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December 2022

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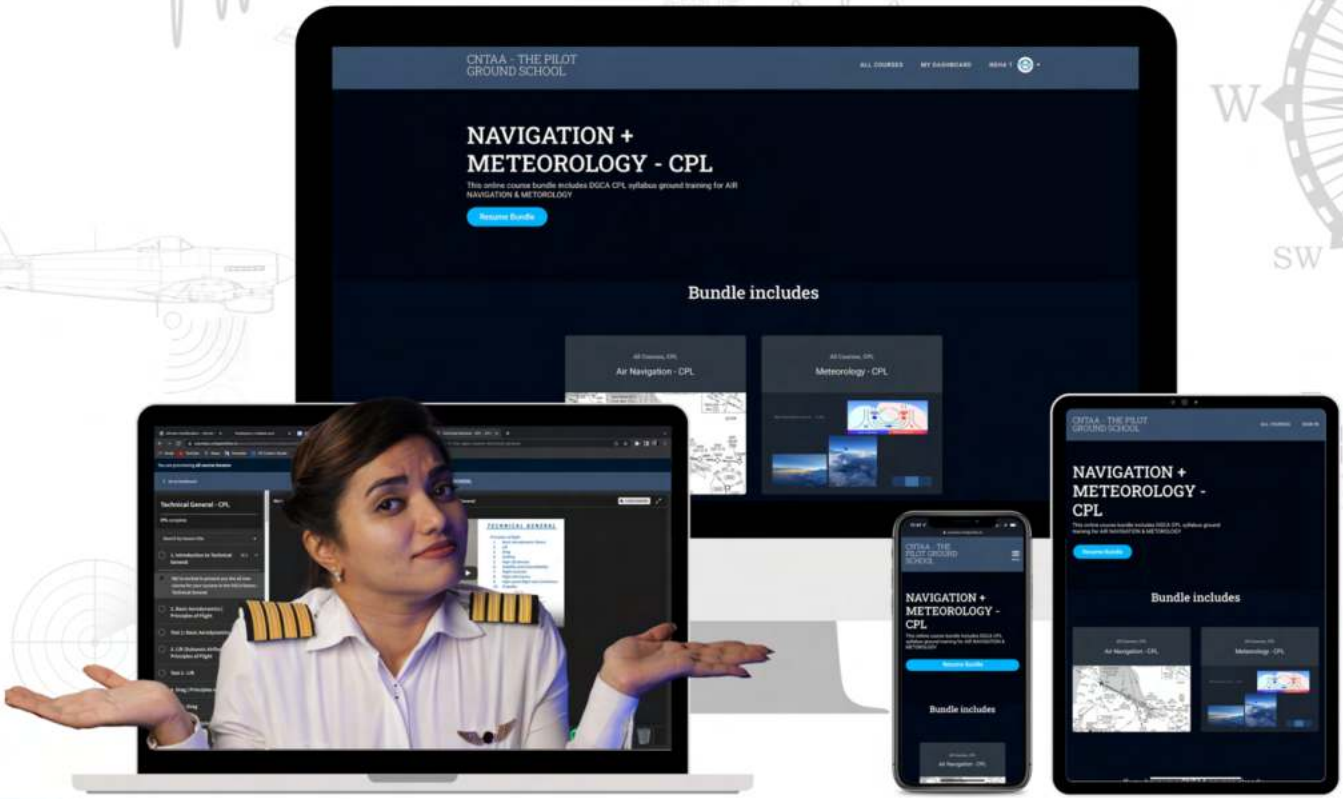
Engine Failure after Takeoff (EFATO)

Safety
Handling Dangerous Goods

Technology
Autonomous Taxiing, Takeoff, and Landing (ATTOL)

Business Aviation
Flying Private

History
Hijack of IC 814



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EDITORIAL DESK

Preet Palash
Editor

Dear Colleagues,

Welcome to the December issue of the 100 Knots Magazine.

With this issue, we complete one full year of our publication. This milestone belongs to the aviation community and us and demonstrates how connected we are. I want to thank all our readers for showing love and appreciation for our work. My special thanks to the industry experts who have come forward, contributed, and motivated us to keep going.

This anniversary coincided with the infamous Indian Airlines IC 814 hijack in December 1999. Today, while revisiting the traumatic events, we take a moment to appreciate this event's successful humanitarian and diplomatic outcome. This was possible thanks to the exemplary act of bravery demonstrated by the crew members and the passengers, the efficient negotiation skills of the Indian government and our allies, and, lastly, the power and motivation showcased by the Indian people.

In this issue, Capt. Balpreet Singh Bhatia talks about managing engine failure after takeoff (EFATO) and briefly takes us through his experience of EFATO in Patna. Mr. Rintu Chitrakar discusses the importance of Dangerous Goods awareness, training, requirements, and handling accidents. Prashant Prabhakar explains the history and new developments in Autonomous Taxiing, Takeoff, and Landing (ATTOL) technology by Airbus. Tanya Singh talks about the prospects and trends of Business Aviation in India.

As always, Contributions, comments, and feedback are always welcome. All papers are received with a high degree of enthusiasm and will find a home in future issues.

Our sincere thanks to all the contributors for their support and interest.

We hope to hear from you soon!

Happy Reading!

