than just a toy; it's an embodiment of complex aerodynamic principles. Its flight involves intricate interactions between shape, speed, angle, and spin, all coming together to create the seemingly simple act of soaring gracefully through the air. Understanding these principles not only enhances our appreciation of this popular pastime but also contributes to our broader knowledge of aerodynamics and physics. Whether for sport, fun, or science, the humble Frisbee continues to captivate and educate, soaring high as a symbol of the intriguing interplay between physics and play.

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# Exploring the Possibilities: Can a Spinning Top Act as a Disc Lift Device?

## Introduction

The world of physics and engineering is replete with innovations that challenge conventional understanding. One intriguing question that arises in this realm is whether a simple spinning top could be transformed into a disc lift device. This article delves into the mechanics and possibilities of using a spinning top as a means to create lift, examining the principles of physics at play and exploring the potential of such a device.

## Understanding the Spinning Top

### Basic Mechanics

A spinning top is a toy that rapidly spins on its axis, maintaining its balance due to the gyroscopic effect. The physics behind a top's stability involves angular momentum and rotational inertia, which prevent the top from tipping over as it spins.

### Gyroscopic Effect

The gyroscopic effect is key in understanding the spinning top. This phenomenon, where a rapidly spinning object resists changes to its axis of rotation, is crucial in many technologies, including gyroscopes in aircraft navigation.

## The Concept of Lift

### Lift in Aerodynamics

Lift is a force that is essential in aerodynamics, allowing objects like aircraft to ascend and stay airborne. It's created when air pressure below an airfoil (like a wing) is greater than the pressure above it, causing the object to rise.

### Translating Spin to Lift

The central challenge in transforming a spinning top into a disc lift device lies in translating the gyroscopic stability and rotational energy into vertical lift. This involves altering air pressure around the spinning object in a way similar to how airfoils work.

## Potential Design Considerations

### Airfoil Integration

Incorporating an airfoil design into the spinning top could be one approach. As the top spins, its edges could act like the wings of an airplane, generating lift. This would require precise design to ensure the top's spinning motion translates effectively into aerodynamic lift.

### Enhancing Spin Dynamics

Maximizing the rotational speed and stability of the top is crucial. Advanced materials and design techniques could be employed to create a top that spins with enough stability and speed to impact air pressure significantly.

## Challenges and Limitations

### Scale and Efficiency

The scale of the spinning top would be a limiting factor. A small toy-sized top is unlikely to generate sufficient lift. Scaling up the design introduces new challenges in terms of materials and the physics of spinning objects.

# Harnessing Vortices for Lift: A New Take on Aerodynamic Foils

## Introduction

Aerodynamics is a field ripe with innovation, constantly challenging and redefining our understanding of flight. A captivating question in this domain is whether applying a vortex to a foil or wing could serve as a viable concept for generating lift. This article explores the feasibility and physics behind using vortices to enhance the lift of aerodynamic foils, a concept that could revolutionize our approach to aerodynamic design and efficiency.

## The Principle of Lift in Aerodynamics

### Understanding Lift

Lift is the aerodynamic force that allows objects like aircraft to ascend and stay airborne. It's traditionally generated when the air pressure below an airfoil (such as a wing) is greater than the pressure above it.

### Role of Low Pressure

In conventional wing designs, the shape of the wing and its angle of attack create a pressure difference, with lower pressure on the upper surface and higher pressure on the lower surface, resulting in lift.

## Vortices and Their Aerodynamic Potential

### What is a Vortex?

A vortex is a spinning, often turbulent flow of fluid. In aerodynamics, vortices are usually seen as by-products of flight, particularly at wingtips. These swirling air masses can be powerful and are often considered in terms of their drag effects rather than their lift potential.

### Concept of Vortex-Induced Lift

The innovative concept here is to intentionally create vortices on or near a wing or foil to enhance lift. The idea is that a controlled vortex could lower the air pressure over the wing's surface more effectively, thus increasing lift.

