International Journal of Advanced Research and Interdisciplinary Scientific Endeavours, Vol. 3(1), 2025
DOI: 10.61359/11.2206-2539

Case Study on Air India Flight -171 Crash

Shashank Sharma*, Bidisha Boruah †

Email Correspondence*: shashank.sharmaaseweurasia@gmail.com

Department of Aerospace Engineering, School of Engineering and Information Technology, IIMT University, Meerut, Uttar Pradesh, India.

Abstract:

This case study shows the detailed analysis of the recent devastating crash of Air India AI-171 , a Boeing 787-8 Dreamliner in Ahmedabad on June 12,2025 just after 5 to 10 seconds after takeoff at 1.38 pm from Sardar Vallabhai Patel International Airport enroute to London which have 242 people onboard including 230 passengers , 10 crew members and 2 pilots surviving only 1 passengers with fatal injuries , crash also resulted in multiple fatalities on ground , including medical students and residents near the impact site resulting in the death toll of 294. Preliminary investigations revealed that the aircraft lost altitude shortly after takeoff with the issuing of Mayday call by the pilot before the plane crashed into a residential area and exploded into flames. The Aircraft Accident Investigation Bureau (AAIB), supported by international agencies promptly initiated a multidisciplinary probe analyzing the Black Box Data and considering all possible causes such as Engine Failure and sabotage. The tragedy has exposed critical regulatory and safety shortcomings within the Indian Aviation Sector prompting calls for urgent systematic reforms.

1. Introduction

On June 12, 2025, Air India Flight AI-171, a Boeing 787-8 Dreamliner en route from Ahmedabad to London, tragically crashed mere seconds after takeoff, claiming the lives of nearly all 242 passengers and crew on board, as well as several individuals on the ground. This catastrophic incident not only shocked the global aviation community but also raised critical questions about aircraft systems, pilot actions, and regulatory oversight. This case study presents a comprehensive investigation into the causes and consequences of the crash, analyzing black box data, aircraft performance, and historical parallels to uncover key insights and recommend systemic reforms in aviation safety.

2. Flight and Aircraft Details

The flight code named AI – 171 of Air India, a Boeing 787-8 Dreamliner a wide body twin engine plane introduced in 2009 which headed towards the London Gatwick from Sardar Vallabhai Patel International Airport from Ahmedabad which has a capacity of 256 passengers and has 242 people onboard with the 10 crew members and 2 pilots with the majority of 169 Indians, 53 British Nationals, 1 Canadian National and other 7 Portuguese Nationals crashed at 1.38 pm and has a 1 British National named Vishwash Kumar Ramesh in seat 11A emerged as a sole survivor in the tragedy.

*Department of Aerospace Engineering, School of Engineering and Information Technology, IIMT University, Uttar Pradesh, India.
†Department of Aerospace Engineering, School of Engineering and Information Technology, IIMT University, Uttar Pradesh, India.

Article Timeline: Received: May 27, 2025; **Revised:** Jul 29, 2025; **Accepted:** Jul 30, 2025; **Published:** Jul 30, 2025

Figure-1 Boeing 787 Dreamliner [Source: www.snl.no/Dreamliner]