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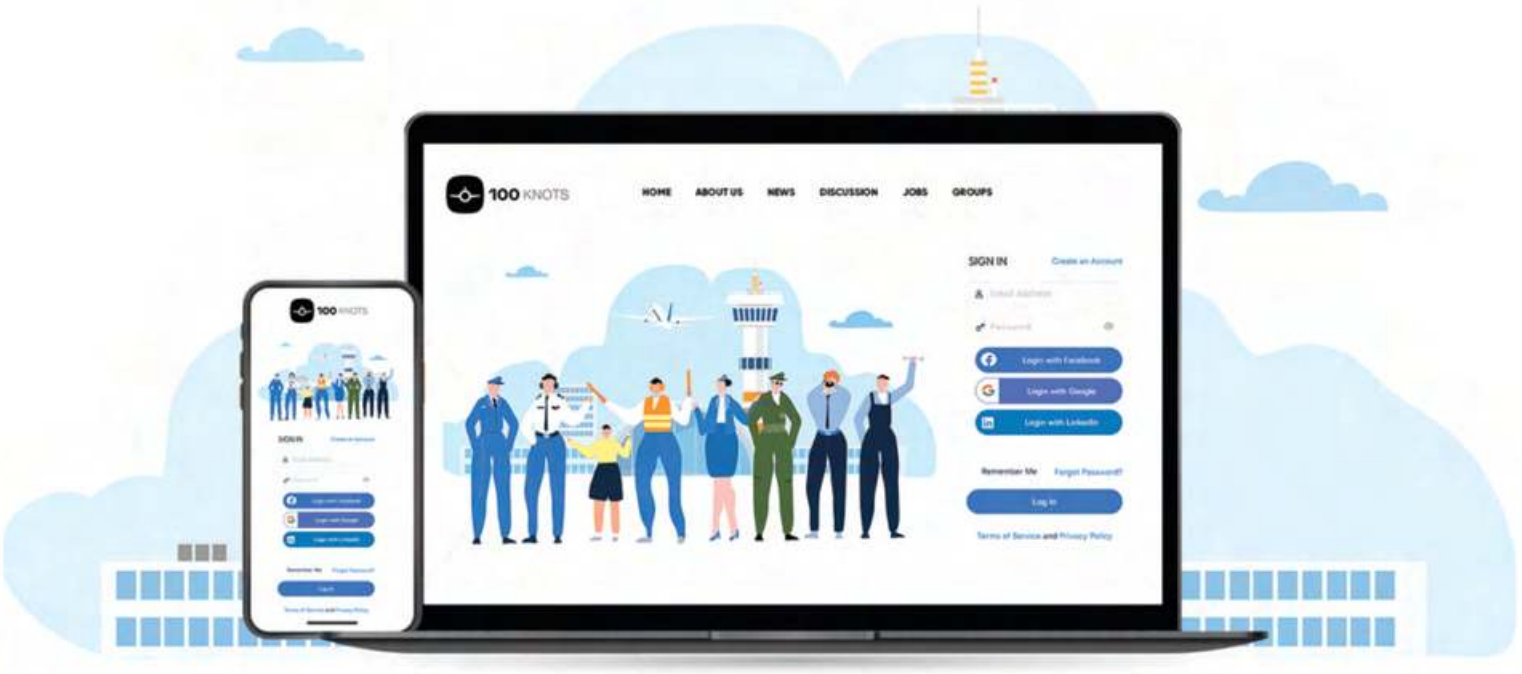

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Hijack of Indian Airlines IC 814

Radhika Bansal & Sakshi Jain

The Indian Airlines Flight IC 814 was hijacked after it took off from Nepal's capital Kathmandu on December 24, 1999. Over the next eight days, as the aircraft was taken to various destinations in the region, it was revealed that the hijackers belonged to a Pakistan-based terrorist group. The objective of the hijack was to secure the release of its leaders under captivity in India. The crisis ended on December 31, 1999 with the release of hostages in exchange for three terrorists from Indian captivity. Let's have a look briefly, how the events unfolded.

Timeline

24th December

16:25 IST

IC 814 takes off with 180 souls from Kathmandu Airport, two hours behind schedule

16:55 IST

Senior steward Anil Sharma confronted by one of the hijackers, informed him the plane was being hijacked and that he was carrying a bomb. Hijackers demand it be flown west to Lahore. Captain Devi Sharan notifies ATC that they were running low on fuel and had not been allowed to land in Lahore by Pakistani ATC. Sharan requests ATC to reach out to Pakistani Authorities and obtain permission to land, as the hijackers did not want to land in India and had already threatened to execute 10 hostages.

18:00 IST

Indian High Commission in Pakistan requests the authorities, permission is denied. Low on fuel, Captain Sharan convinces hijackers to land in Amritsar Instead for refuelling.

18:40 IST

Crisis Management Group instructs to delay the plane for as long as possible including slow refuelling and deflating the aircraft tires if necessary.

18:45 IST

The Prime Minister of India, Atal Bihari Vajpayee briefed regarding situation, a full hour and 40 minutes after the hijacking.

19:05 IST

IC 814 Lands in Amritsar.

19:40 IST

Hijackers upset by the delay in refuelling claim to kill 5 hostages. Captain Sharan advises ATC that hijackers have begun killing hostages, requests to refuel as fast as possible to prevent any additional deaths. Passenger Satnam Singh is attached with a knife, causing several wounds to the neck.

19:51 IST

No rescue operation could be undertaken and IC 814 takes off again without refuelling. With just 15 minutes of fuel remaining, Captain Sharan tell ATC, "We are all dying". NSG commandos arrive at the airport after the departure of IC 814.

20:11 IST

Pakistani ATC again denies permission to land turns off all airport lights and navigational aids. Out of fuel, Captain Sharan attempted to land without any lights , nearly landing on a highway. Following this, IC 814 is finally allowed to land at Lahore. India's request to have the plane grounded is denied by Pakistan.

10:43 IST

After refuelling the flight departs into Afghan airspace with Kabul as destination. Authorities deny landing permission due to no night landing facilities at Kabul.