## Potential Designs and Mechanisms

### Vortex Generators

One approach could be integrating vortex generators on the wing surface. These small, strategically placed devices could manipulate the airflow to create beneficial vortices, enhancing the lift without significantly increasing drag.

### Active Flow Control

Advanced systems could be developed to actively control airflow around the wing, using technologies like fluidic oscillators or synthetic jets to create vortices on demand, adapting to different flight conditions for optimal performance.

## Challenges and Considerations

### Controlling Vortices

Vortex behavior can be unpredictable and potentially disruptive. Ensuring that these vortices contribute positively to lift without causing instability or excessive drag is a significant engineering challenge.

## Efficiency and Practicality

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# The Rotating Cylinder as a Wing: A Journey Through Aviation History

## Introduction

The exploration of unconventional wing designs has been a consistent theme in aviation history. One such intriguing concept is the use of a rotating cylinder as a wing, known as the Magnus effect. This article delves into how a rotating cylinder can act as a wing and explores various examples throughout aviation history where this principle has been applied or tested.

## Understanding the Magnus Effect

### The Physics Behind the Concept

The Magnus effect occurs when air flows around a spinning object. The rotation of the object drags some air with it, creating a difference in airspeed on either side of the object. This difference results in a pressure differential, with lower pressure on one side and higher pressure on the other, creating lift.

### Rotating Cylinder as a Wing

In the context of aviation, when a cylinder is rotated rapidly, the air moving over the surface of the cylinder experiences different velocities. This variation in airspeed above and below the cylinder generates lift, similar to how a traditional wing works.

## Historical Applications and Experiments

### The Flettner Airplane (1920s)

One of the earliest applications of the Magnus effect in aviation was by Anton Flettner, a German engineer. He designed an aircraft with rotating cylinders instead of conventional wings, aiming to utilize the Magnus effect for lift. While the Flettner airplane flew, it was not as efficient as traditional designs and did not gain widespread acceptance.

### The Buckau, a Rotating Cylinder Ship (1920s)

Though not an aircraft, the Buckau, later rechristened as the Baden-Baden, was a ship equipped with rotating cylinders instead of sails. This ship successfully utilized the Magnus effect for propulsion, demonstrating the practical application of the concept.

### Modern UAVs and Drones

In recent years, the concept has seen a revival in the form of unmanned aerial vehicles (UAVs) and drones. These modern applications often explore the Magnus effect for its ability to provide vertical lift and maneuverability.

## Advantages and Limitations

### Unique Lift Capabilities

The Magnus effect can create lift in a different manner than traditional wings, potentially offering advantages in maneuverability and control, especially in compact or vertical take-off and landing (VTOL) aircraft.

### Efficiency Concerns

One of the significant limitations of using rotating cylinders as wings is efficiency. The energy required to rotate the cylinders can outweigh the aerodynamic benefits, making it less practical than conventional wings for most aircraft.

## Structural and Aerodynamic Challenges

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# Spinning Top Surfaces on Stationary Foils: A New Avenue for Lift?

## Introduction

In the quest for innovative aerodynamic designs, engineers and scientists constantly explore unconventional methods to achieve lift. One such intriguing concept is the idea of using a spinning top surface on a stationary foil to generate lift. This article examines the feasibility of this idea, the physics behind it, and its potential implications in aerodynamic design.

## The Concept of a Spinning Surface for Lift

### Theoretical Basis

The concept involves a stationary airfoil (or foil) with a portion of its surface designed to spin rapidly, much like a top. The idea is that the spinning surface could manipulate the airflow around the foil in a way that generates lift, possibly through mechanisms akin to the Magnus effect or by creating a low-pressure area above the foil.

### Relation to the Magnus Effect

The Magnus effect, typically associated with spinning cylinders or spheres, results in a lift force when a rotational motion impacts the airflow around an object. Translating this principle to a spinning surface on a stationary foil suggests the potential for a similar aerodynamic effect.