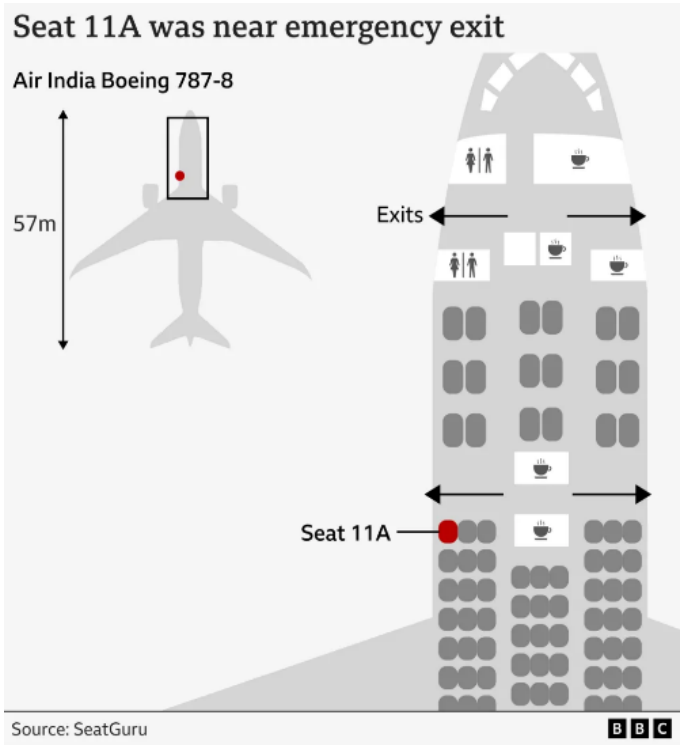

Figure-2 Seat 11 A showing Emergency Exit

[Source: www.ichef.bbci.co.uk]

3. Timeline of the Air India AI-171 Crash – June 12,2025

Table-1 Timeline of the Air India AI-171 Crash

Time (IST)	Event
1:38 PM	Aircraft takes off from Sardar Vallabhbhai Patel International Airport, Ahmedabad
1:38:05 PM	Aircraft reaches approximately 625 feet altitude
1:38:08 PM	Pilots issue a "Mayday" distress call indicating an emergency
1:38:10 – 1:38:15 PM	Aircraft begins a rapid and uncontrolled descent
Approximately 1:38:15 PM	Aircraft crashes into the Meghani Nagar residential area and doctors' hostel
By 1:39 PM	Fire breaks out due to crash impact and fuel; fire temperatures reach around 1500°C
1:41 PM	First emergency responders arrive at the crash site
June 13, 2025 (Evening)	Cockpit Voice Recorder (CVR) recovered, containing only six seconds of data
Following Days	Wreckage removal begins; both black boxes sent to the United States for decoding

4. What do we know about the plane?

The aircraft involved was a Boeing 787-8 Dreamliner. The model was launched 14 years ago. Just six weeks ago, Boeing lauded the fact that it had reached the milestone of carrying one billion passengers. Air India operates a fleet of more than 190 planes including 58 Boeing aircraft, according to its website. The crashed 787 Dreamliner was 11 years old and had completed more than 700 flights in the year leading up to the disaster, Flightradar24 data showed.

Sequences and Events

The flight took off from Sardar Vallabhai Patel International Airport at 1.38 pm which was scheduled to land on London Gatwick at 6.25 pm (BST) crashed shortly moments after take-off in the residential area at Meghani Nagar into a building that was used as doctors' accommodation at the Byramjee Jeejeebhoy Medical College and Civil Hospital when it had a lunch break in the hostel when parts of the plane crashed through the roof of the dining hall. The flight took off with 1,35,000 litres of fuel and shortly after take-off from runaway departing Ahmedabad only reaches at 625 feet when it starts to lose altitude significantly speculating the theory of Ram Air Turbine resulting in the failure of generation of thrust. This shows that the both the engines were failed to generate power and thrust leading to not generation of enough lift as the flight starts to lose altitude resulting in the issuance of "Mayday" call by the Pilots which is distress call in case of any emergency and catastrophic failures. There is also some theory that the flaps and slats are not fully deployed to maintain AOA (Angle of Attack) which can be responsible to not generation of lift and then aircraft was nose up position which means it has tried to gain altitude but landing gear is also not in the plane which increases drag and would eventually reaches 625 feet before crashing into the doctor's mess leading to the death of 19 people including 4 medical students with 60 injured and others hospitalized

due to injuries sustained by the accident. After the crash in minutes an emergency call was made but didn't respond to calls by ATC (Air Traffic Control). The intense heat of the crash, estimated at 1,500°C (2,700°F), hindered rescue and identification efforts for both passengers and ground victims. The take-off was perfect and just, I believe, short of taking the gear up, the aircraft started descending, which can happen only in case the engine loses power, or the aircraft stops developing the lift.