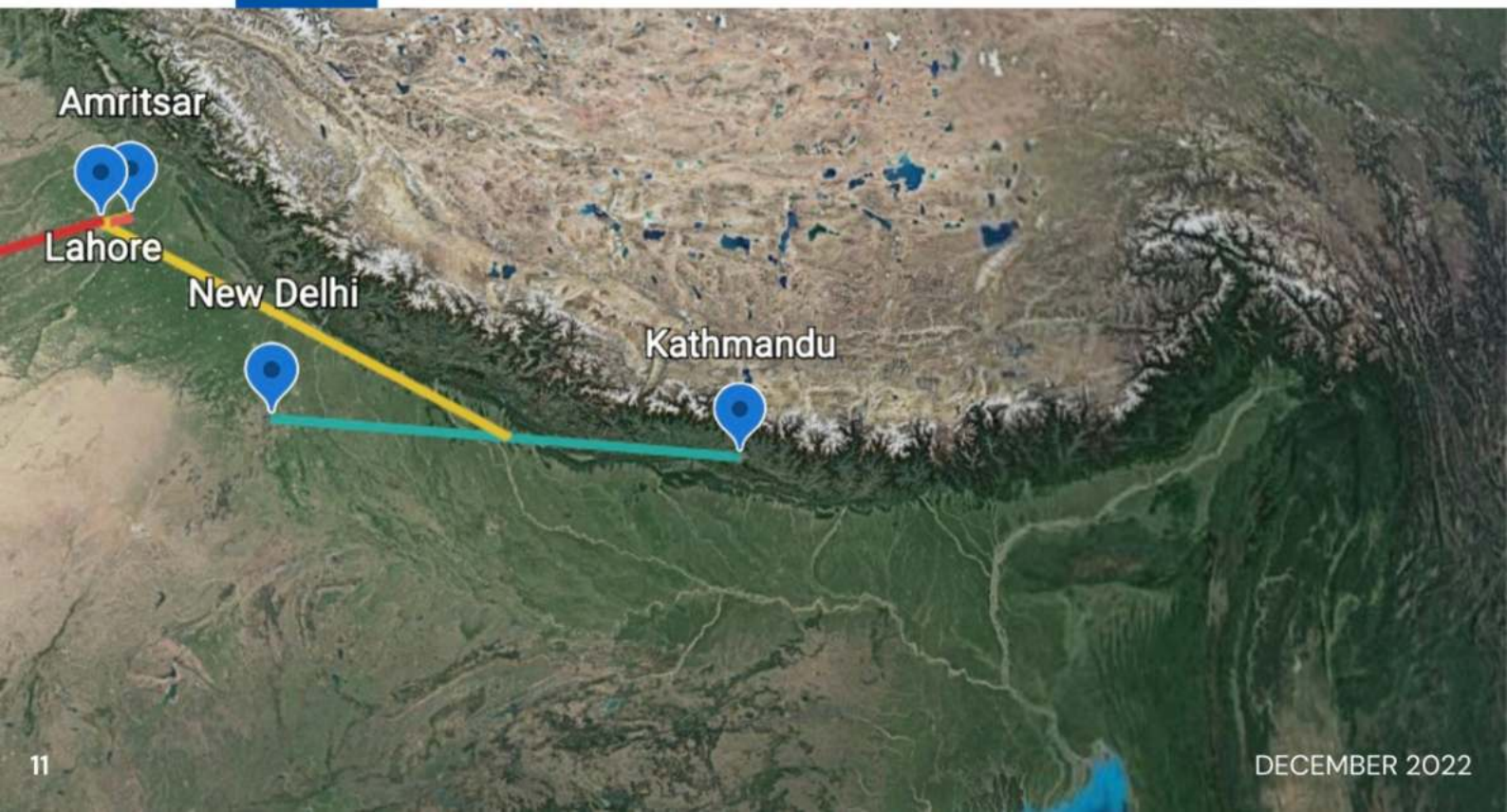
25th December

01:35 IST

IC 814 is denied landing in Oman, Hijackers push to lands in Dubai international airport. UAE allows landing at the Al Minhad Air Base. 27 passengers and the body of Rupin Katyal, killed by the hijackers, are released. Indian authorities request to assault the aircraft with Indian commandos trained in hijack rescue refused by UAE government. Indian Ambassador to UAE, KC Singh, and Asoke Mukherjee, Consul General in Dubai, are not allowed to enter the air base till the aircraft departs.

08:39 IST

IC 814 lands at Taliban-controlled Kandahar Airport. Taliban militiamen fighters encircled the aircraft to prevent any Indian military intervention. National Security Advisor Ajit Doval finds two Inter-Services Intelligence (Pakistan) officers there.



26th December

India's lack of previous contact with the Taliban regime complicated the negotiating process. External Affairs Minister Jaswant Singh's press conference is interrupted as family members of the hostages storm the briefing room. India dispatches AR Ghanashyam, Counsellor at its Islamabad High Commission to make official contact with the Taliban.

27th December

India's lack of previous contact with the Taliban regime complicated the negotiating process. External Affairs Minister Jaswant Singh's press conference is interrupted as family members of the hostages storm the briefing room. India dispatches AR Ghanashyam, Counsellor at its Islamabad High Commission to make official contact with the Taliban.

The negotiations drag on over the next three days. These demands included the release of 36 detainees, the body of Sajjad Afghani, the founder of HuM (Harkat-ul-Mujahideen), and US$ 200 million. Surprisingly, the Taliban mediates the hijackers out of their demand for cash and reduces the negotiations to three prisoners only, Maulana Masood Azhar, Mushtaq Ahmed Zargar and Ahmed Omar Saeed Sheikh.

December 30

With no other alternatives and little time left, the Indian government agrees to release the three terrorists.

31st December

Jaswant Singh leaves with the three terrorists. The hostages are released after the three terrorists arrive in Kandahar.

A special plane then departs for India with Singh and the freed passengers of IC 814. The hostages arrive home and a long process of review and investigation begins

Hijackers

Ibrahim Athar, Sunny Ahmed Qazi, Shahid Akhtar Sayed, Zahoor Mistri & Shakir (Left to Right)

Released Terrorists

Mushtaq Ahmed Zargar

Zargar was born in Kashmir and considered the front man of the terror outfit Al-Umar Mujahideen, involved in terrorist activities and separatist movements in the Kashmir valley since mid-80's. In August 1989, Zargar carried out the kidnapping of Rubaiya Sayeed, the daughter of then Home Minister of India Mufti Mohammad Sayeed and secured release of five of his comrades. Zargar was arrested on May 15, 1992, and incarcerated in Srinagar. He currently lives in Pakistan.