## Challenges in Application

### Engineering Feasibility

One of the primary challenges is the engineering feasibility of integrating a spinning surface on a stationary foil. This includes concerns about the structural integrity of the foil, the mechanics of the spinning component, and the overall aerodynamic efficiency.

### Energy Efficiency

The energy required to spin part of the foil's surface at a rate sufficient to impact airflow and generate lift is a significant consideration. This energy demand must be balanced against the aerodynamic benefits gained.

### Aerodynamic Complexity

The interaction between the spinning surface and the stationary parts of the foil introduces complex aerodynamic scenarios. Predicting and controlling these interactions, especially under varying flight conditions, would be challenging.

## Historical and Modern Context

While the use of spinning surfaces for lift is not widely documented in historical aviation designs, it aligns with modern trends in exploring alternative aerodynamic mechanisms. This includes research into active flow control, adaptive surfaces, and other methods to enhance lift and reduce drag.

## Potential Applications

### Drone and UAV Design

In the realm of drones and unmanned aerial vehicles (UAVs), where size, weight, and maneuverability are critical, such a design could offer unique advantages.

# Static Electricity and Plasma in Aerodynamics: Enhancing Lift on Wing Surfaces

## Introduction

The quest for improved aerodynamic efficiency has led to exploring various innovative techniques, among which the use of static electricity and plasma stands out. This article delves into the role of these phenomena in enhancing lift on wing or foil surfaces, a cutting-edge area in aerospace engineering that promises to revolutionize aircraft design and performance.

## The Basics of Lift Enhancement

### Traditional Lift Mechanisms

Conventional aircraft wings generate lift through their shape and motion through the air, creating a pressure difference between the upper and lower surfaces. Enhancements in lift are typically achieved through mechanical means, such as altering wing shape or surface.

### The Need for Advanced Solutions

With the increasing demand for efficiency, speed, and environmental friendliness, the aviation industry continually seeks more advanced methods to enhance lift while reducing drag and fuel consumption.

## Role of Static Electricity in Lift Enhancement

### Concept of Electro-Aerodynamic Lift

The idea of using static electricity involves creating an electric field over the wing surface. This electric field can alter the behavior of air particles around the wing, potentially reducing drag and enhancing lift.

### Challenges and Research

Implementing static electricity for lift enhancement poses significant challenges, particularly in generating a strong enough electric field without adding excessive weight or complexity to the aircraft. Research in this area is ongoing, with experiments exploring various methods of electric field generation and application.

## Plasma and Its Aerodynamic Applications

### Understanding Plasma in Aerodynamics

Plasma, often referred to as the fourth state of matter, is an ionized gas with unique properties. In aerodynamics, plasma can be used to manipulate airflow around a wing, influencing lift and drag characteristics.

### Plasma Actuators

One application is the use of plasma actuators on the wing surface. These devices ionize air molecules to create plasma, which can then be manipulated by electric fields to modify the airflow, enhancing lift or reducing drag.

### Benefits and Potential

The use of plasma for aerodynamic control offers several advantages. It is a non-mechanical means of airflow manipulation, meaning it has no moving parts, potentially reducing maintenance and mechanical failure. It also allows for more precise and adaptable control of airflow.

## Examples and Experimental Successes

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# Exploring Teflon Coatings for Static Charge Generation on Wing Surfaces

## Introduction

In the continuous pursuit of advancing aircraft efficiency, the integration of innovative materials and technologies plays a pivotal role. Building upon previous discussions about the enhancement of lift using static electricity and plasma, this article explores the possibility of using Teflon coatings on upper wing surfaces to generate static charge through airflow. We delve into the scientific principles behind this concept and assess its potential impact on aerodynamic performance.

## The Science Behind Teflon and Static Charge Generation

### Teflon's Unique Properties

Teflon, known for its non-stick and low-friction properties, is also characterized by its ability to accumulate static charge. This phenomenon occurs due to its high electronegativity, which makes it prone to gaining electrons and developing a static charge when in contact with other materials.