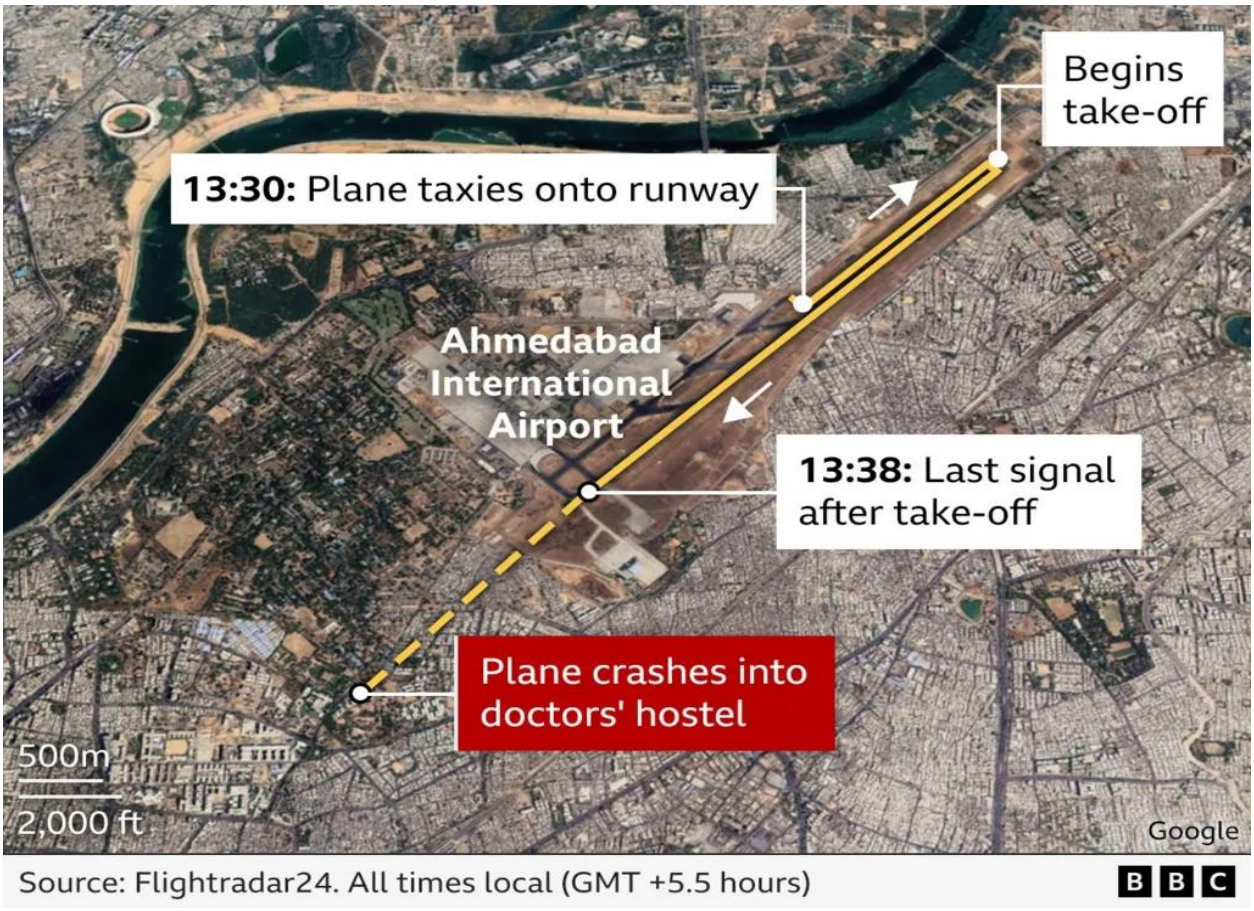

Figure-3 Flight Path of Air India AI-171: Final Moments Before Crash

[Source: ichef.bbci.co.uk]