Ahmed Omar Saeed Sheikh

British national of Pakistani origin and former London School of Economics student, Omar was affiliated to various terror outfits. He was arrested in 1994 for the kidnapping of four foreign tourists. He was held captive at Tihar Jail, New Delhi.

Masood Azhar

Arrested in 1994 when he had come to India to settle some disputes between different factions of the jihadist outfit, the Harkat-ul-Ansar (HuA). Several attempts were made to secure his release including kidnapping foreign tourists and even prison break. He was held captive at Kot Balwal prison, Jammu. BBC News described him as "the man who brought jihad to Britain. On 1 May 2019, Masood Azhar was listed as an international terrorist by the United Nations Security Council. Masood Azhar is rumoured to be rotating between Afghanistan and Pakistan.

Since then, the three have been linked to additional terrorist attacks, including the 2001 attack on the Indian Parliament, the 2002 abduction and death of Daniel Pearl, the 2008 Mumbai terror attacks, the 2016 Pathankot attack, and the 2019 Pulwama attack. Al-Qaeda and Osama bin Laden provided organisational support for the kidnapping.

Aftermath

Policy Changes

Before the IC814 hijack, India has not laid down any regulations or a clear strategy on how to handle such instances. The result: Three militants were freed after the eight-day conflict, leaving 17 people were hurt, and 1 casualty. Eighteen years after the hijack, in 2017, a new anti-hijack law was formalised by the Indian government which provides it with the authority to pursue down and punish hijackers without showing any mercy. The new anti-hijack law punishes hijackers with the death penalty for any fatalities, including those of ground crew or security officers. The previous law only granted death when hostages died.

The term "hijacking" has also been expanded to encompass threats, attempts, and aiding and abetting the commission of the crime; under the new law, even individuals who plan or lead someone else to perform the crime would be considered hijackers.

Aircraft

Registration: VT-EDW
MSN/Serial number: 36
Type: 300B2-101
First flight date: 05 OCT 1976
Delivery Date: 29 NOV 1976
Engines: 2 x GE CF6-50C

After returning from Kandahar, the plane was impounded as case property on February 5, 2000, and stationed at the airliner's Airbus 300 hangar at Mumbai. While the case went on, the airliner floated a global tender for the plane's sale on March 22, 2000. No bids were received and the tender was repeated two months later. On May 30, 2000, the Florida-based Aviation System International Inc. (ASI Inc.) sent a bid of $23,75,000. The offer was accepted within a week and the Ministry of Civil Aviation granted approval on September 25, 2000. Subsequently, an earnest amount of $1,18,000 was deposited.

Indian Airlines then approached a Patiala court seeking permission for sale. The court, however, turned down the plea. Following this, the airliner moved the Punjab and Haryana High Court which while allowing the sale, ordered prior preparation of a 10 feet model of the aircraft. Also, Indian Airlines was asked to facilitate detailed photography and videography of the plane. Once this was done, VT-EDW was all set to make the journey to Florida in February 2001.

Fate, however, again threw a spanner in the works. ASI Inc. first expressed inability to take delivery of the plane on technical grounds and then declined to pick it up due to "non-availability of maintenance slot". Frustrated by the continuous wrangling, Indian Airlines decided to "cannibalise" the plane in December 2001. This involved removal of all functional parts and spares. (The Hindu, 2002) Three and a half years after the hijacking, Indian Airlines sold the hijacked plane for scrap in May 2003, and it was then dismantled and demolished in Mumbai in December 2003.

Crew

Captain Devi Sharan – Continued to serve Air India until his retirement in 2020

First officer Rajinder Kumar – Flying with Air India as a Captain on B777

Flight engineer Anil Kumar Jaggia – Continued to work for Air India until his retirement. He passed away 8 years ago.

Senior Flight Purser Anil Sharma - Sharma worked with Air India for 32 years till 2012. He released a book named "IA's terror trail" in 2014 recalling the incidents of the hijacking.

Flight Purser Sateesh – Presently working with Air India

Cabin Crew

Kobita Mukherjee – Kobita took early retirement.

Kalpana Mazumdar - Presently working with Air India

Rajni Shekhar - Presently working with Air India

Sapnarani Menon - Presently working with Air India

Tapa Debnath – Unknown/Couldn't be reached

Sabita Khalkho – Unknown/Couldn't be reached

Passengers

Crew and passengers were threatened with death, beaten up, tied up, and separated from their wives and kids while wearing blindfolds. They weren't allowed to move as they all sat still with their heads on our knees, crushed rigid with the other passengers into those economy seats breathing spoiled breaths with the smell of sweat, vomit, and faeces.

The only casualty, Rupin Katyal, was pulled by his hair to the front of the aircraft and brutally stabbed numerous times in the neck. He had travelled to Kathmandu for a honeymoon and had only recently tied the knot 15 days prior. Sadly, he passed away before arriving in Dubai as a result of inadequate medical care in Lahore. Rachna and Rupin Katyal were wed on December 3.

Conclusion

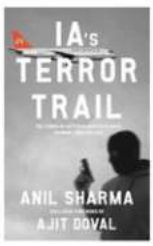
The Hijack of IC 814 was one of the most dramatic hostage crisis, the country has ever seen before 26/11 Mumbai terror attacks. The hijack shook prime minister Atal Bihari Vajpayee's NDA government thatwas confronted with one of its toughest choices, the choices that continue to haunt us even today.

A lot has changed since then. From security protocols at the airports to the use of advanced technology to better coordination and information sharing with airport authorities of neighboring countries, India's security management at airports has improved manifolds in the last 20 years. Thanks to these efforts, there have been no major terrorism related incidents at any of the airports in India since IC-814. Today,India's security management at airports is considered one of the finest. There are regular high alerts issued at airports whenever any terror group issues a threat or intelligence agencies receive information on a hijacking plan.