### Generating Static Charge through Airflow

The concept of generating static charge on wing surfaces involves using the airflow over the wing to create friction with the Teflon coating. This friction could potentially lead to the accumulation of static charge on the wing's surface, leveraging the principles of triboelectric effect.

## Potential Benefits for Aerodynamics

### Enhanced Lift

The static charge generated on the wing surface might influence the airflow around the wing, potentially reducing turbulence and drag, and enhancing lift. This could lead to improved aerodynamic efficiency, especially at higher speeds.

### Fuel Efficiency

Improvements in lift-to-drag ratio directly impact fuel consumption, offering potential for more fuel-efficient flights. This aspect is particularly appealing in the context of increasing environmental concerns and the aviation industry's efforts to reduce its carbon footprint.

## Challenges and Considerations

### Material Durability and Maintenance

Teflon's durability when exposed to high-velocity airflow and various weather conditions is a crucial factor. The coating must withstand the rigors of flight without significant wear or degradation.

### Safety and Control

Managing the static charge on an aircraft's surface poses unique safety challenges. It's essential to ensure that the charge does not interfere with the aircraft's electronic systems or pose a hazard during ground operations.

### Efficiency of Charge Generation

The efficiency of static charge generation and its effective impact on lift and drag needs thorough investigation. This includes understanding how different flight conditions affect the charge accumulation and its aerodynamic influence.



# Teflon in Gas Turbines: Generating Static Electricity Through Airflow

## Introduction

The quest for efficiency and innovation in turbine technology often leads to the exploration of unconventional materials and methods. One such intriguing idea is the application of Teflon as a coating material in the compressor section of a gas turbine. This article examines the feasibility of using Teflon to generate static electricity through the massive volume of airflow in gas turbines, where heat is not a significant factor.

## Teflon: Properties and Potential in Gas Turbines

### Unique Characteristics of Teflon

Teflon, known for its non-stick properties and high resistance to heat, also has the ability to accumulate static electricity. This trait arises from its tendency to gain electrons when in contact with other materials, a result of its high electronegativity.

### Concept of Static Electricity Generation

The idea is to harness the triboelectric effect, where friction between the Teflon coating and the air molecules in the compressor section of a gas turbine generates static electricity. Given the high volume and speed of airflow in this section, the potential for significant static charge accumulation exists.

## Application in the Compressor Section of Gas Turbines

### Role of the Compressor Section

In a gas turbine, the compressor section plays a crucial role in increasing the pressure of the incoming air, which is then mixed with fuel and ignited in the combustion chamber. The compressor's environment, predominantly characterized by high airflow rather than extreme temperatures, presents a suitable setting for Teflon application.

### Potential Benefits

Applying a Teflon coating in this area and generating static electricity could offer several benefits:

- Energy Harvesting: The static electricity generated could potentially be harnessed as a minor power source for auxiliary systems within the turbine or the broader system it powers.
- Improved Efficiency: If the Teflon coating also reduces friction between air molecules and the compressor blades, it could lead to a more efficient compression process.

## Challenges and Considerations

### Durability and Wear

The durability of Teflon under continuous high-speed airflow conditions is a primary concern. The coating must withstand the mechanical stresses without significant degradation.

### Safety and Electrical Control

Managing the generated static electricity safely is crucial. This includes ensuring that the static charge does not interfere with the turbine's operation or pose a risk to maintenance personnel.

### Quantifying Electricity Generation

The efficiency of static electricity generation under these conditions needs thorough investigation. It's essential to determine whether the amount of electricity generated is substantial enough to justify the application.

# Spinning Discs on Wings: Revolutionizing Lift with Low Pressure Centers

## Introduction

In the realm of aerospace engineering, the quest for enhanced lift and aerodynamic efficiency is perpetual. Building upon previous discussions about innovative lift mechanisms, this article explores a novel concept: the integration of spinning discs on the top surface of a long rectangular wing to create low-pressure centers for lift purposes. We delve into the theoretical underpinnings of this idea, its potential advantages, and the challenges it may present.