5. After the Accident

Multiple fire engines and fire accidents were sent to crash site to carry out rescue operations, but the flame has a temperature around 1500 degree Celsius (2700 degree) Fahrenheit which hinder rescue operations. The DGCA has expected to initiate the formal investigation along with a possible team from Boeing. Experts also suggested that the heavy fuel load for the international route could have worsened the post- crash fire hindering rescue efforts. As per investigation reports , after this incident within 2-3 minutes police and other agencies reached the spot and almost 70%-80% of the area has been cleared. The UK govt. is working with the local authorities in India to establish the facts and support to those who involved, and the Boeing officials are also working with the Air India officials to determine the possible causes in the accident. The aircraft consists of 2 Black Boxes which include Cockpit Voice Recorder and Flight Data Recorder. 1 black box has been recovered within 28 hours, which is Cockpit Voice Recorder which has only 6 seconds of voice recording. But in recent investigations we hear that the 2 black boxes, but Indian Infra-structure

has not been fully equipped to decode the black box. Both of them were sent to the USA for the decryption or for further investigations.

Figure-4 Indian Army Engineers Mobilized to Remove Flight AI-171 Wreckage

[Source: ichef.bbci.co.uk]

Figure-5 Tail Section of Flight AI-171 Within Impacted Building

[Source: dims.apnews.com]

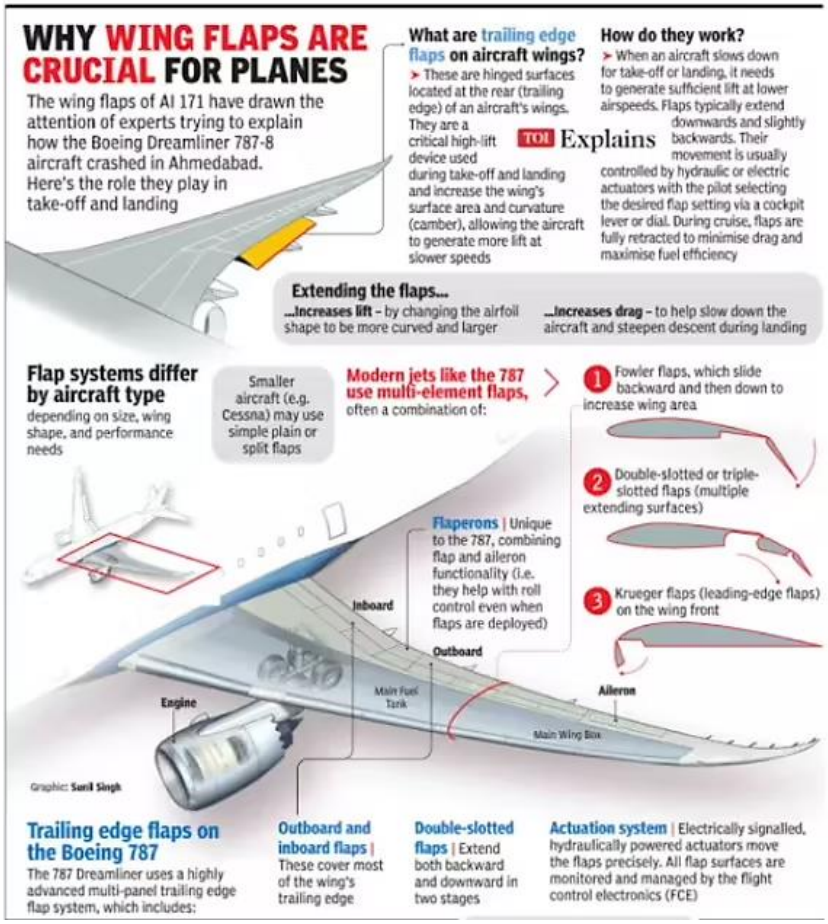

Figure-6 Why are wing flaps crucial in plane?

[Source: static.toiimg.com]

6. Did Wing Flaps Play a Role in Crash?

Aviation experts have told the BBC the position of the plane's wing flaps as it took off may have caused a problem for the plane. One video verified by the BBC shows the plane descending before a large explosion occurs as it hits the ground. "When I'm looking at this, the undercarriage is still down but the flaps have been retracted," aviation analyst Geoffrey Thomas said. Another expert, Terry Tozer, said: "It's very hard to say from the video for sure, it doesn't look as if the flaps are extended and that would be a perfectly obvious explanation for an aircraft not completing its take-off correctly." "That would point to potential human error if flaps aren't set correctly," said Marco Chan, a former pilot and a senior lecturer at Buckinghamshire New University. "But the resolution of the video is too low to confirm that."