However, with advancement of technology, threats to aviation continue to evolve. It is clear risks cannot be totally avoided or eliminated. However, the goal is to reduce, as far as practicable and reasonable. There is need for a robust Security Management System, an entity with a framework of operating principles and guidance which will enable enhanced security performance by proactively managing risks, threats, and areas where there are gaps and vulnerabilities. Authorities will also need reforms in infrastructure. For example, India's plans to install full body scanners at Indian airports have not fructified even after a decade except some trials that went on at couple of major airports. Similarly, the perimeter security of several airports remains a concern.

Read More

In addition to this, in the book Flight into Fear: A Captain's Story, Captain Devi Sharan (Commander of IC814) detailed what transpired.



Flight engineer Anil K. Jaggia also wrote a book specifically depicting the events that unfolded during the hijacking ordeal titled IC 814 Hijacked! The Inside Story.

IA's Terror Trail is a first-hand account of the Flight Purser in charge of the cabin on IC 814, Anil Sharma and narrates the story of Indian Airlines, that was hijacked sixteen times, from 1971 to 1999.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Managing Engine Failure after Takeoff

Balpreet Singh Bhatia
Senior First Officer B737
SpiceJet

With an average of one accident in over 10 million flights, flying is certainly one of the safest modes of travel in today's world. With advancement in Aerospace technology, these beautiful machines rarely fail, but it wasn't always this way.
In the early days of jet engine powered transport aircraft, engine failures, in all phases of flight, were a fairly frequent occurrence. Statistics from the 1960's indicate that failures resulting in inflight shutdowns occurred at an approximate rate of 40 per 100,000 flight hours (or 1 per 2,500 flight hours). This rate is the equivalent of every engine failing once every year. By contrast, the failure rate of the engines installed on current generation aircraft have a failure rate of less than 1 per 100,000 flight hours.

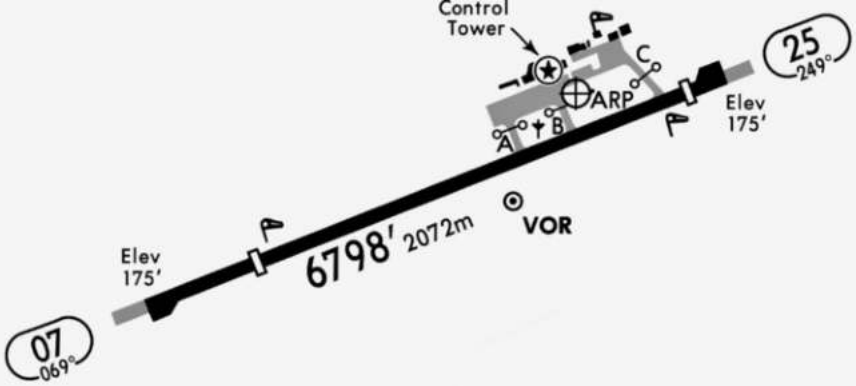
However, when engines do fail, Flight crew competencies with knowledge of Engine failure procedures, Familiarity with Flight control characteristics and manual flight control skills are instrumental in a favorable outcome. All of this came in handy on the 19th of June this year, on my flight SG723 from Patna to its scheduled destination, New Delhi. The flight was operated by the Pilot in Command, Capt. Monica Khanna, and Second in Command, Balpreet Singh Bhatia (myself). But before we go any further, let me tell you a bit about the Boeing B737 and Patna Airfield.

The Boeing B737

The Boeing 737 is a narrow-body aircraft produced by Boeing since 1967. As of September 2022, 15,348 Boeing 737s have been ordered and 11,154 delivered making it the second highest-selling commercial aircraft after the competing Airbus A320. Over 80 of these types are being operated in India currently with Air India Express, SpiceJet, Vistara and Akasa.

Boeing 737 comes with state-of-the-art avionics. It can automatically land in zero visibility without any input from the pilots (unless a failure occurs). It has the capability to fly over 7 hours at a stretch with speed of over 1000 KM/Hr. It can accommodate approximately 210 passengers, depending on the configuration of the aircraft.

Patna Airport



Jayprakash Narayan Airport (VEPT/PAT) serves the city of Patna and neighboring districts. It is named after the independence activist and political leader, Jayprakash Narayan and presently the 14th busiest airport in India. Airport has one runway designated 07/25 with length of 2072 meters.

Patna is a special airport and it has more than one reason to be so. One of the major issues with Patna airport is the surprisingly short runway of 2000m, probably the shortest of all international airports in India. For your perspective, the adequate runway length required for a safe landing of two most common types operating here, the Boeing 737s and Airbus A320s is 2,300 meters. This is the reason Patna Airport has been categorized as a Cat C airport that places it in the same league as Kathmandu or Leh airports. Cat C categorization means operations are considered challenging and special flight crew training is required to operate here.

The Airport is fully submerged in one of the most populated areas of the state located right in the middle of the city, with presence of open abattoir and meat shops around the airport that invite birds and increasing chances of bird strikes. If that's not enough, Patna Zoo, surrounded by tall trees shares the boundary with the airport. These tall trees act as an obstacle for aircraft, hinders the pilots' vision and become the perfect spot for birds to build their nests, increasing the chances of bird strikes.

Back in 2000, as many as 60 people were killed after an Alliance Air Flight 7412, a Boeing B737-200 nose-dived and crashed into a residential area near the airport. Though it had nothing to do with the airport and the reason for crash was pilot disorientation, the crash was one of the worst air accidents in the history of India.

Engine Failure in Flight

Engine failures, however uncommon does happen from time to time. There are six main generic causes for Engine Failure in Modern Turbojet Engines namely:

Fuel
This could be due to fuel contamination, starvation (fuel is not getting to the engine from the tanks), exhaustion (no fuel left in the tank), or pump failure.

Volcanic Ash Encounter

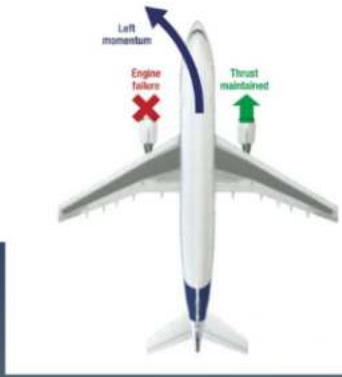
Heavy Rain, Hail or Icing

Bird Strike
More than 90% of foreign object debris (FOD) damages to aircraft engines can be attributed to avian creatures.