## Conceptualizing Spinning Discs for Lift

### The Idea

The proposition involves embedding spinning discs into the upper surface of a wing. These discs, when rotated at high speeds, are theorized to create areas of low pressure above the wing. According to aerodynamic principles, this low-pressure region could enhance the wing's lift capabilities.

### Relation to Aerodynamic Principles

This concept is partially inspired by the Magnus effect, where a rotating object in a fluid (air, in this case) creates a pressure differential. However, instead of a rotating cylinder or sphere, this approach uses flat, spinning discs embedded in a wing's surface.

## Potential Aerodynamic Advantages

### Enhanced Lift

The primary expected benefit is an increase in lift generated by the wing. The low-pressure areas above the spinning discs could effectively alter the airflow, reducing pressure drag and potentially allowing for more efficient lift.

### Control and Maneuverability

This system might offer novel ways to control lift distribution across the wing. By varying the speed and direction of the discs, it might be possible to dynamically adjust lift, aiding in maneuvers and stability.

## Engineering Challenges and Considerations

### Integration and Structural Integrity

Incorporating spinning discs into a wing's structure presents significant engineering challenges. The design must ensure the integrity and strength of the wing while accommodating the mechanical components of the discs.

### Energy and Efficiency Trade-offs

The energy required to spin the discs must be considered against the aerodynamic gains. The system's overall efficiency depends on whether the additional lift compensates for the energy expenditure and added weight.

### Aerodynamic Complexity

The interaction between the rotating discs and the airflow over the wing is complex. Predicting and controlling the aerodynamic effects, particularly under varying flight conditions, poses a substantial challenge.

## Historical Precedents and Modern Context

### Innovative Lift Mechanisms in Aviation History

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# Revolutionizing Aviation: Can Innovative Lift Mechanisms Reduce Noise in Drones and Aircraft?

## Introduction

The pursuit of quieter skies has become a paramount goal in modern aviation, particularly with the increasing use of drones and the growth of urban air mobility. Innovative concepts like spinning discs on wings, Teflon coatings for static electricity generation, and plasma actuation, previously discussed, not only promise enhanced aerodynamic efficiency but also pose an intriguing question: Could these advancements lead to a lower noise footprint for drones and aircraft? This article delves into the potential noise reduction benefits of these novel aerodynamic mechanisms.

## Understanding Noise Generation in Aviation

### Sources of Aircraft Noise

Aircraft noise typically originates from engines, aerodynamic friction, and turbulence around the aircraft's body and wings. Reducing this noise is crucial for minimizing environmental impact, especially in populated areas.

### The Challenge with Drones

Drones, known for their buzzing sound, produce noise mainly due to their rotors and airflow disruption. As drones become increasingly common, their noise impact is a growing concern in urban environments.

## Potential Noise Reduction Through Advanced Aerodynamics

### Spinning Discs on Wings

The concept of embedding spinning discs in wing surfaces, aiming to create low-pressure centers for enhanced lift, could potentially reduce noise. By altering airflow and reducing turbulence, these discs might lead to smoother air passage over the wing, diminishing aerodynamic noise.

### Teflon Coatings for Static Electricity

The use of Teflon coatings to generate static electricity in the compressor section of a gas turbine or on wing surfaces might also contribute to noise reduction. If these coatings lead to smoother airflow and less friction, they could reduce the aerodynamic noise generated by turbulent airflows.

### Plasma Actuators

Plasma actuators, used to manipulate airflow around the wing and enhance lift, could decrease noise by controlling boundary layer separation and reducing turbulence-induced noise, a significant contributor to the overall noise footprint.

## Challenges and Research Directions

### Balancing Efficiency and Noise Reduction

While these innovative concepts promise enhanced aerodynamic efficiency, it remains to be seen how effectively they can reduce noise. The key is balancing aerodynamic improvements with tangible noise reduction benefits.

### Integration and Complexity

Integrating these technologies into existing aircraft and drone designs presents significant engineering challenges. It requires not only structural modifications but also considerations for power consumption and weight.

## Empirical Testing and Validation

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