**Aviating Turbulent Skies**

[Ameer Abdullah Khan](https://dailytimes.com.pk/writer/ameer-abdullah-khan/" \o "More Articles by Ameer Abdullah Khan)

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From prehistoric times to the present day, human beings have been fascinated by flying. However, like any other human endeavour, air travel is not exempt from the effects of nature. One such effect is air turbulence, which usually causes only minor inconvenience, but the recent climate change-induced increase in both the frequency and intensity of air turbulence has raised concerns within the aviation community.

Two recent episodes of severe air turbulence within a week have shaken the global aviation industry. A Singapore Airlines Boeing 777-300ER encountered intense turbulence while flying over Myanmar, resulting in the death of a passenger and injuries to 71 others. Just a few days later, a Qatar Airways Boeing 787-9 Dreamliner also faced severe turbulence, causing injuries to 12 passengers and crew members. Scientists are linking these occurrences to global climate change.

A study conducted by the University of Chicago suggests that for every 10C rise in the planet’s temperature, there could be a two per cent increase in the speed of winds in the ‘fastest upper-level jet streams’. This poses a paramount risk to the aviation industry as projections by the Intergovernmental Panel on Climate Change indicate a four-degree Celsius rise in Earth’s temperature by the end of this century.

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Scientific studies also show a direct relationship between global warming and clear-air turbulence (CAT), a phenomenon that is extremely difficult to predict. Researchers at the University of Reading have discovered a 55 per cent increase in CAT over the North Atlantic Ocean during the past four decades. Another study predicts a 15 per cent rise in CAT by 2059. The North Atlantic, a crucial route between North America and Europe is likely to witness the most drastic increase in air turbulence, with significant surges also anticipated in southeast China, the western Pacific, and northern India.

Globally, turbulence is estimated to cost the aviation industry around USD1 billion annually. While experiencing severe turbulence, aircraft face additional airframe fatigue and, in extreme cases, suffer structural damages, resulting in additional maintenance costs and downtime. Furthermore, airlines also pay hefty medical bills due to injuries to passengers and crew members requiring hospitalisation. Additionally, in the case of severe damages, the airlines have to pay for legal liabilities, which increases the costs by manifolds.

The age of melting ice sheets has put the aviation industry in a paradox. On the one hand, the industry contributes to global warming by relying on cheaper fossil fuels for high profits. On the other hand, it is adversely affected by climate change. Apart from turbulence, intense and frequent weather-related disruptions of operations, aerial detours, and altered flight routes, as well as physical and infrastructural damages due to extreme weather events, are major climate-induced threats to the aviation industry.

These looming threats call for proactive and sustainable measures. While they may not be economical or easy to implement, they are crucial for the industry to survive and thrive amidst the changing climate. The foremost priority needs to be given to sustainable aviation fuels (SAFs) produced from non-petroleum feedstocks, for reducing carbon footprints as compared to traditional jet fuels. Improving the fuel efficiency of aircraft through advanced aerodynamics, lightweight materials, and efficient jet engines is another imperative. Therefore, transitioning to newer and more efficient aircraft is now inevitable for several airlines, despite the significant upfront costs.

Besides these direct measures, the industry needs to collaborate with other sectors. Developing better weather forecasting tools for air turbulence and improving predictive technologies are essential. Each penny invested in advanced meteorological systems and predictive analytics will help the industry mitigate the impacts of climate-induced turbulence. Furthermore, the industry needs to participate in carbon offsetting measures such as renewable energy, afforestation and waste management to compensate for its emissions. While this does not reduce emissions at the source, it is a critical interim measure to balance out the industry’s environmental impact. Lastly, the industry needs to garner support from governments and international bodies. The industry needs to back policies and incentives for promoting greener aviation practices and for producing coordinated regulatory frameworks.

Despite likely resistance to such adjustments, the aviation industry has limited options for ensuring a sustainable future. Nevertheless, the industry has demonstrated remarkable resilience and adaptability in the past, and with concerted effort, it can rise to meet the demands of a greener future. By prioritising sustainability, the aviation sector can continue to connect the world while mitigating its environmental impact, ensuring safer and more sustainable skies for generations to come.

*The writer is a Senior Researcher at the Centre for Aerospace and Security Studies (CASS) in Lahore. He can be reached at info@casslhr.com*