Engine Stall
Caused due to disruption of airflow because of compressor blades inability to compress air from the front to the rear of the engine.

Engine Control Malfunction
The most critical time for an engine failure is just as the airplane lifts off. Due to the lack of altitude, runway remaining to stop and the sudden asymmetry of thrust, Engine failure immediately after takeoff provides the least margin and the greatest chance for disastrous results.

The good news is that all commercial aircraft are designed in a way that they can climb, cruise and safely land if an engine fails. In fact, most airlines and pilots wouldn't even consider losing an engine during flight as a particularly serious problem, with all personnel trained extensively in order to deal with it. As these scenarios cannot be practiced in real aircraft, simulators provide the only opportunity to practice this emergency safely. It is Infact a part of regulatory requirement and at every license check, pilots need to demonstrate their proficiency in handling engine failure on take-off, a single engine precision and a non-precision approach, and a go-around.



Now that you know some background, let me take you through my experience on that day. Please be advised that this recount is not extensive and has been simplified for a broader audience.

D-Day

With 185 passengers on board, we were given pushback for Runway 25. We planned a No Engine bleeds take off, a supplementary procedure for takeoff where the entire power of the engine is dedicated to the takeoff so that the Aircraft can leave the runway and get airborne as quickly as possible. It's a common procedure followed at airports with shorter runway lengths. Everything went as per the plan and we were cleared to enter and backtrack on runway 25 for takeoff. After completing all the necessary checklists, ATC cleared us to take off from runway 25.

As soon as we heard V1 (Callout) Boom, we hear a continuous, massive thud noise and severe vibrations from the left side. My instant reaction was that maybe the landing gear has collapsed. Since we were past our decision speed (V1), we continued with the takeoff.

At 50 feet, ATC called us informing us that our Left engine was on fire. Surprisingly, there were no fire warning in the cockpit.

At this point, our aim was to safely control the airplane and put it on the correct trajectory. Like all airliners, Boeing procedures dictate, no actions to be taken until reaching 400 feet, except the once essential for performance like putting the landing gear up or selecting maximum power (TOGA). This is to ensure that pilots are not distracted and obstacle clearance is achieved.

At around 400 feet, we got a call from our cabin manager. One of the passengers had seen the engine on fire and came running to inform him. I then asked him, "Which engine? He replied, "I'll check and get back to you."

At around 600 Ft, the ATC again called us and informed us that our left engine was on continuous fire.

At about 850 feet, we got a call from our crew working at the back of the aircraft confirming fire on the left engine.

The aircraft was producing a continuous loud thud noise and severe vibrations throughout. However, there were no indications of fire in the cockpit. This can happen sometimes if the fire has not activated the sensors. We immediately initiated our Engine Fire Memory actions, which eventually guided us to shut down the affected engine.

With just one engine running, we didn't have the luxury of time. We completed the non-normal checklist, calculated the landing distance and decided to turn back and land in Patna, our obvious choice given the nature of emergency and proximity to the airport. ATC cleared us for an ILS approach to runway 25. For those who don't know, ILS is a facility that provides vertical and lateral guidance to an airplane that is aligned to the centerline of the runway for landing. It helps the pilots maintain the centerline of the runway and shows if the aircraft has deviated from the correct track.

These aircraft are beautifully designed, keeping these situations in mind and having experienced it firsthand, I am even more amazed with the capabilities of this machine. We landed and stopped right in the middle of the runway, without any casualties or further damage to the aircraft. All 185 passengers were deboarded safely.

Post landing, investigation showed three fan blades damaged due to a bird hit.

Having experienced this, I have few tips for my fellow aviators that could be helpful not only in emergencies but also in daily operations.

Staying calm is key
It helps in avoiding the startle effect, identifying the correct malfunction and initiating the correct. In the past, many similar emergencies had catastrophic outcomes because pilots rushed into the procedure, missing out on important steps. On a personal note, practicing meditation regularly has benefitted me in stay calm in my personal life and enhancing my decision-making abilities.

Rest well
Having proper and sufficient rest before the flight helps to keep you alert and ready to react in any situation.

Healthy Cockpit Environment
Having a healthy, friendly, and positive cockpit environment helps promote proper communication between the crew. This can be achieved by being respectful while motivating and trusting each other.

Communicate with Crew
They are our eyes and nose in the back. Communication between cabin and flight deck should be open and free.

Follow the Procedures
These procedures are established after a thorough brainstorming by industry experts and most importantly lessons from past accidents. Strict compliance is therefore necessary. This includes flight preparation, following SOP's, sterile flight deck, proper phraseology and effective briefings covering non normal situations.

Knowledge
Having sufficient and proper knowledge about the subject will not only help in effective decision-making but will also help in initiating correct and timely actions towards any situation. Having proper knowledge also keeps confidence and motivation levels high.

Conclusion

The failure rate of aircraft engines has reached an all-time low. This means that many flight crews will never face an engine failure during their career, other than those in the flight simulator. However, despite the significant improvement in engine reliability, the number of accidents due to an incorrect crew response following an engine malfunction has remained constant. I would like to take this opportunity to emphasize the importance to strict adherence to established procedures. To safely and efficiently manage engine malfunctions, flight crews should:

1. Stabilize the aircraft trajectory before dealing with the malfunction
2. Never rush to shut down the affected engine during critical flight phases: Engines have been certified in extreme conditions
3. Know how to identify various engine malfunctions and their consequences.

On a personal level, this experience has cemented the beauty of teamwork and appreciation for the work of all the other departments. A big bow to our engineers who meticulously take care of the aircraft ensuring a smooth ride for all of us. The excellent cabin crew, who not only provide the best hospitality but also take care of our and passengers safety. I also salute the entire ground staff community, the emergency response team and finally the highly efficient Air Traffic Controllers.