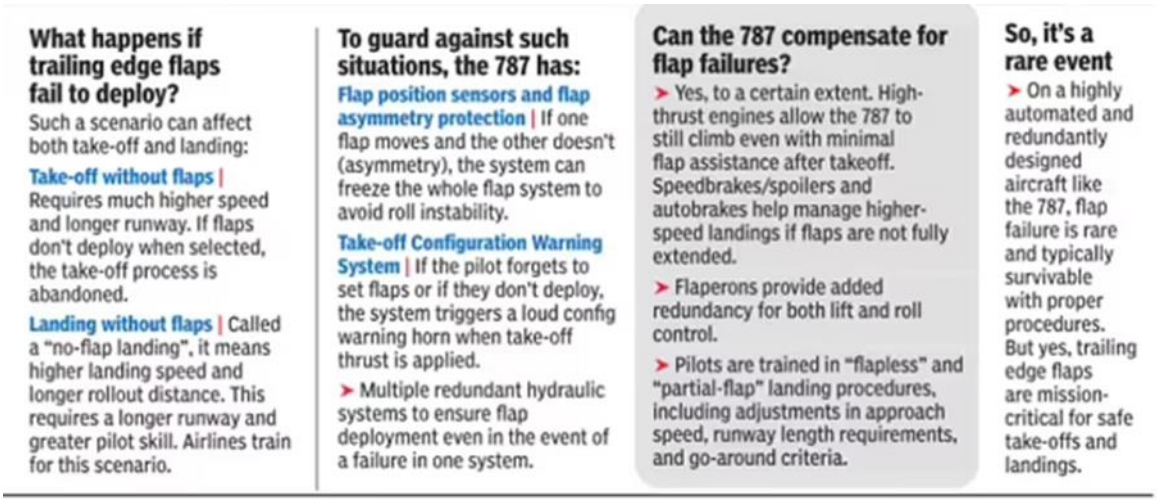

Figure-7 Boeing 787 Flap System Functionality, Failure Scenarios, and Redundancy Mechanisms

[Source: static.toiimg.com]

7. Investigation

Investigators will be probing all these possibilities – and more , all crash investigations rely on triangulation matching physical evidence from the wreckage with recorded aircraft performance data to determine what went wrong. Every component including scorched cable, damaging turbine blade, airplane maintenance log and signals and sounds from the flight data and cockpit voice recorders from the black box will be examined. The clues came from the wreckage of the two engines whether the engine were generating power at impact-turbines fractured differently when spinning at high-speed. Turbines are crucial rotating components that play a role in extracting energy to generate thrust. Then they search for Flight Data Recorder, and these devices capture extensive flight data and cockpit sounds and these voice recordings come from individual pilot mics, radio transmissions and an area microphone that picks up background noise in cockpit. Data recorders track with high precision the position of gear and flap levers, engine performance, fuel flow and even fire handle activation. If the recorder shows the engines were making full power then we will move to flaps and slats. Flaps and slats increase lift at lower speeds helping an aircraft take off and land safely by allowing it to fly slower without stalling. The Boeing 787's flight management control system is a highly automated suite that manages navigation, performance and guidance. It integrates data from a number of sensors to optimize the aircraft's flight path and fuel efficiency. After inspection of Air India's Boeing 787 fleet – 24 of 33 aircraft have been checked so far – " did not reveal any major safety concerns", adding that the planes and maintenance systems complied with existing standards. The wreckage is moved to a nearby hangar or secure facility, laid out to identify the nose, tail and wingtips, and then pieced together. Investigators will also examine fuel filters, lines, valves and residual fuel to check for contamination – something that's easy to detect or rule out and they will also gather maintenance and fault history records from airline and Boeing ACARS (Aircraft Communications Addressing and Reporting system) which transmits data via satellite to both Boeing and Air India. They review all flights operated by aircraft and the crew over recent months with the technical log of pilot-reported faults and corrective actions taken before release of aircraft to service. They will also examine pilot licenses, training records, simulator performance and instructor remarks – including how pilots handled scenarios like engine failures in advanced flight simulators and review the history of all service components of the aircraft that

