



High Temperature Impacting Flight Operations

For Prelims: Global Warming, Aviation Basics, Flight Operations.

For Mains: Impact of Global Warming on Aviation Industry, Causes, Impact of Plane Crashes, Implications and Way Forward.

[Source: IE](#)

Why in News?

Recently, several air operators cancelled their flights to Leh citing high temperature in the region that led to runway restrictions.

- The mountainous region has seen a rise in temperatures due to climate change in India's cold desert.

What is the Impact of High Temperatures on Aircraft Operation?

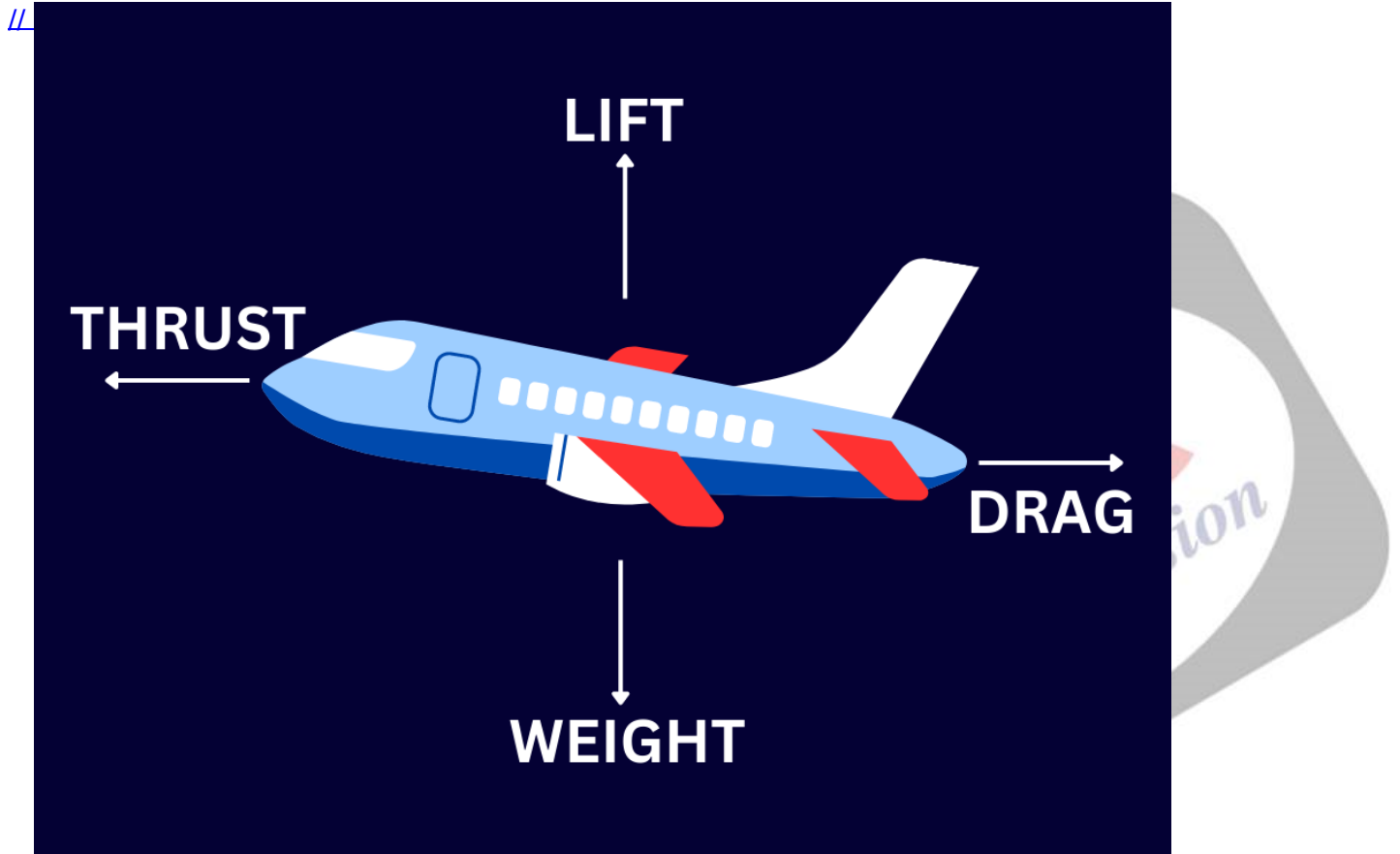
- **Reduced Lift:** Less dense air provides **diminished support for aircraft wings, necessitating higher speeds and longer runways** for takeoff. The **lift-to-drag ratio** is adversely affected, impacting overall aircraft efficiency.
- **Engine Performance Deterioration:** The combustion process within aircraft engines is compromised due to the **decreased oxygen content in thinner air**. This results in reduced engine thrust, further exacerbating takeoff challenges.
- **Extended Landing Distances:** The reduced effectiveness of reverse thrust in less dense air prolongs the landing process, requiring **greater runway length for deceleration**.
 - A 2023 study revealed that **global warming** is expected to **increase the take-off distance** for **Boeing 737-800 aircraft** by an average of 6% during the period of **2071-2080**, compared to 1991-2000.
 - This change is **particularly significant at low-altitude airports**, necessitating an additional 113-222 meters for take-offs in future summers.
- **Operational Constraints:** Airports situated at higher altitudes, where air density is naturally lower, are particularly **vulnerable to temperature-induced flight restrictions. During periods of extreme heat, takeoff weight limits may be imposed**, and flight operations could be suspended altogether.