About the Author

Balpreet is presently working as a Senior First Officer B737 with SpiceJet. Balpreet started his career as a banker with American Express Bank before joining Jet Airways as a Trainee First Officer. He holds a Bachelor's of Science degree and am currently pursuing a Masters. New Father to a 4-month-old boy, Balpreet enjoys Swimming, Golf and family time.

Handling Dangerous Goods

Rintu Chitrakar
DGR Training Manager
Indigo Airlines

What are Dangerous Goods?

The thought rarely crosses our minds, but many goods we use regularly pose dangers to the aircraft. For example, lithium batteries, dry ice, and aerosol whipped cream are dangerous goods. These products may seem harmless; however, they can be very dangerous when transported by air. Vibrations, static electricity, temperature, and pressure variations can cause items to leak, generate toxic fumes, start a fire, or even explode if these products are not appropriately handled. According to the Federal Institute for Risk Assessment, the register of internationally classified dangerous goods has 3,500 entries.

According to IATA's Dangerous Goods Regulations (DGR) Manual, "A dangerous good (also known as hazardous material or hazmat) is any substance or material that is capable of posing an unreasonable risk to health, safety, and property when transported in commerce."

Training

IATA and DGCA mandate dangerous goods training for all persons across the entire supply chain to ensure that the hazards posed by dangerous goods are understood and that everyone involved is competent to perform their duties. While some functions require basic knowledge of dangerous goods regulations, other functions need detailed information. In any case, regulations and adequate training are necessary for each job function. This is true for shippers, packers, freight forwarders, operators, ground handling agents, security screeners, pilots, and flight attendants. Having everyone who may come in contact with dangerous goods adequately trained is imperative.

Undeclared Dangerous Goods

Undeclared and misdeclared dangerous goods are a growing concern in the aviation industry. Safe handling, stowage, and segregation of packaged dangerous goods cannot be carried out if there is no knowledge of the presence of dangerous goods inside the cargo transport unit or if the goods have been incorrectly declared.

Most common goods are Aerosols, ammunition, batteries (wet and lithium), camping stove, drain cleaners, dry ice, fireworks, lighters, matches, oil-based paint or corrosive paint, parts (with gasoline or kerosene), perfume, propane, radioactive materials, solvents, used parts or equipment that contain fuel or have the residue of fuel. Fuels (such as gasoline and kerosene) are flammable, and these items are regulated as DG even when emptied of fuel because of the remaining odor/residue.

Classification

Identifying dangerous goods is the first step to reducing the risks posed by the product. Based on the product's specific chemical-physical properties and the type of risks, Dangerous goods are categorized into nine hazard classes that are internationally regulated via a model regulation of the United Nations. Each entry is assigned a UN number and a proper shipping name. Simply put, every good with a UN number is a dangerous good!

Class 1 Explosives

Examples: TNT, Airbags

Class 2 Gases

Examples: Helium, Neon, Nitrogen

Class 3 Flammable Liquids

Examples: Gasoline, Diesel, Fuel Oil, Alcohol

Class 4 Flammable Solid, Spontaneously Combustible, and Dangerous When Wet

Examples: Aluminum Powder, Phosphorus, and Calcium Carbide

Class 5 Oxidizer, Organic Peroxide

Examples: Oxygen, Cross-Linking Agents in the Rubber Industry

Class 6 Poison (Toxic), Poison Inhalation Hazard, Infectious Substance

Examples: Oxygen, Cross-Linking Agents in the Rubber Industry

Class 7 Radioactive Materials

Examples: Spent Fuel Rods, Medical Equipment, or Medicines

Class 8 Corrosives

Examples: Sulfuric Acid

Class 9 Miscellaneous Hazardous Materials and Lithium Batteries

Examples: Asbestos, Lithium Batteries

Transport by Air

Every year more than 1.25 million dangerous goods shipments are transported by air. With air cargo growth predicted at 4.9% every year over the next five years, the number of dangerous goods shipments will rise significantly. For Dangerous Goods to be shipped by air, very specific procedures must be met. Let's have a look at them in detail.

Step 1 : Documentation

First, the shipper must meet their criteria, such as declaring the shipment as dangerous goods, properly completing the Dangerous Goods Declaration, and adequately preparing the shipment for transport. This part can get very complex, and we must be proficient with the regulations. Some goods are permitted while others aren't depending on factors like chemical strength, composite of the product, and what logistics company or airline is moving the cargo.

The shipper is responsible for completing the Shipper's Declaration for Dangerous Goods and Air Waybill document. When filling out the Dangerous Goods Declaration, the format, language, color, and size of the document are all very specific and must be adhered to.

This document proves that the goods are compliant with IATA's DGR. A Material Safety Data Sheet (MSDS) is also typical. This contains most of the essential hazardous information about the shipment, so it can be handled appropriately.

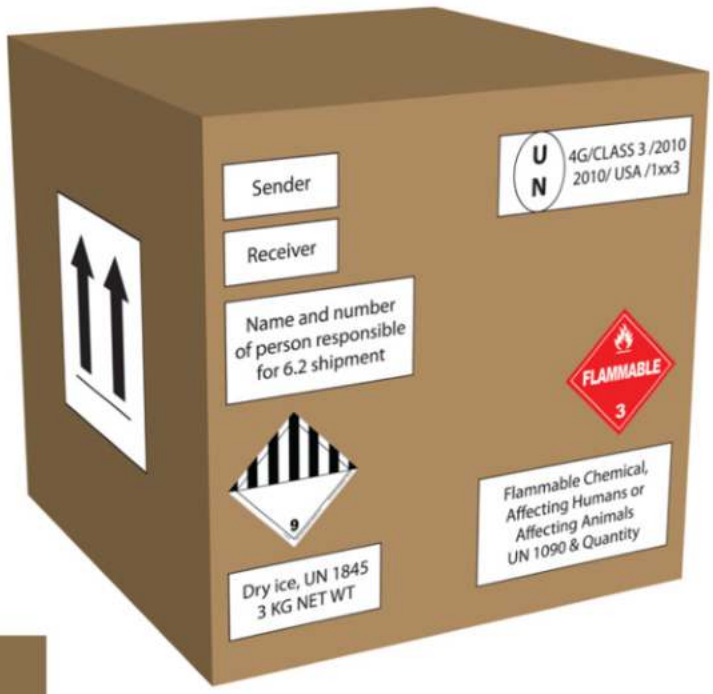
- The ingredients of the goods.
- Hazard assessment relating to handling, storage, and use.
- Measures need to protect workers/handlers.
- Health effects of exposure (if applicable).
- Any emergency procedures to follow.