were removed and replaced examining reported defects – or signs of problems that could have affected this flight. In a statement, Boeing said: "We are in contact with Air India regarding Flight 171 and stand ready to support them. Our thoughts are with the passengers, crew, first responders and all affected."

Comparative Analysis of the Air India AI-171 Crash with Historical Aviation Incidents

The Air India AI-171 crash in June 2025, involving a Boeing 787-8 that went down shortly after takeoff from Ahmedabad, shares key similarities with past aviation disasters such as Spanair JK5022 (2008), where improper flap configuration led to immediate stall and crash, and Asiana 214 (2013), where automation mismanagement caused a fatal descent. Preliminary signs in AI-171 suggest possible flap/slat misconfiguration and engine thrust loss, preventing sufficient lift at low altitude. The aircraft's failure to climb beyond 625 feet and only 6 seconds of cockpit audio further complicated investigation. Similar to Air France 447 (2009), which suffered from sensor failure and misinterpreted cockpit actions, AI-171 may also involve human error compounded by system limitations. These past incidents highlight the need for stricter pre-flight checks, better pilot training in manual overrides, improved black box data recovery, and stronger regulatory oversight. Drawing from these historical patterns, the AI-171 tragedy underscores that even modern aircraft remain vulnerable to basic configuration and communication failures if systemic checks are not rigorously enforced.

Regulatory and Industry Reaction to the AI 171 Boeing 787 Crash

Following the June 12, 2025, crash of AI 171, investigators determined that both engine fuel control switches were moved to "cutoff" within one second after takeoff, causing a dual thrust loss and subsequent crash in Ahmedabad with 260 total fatalities and 32 seconds of flight duration. In response, the DGCA mandated inspections of fuel control switch locking mechanisms on all Boeing 787 Dreamliners and select 737s, requiring airlines to report findings by July 21, 2025 . Global carriers—Lufthansa, Singapore Airlines, Japan Airlines and others—also performed precautionary switch inspections, finding no anomalies. The Aircraft Accident Investigation Bureau (AAIB) released a preliminary report confirming the switch movements, urged restraint in public speculation, and said further analysis under ICAO Annex 13 is underway. Air India's internal checks of its fleet revealed no issues, and the airline pledged full cooperation with investigators. Simultaneously, a multi-disciplinary government committee was convened, and Parliament called for audits and regulator-strengthening measures to enhance transparency and safety oversight.

Prevention by Indian Authorities

Air India ordered safety inspections and additional maintenance actions on fleet with GE Aerospace GEnx Engines after crash. India's aviation regulator has ordered safety checks on the airline's entire Boeing-787 fleet. The Directorate General of Civil Aviation has also announced that from 15 June one-time checks of take-off parameters will be implemented for every departure of a Boeing 787-7 or 787-9 plane. Power assurance checks will begin in two weeks.

Recent Advancements of Air India AI-171 Plane Crash

Just 3 seconds after takeoff the flight has reached its maximum recorded airspeed. Both engine fuel switches were inexplicably cut-off within a single second cutting fuel supply leading to confusion in both the pilots in cockpit with each pilot denying the responsibility of moving the fuel switches according to Bloomberg report there was a 10 sec delay before the first fuel switch was reset and another four seconds before the second was restored as the aircraft was too low and slow for the engines for to be reignited in

time to regain thrust as these 10 seconds are crucial as the aircraft is too low in order to regain thrust. This sudden shutdown triggered the cockpit alarms causing a psychological startle effect and momentary freeze in the pilot's response. Emergency systems such as Ram Air Turbine had deployed to provide minimal power but only to captain's controls forcing a rapid transfer of control from co-pilot to captain. Despite resetting the switches, the crew ran out of time the "Mayday" call was sent but the plane crashed resulted in losing of lives. There was no evidence of fuel contamination, mechanical failure, or bird strikes; equipment was otherwise appropriately configured. Attempts to restart the engines were unsuccessful because the aircraft had not reached sufficient speed and altitude for a successful relight.