Note

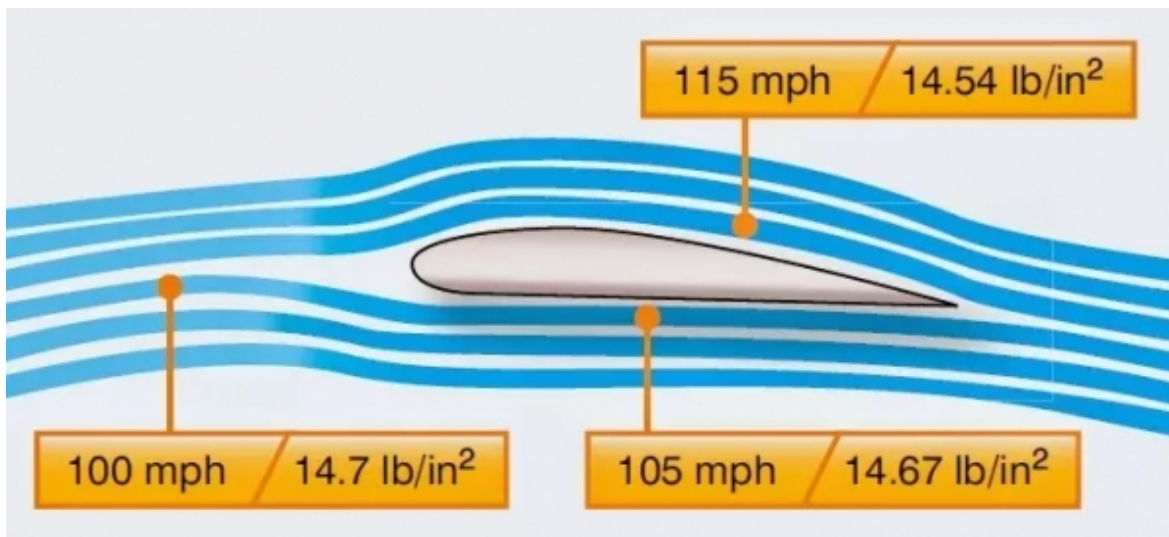
- The global average temperature has risen by at least **1.1 degrees Celsius since 1880**, with India experiencing an increase of approximately **0.7 degrees Celsius** compared to 1900 levels.

What is the Principle of Aircraft Flight Operation?

- All flying objects that use wings require air, as moving air generates a lifting force essential for maintaining the flight of kites, airplanes, and balloons.
- **An aircraft experiences 4 basic forces:**
 - **Lift:** The **upward force** acting on the aircraft which helps the airplane to fly.
 - **Drag:** The **backward force** caused by the resistance of air flow.
 - **Thrust:** The **forward force** produced by the engines of the aircraft
 - **Weight:** The **body and cargo weight** of the aircraft acting in a **downward direction**.



- **An aircraft flies when the lift force generated by its wings overcomes its weight.** To achieve this, the aircraft requires sufficient forward speed.
- The **engines** provide **thrust** to propel the aircraft forward. As the aircraft moves, the **airfoil-shaped wings** interact with the air, creating **lift**. This lift is generated due to a **pressure difference** between the upper and lower surfaces of the wing.
- The **curved upper surface** of the airfoil accelerates the air flowing over it, reducing the pressure according to **Bernoulli's principle**. Simultaneously, the air flowing under the wing is slightly compressed, increasing pressure. This pressure difference creates an **upward force, lifting the aircraft**.



- The **angle of attack**, the angle between the **wing and the oncoming air**, significantly influences lift. A small increase in angle of attack generates more lift, but excessive angles can lead to a **stall**.
- To maintain level flight, the **lift force must equal the aircraft's weight**. Pilots control lift by adjusting the wing's angle of attack and shape using control surfaces.

What are the Causes of High Temperature in Leh-Ladakh Region?

- **Altitude:** Leh-Ladakh's high elevation of approximately 3,000 metres **causes thinner atmospheric density**.
 - Further the region's **clear skies, minimal cloud cover, and sparse vegetation** which **increases solar radiation penetration** and results in **higher daytime temperatures** during the summer.
- **Topography:** The [Himalayas](#) and [Zaskar ranges](#) create a **rain shadow effect** (form rain shadow desert) by **blocking moisture-laden winds**, resulting in minimal precipitation.
 - This dry air **enhances temperature fluctuations**, causing higher daytime temperatures.
- **Climate Change:** [Global warming](#) has led to **rising temperatures globally**, affecting cold deserts as well. This phenomenon alters **local weather patterns**, potentially leading to warmer conditions in Leh-Ladakh.
- **Human Activities: Urbanisation and infrastructure development in Leh** and surrounding areas create **localised warming effects**, known as the [urban heat island effect](#).
 - "**Urban heat islands**" occur when **cities replace natural land cover** with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat, increasing energy costs, air pollution, and heat-related illness and mortality.
 - Additionally, increased human activity, including **tourism and military movement**, contributes to rising temperatures.



Drishti Mains Question:

What is Global warming and its implications on the aviation sector worldwide?

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims:

Q. "Momentum for Change: Climate Neutral Now" is an initiative launched by (2018)

- (a) The Intergovernmental Panel on Climate Change
- (b) The UNEP Secretariat
- (c) The UNFCCC Secretariat
- (d) The World Meteorological Organisation

Ans: (c)

Mains:

Q. 'Climate change' is a global problem. How India will be affected by climate change? How Himalayan and coastal states of India will be affected by climate change? (2017)