8. Conclusion

The AI-171 investigation showcases notable advancements in India's accident investigation infrastructure, faster domestic technical response, and global collaboration, though significant uncertainties about the crash mechanism and contributing factors remain pending further analysis and public disclosure. The overall conclusion is that the AI-171 disaster was triggered by the unexpected cut-off of fuel to both engines immediately after takeoff. However, there is still no definitive answer as to whether this was due to human action, a design flaw, or an automation fault. The investigation has fueled continued debate and speculation, particularly regarding the role of cockpit automation and fuel switch design, but it has not closed the central mystery: why the switches were flipped at that critical moment. The Air Accident Investigation Bureau stressed ongoing work to identify root causes and to propose preventive measures, but the "haunting, unexplained detail" about fuel cutoff remains unsolved in the final published findings.

9. References

[1] AP News. (n.d.). India plane crash. https://apnews.com/article/india-plane-crash-cad8dad5cd0e92795b03d357404af5f8

[2] The Guardian. (2025, June 12). Air India Flight 171 plane crash: What we know about Ahmedabad-Gatwick incident. https://www.theguardian.com/world/2025/jun/12/air-india-flight-171-plane-crash-what-we-know-ahmedabad-gatwick

[3] The Guardian. (2025, June 12). Air India Flight AI171 plane crash live updates. https://www.theguardian.com/world/live/2025/jun/12/air-india-flight-ai171-plane-crash-ahmedabad-india-latest-updates

[4] NDTV News. (2025). Air India crash in Ahmedabad: Lack of lift, pilots yanking yoke—what may have happened in cockpit. https://www.ndtv.com/india-news/air-india-crash-ahmedabad-ai-171-lack-of-lift-pilots-yanking-yoke-what-may-have-happened-in-planes-cockpit-8649930

[5] The Guardian. (2025, June 16). Air India plane crash: Pilot and black box investigation. https://www.theguardian.com/world/2025/jun/16/air-india-plane-crash-pilot-black-box-ai171-ahmedabad

[6] AP News. (n.d.). Live: Air India plane crash AI171—Ahmedabad to London. https://apnews.com/live/air-india-plane-crash-ai171-ahmedabad-london

[7] The Times of India. (2025). Plane crashes in Ahmedabad's Meghani area. https://timesofindia.indiatimes.com/city/ahmedabad/plane-crashes-in-ahmedabads-meghani-area/articleshow/121798487.cms

[8] BBC News. (2025). Air India crash updates. https://www.bbc.com/news/articles/c5y5nq170z4o

[9] The Times of India. (2025). AI-171 crash probe: Ground handling agencies at SVPI Airport questioned. https://timesofindia.indiatimes.com/city/ahmedabad/ai-171-crash-probe-ground-handling-agencies-at-svpi-airport-questioned/articleshow/121916217.cms

[10] BBC News. (2025). AI-171 tragedy coverage. https://www.bbc.com/news/articles/c4gkd555jlko

[11] The Times of India. (2025). Ahmedabad Air India plane crash live updates. https://timesofindia.indiatimes.com/city/ahmedabad/ahmedabad-air-india-plane-crash-news-live-air-india-london-flight-crash-sardar-vallabhbhai-patel-international-airport-deaths-injured-rescue-operation-latest-updates/liveblog/121799226.cms

[12] AP News. (n.d.). India plane crash. https://apnews.com/article/india-plane-crash-cad8dad5cd0e92795b03d357404af5f8

[13] The Times of India. (2025). [Shortened URL source]. https://shorturl.at/7tjCI

[14] BBC News. (2025). The voices in the cockpit fuelling controversy over Air India crash. https://www.bbc.com/news/articles/cn9yw0rljwvo

10.Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

11.Funding

No external funding was received to support or conduct this study.