Did you know?
The most commonly shipped items are flammable liquids, dry ice, and lithium batteries.

Step 2 : Packaging and Labeling

Dangerous goods cargo requires more durable packaging than general cargo. It begins with correctly identifying the dangerous good and then the quality of packaging, which means being strong enough to withstand the loading and transport from pallets and Unit Load Devices (ULDs). They must also ensure no damage or leakage and that the changes in pressure and temperature will not damage the goods within it. This is why dangerous goods shipments have been further broken down into Packing Groups. This is crucial, as it protects the handlers, the plane, and the surrounding cargo. Often, these regulations will mean a less efficient packaging of your goods, adding to your supply chain costs, but then it is for everyone's safety and legally binding standard.

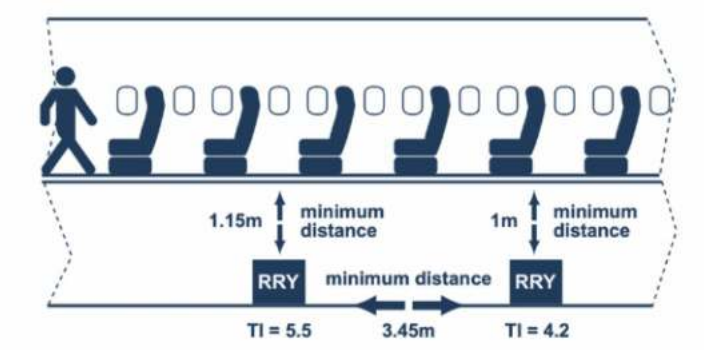
Another critical area of hazardous packaging goods is the labeling requirements. IATA sets the standards for labeling, and Logistics companies will take care of this for you. Once the class is specified, you must work out the correct label.

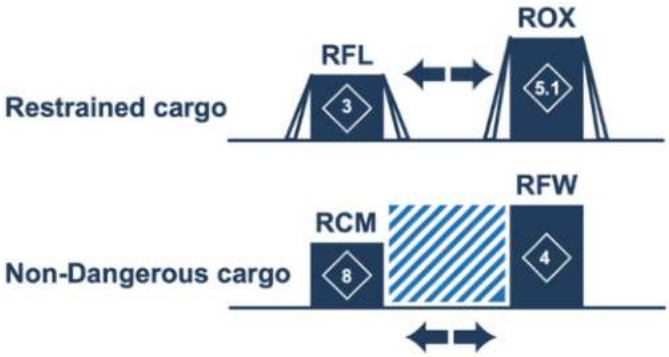


Step 3: Shipping and Handling

The operator must go over the Dangerous Goods Checklist and ensure that the shipper declaration complies with the Dangerous Goods Regulations.

While dangerous goods storage and handling occur throughout the proceeding, the loading process comes next. It is important not to store or load certain dangerous goods next to one another and never next to food items. All packaging must be secured, as well as other items being shipped, so that they do not shift during transport and fall into the dangerous goods causing damage to their packaging.





Proper safety for transporting hazardous material begins with shippers and ends with the operators. The shippers have specific responsibilities that must be closely adhered to for their goods to be accepted by the airlines.

- Comply with specific packaging requirements
- Use only the packaging permitted per IATA's Dangerous Goods Regulations (DGR)
- Correctly assemble and secure packaging according to instructions
- Adhere to the proper quantity per package
- Ensure the packaging exterior does not contain any contaminants
- Remove any previous marking of container that no longer apply
- Properly label each package
- Fill out Shipper's Declaration for Dangerous Goods correctly, along with Air Waybill.

The operators will ensure that the shippers meet all guidelines and process each package against the Dangerous Goods Checklist to prepare for storage or loading.

Special Cases

Radioactive Materials

The challenges presented by transporting radioactive material are high. Even when compared to other dangerous goods. So much so that the DGR has its own section dedicated to it.

Infectious Substances

As the shipping of infectious substances, including specimens being shipped for diagnostics purposes, is typically limited to people involved in the healthcare industry, including the veterinary sector, IATA has created the Infectious Substances Shipping Guidelines.

Lithium Batteries

Lithium batteries are one of the most commonly transported dangerous goods. The rules and regulations regarding the transport of lithium batteries need to be explicitly addressed, so IATA created a unique manual geared specifically to shippers of lithium batteries.

How to Deal with Dangerous Goods Accidents?

Consider landing as soon as possible
Because of the difficulties and possibly disastrous consequences of any dangerous goods incident, consideration should be given to landing as soon as possible.

Identify the Item, Source and Emergency Response Drill Code
The passenger may be able to give some guidance on the hazard(s) involved and how these could be dealt with. The drill code assigned to an item of dangerous goods consists of a number plus one or two letters. This corresponds to a line of information concerning the hazard posed by that substance and guidance on the preferable action that should be taken. Use the dangerous goods notification form to determine the response drill code.

Protect yourself
Flight crew should use 100% oxygen. Cabin should be configured to avoid recirculation of contaminated air. The hands should always be protected before touching suspicious packages. Gas-tight breathing equipment should always be worn when attending to an incident involving smoke, fumes or fire.

Right altitude
Reducing altitude will reduce the rate of vaporization and may reduce leakage. If structural damage or explosion, keep the differential pressure as low as possible.

Move passengers away from the area and distribute wet towels
A more effective aid to passengers in a smoke- or fume-filled environment would be the use of a wet towel or cloth held over the mouth and nose. Avoid the use of therapeutic oxygen bottles or the passenger drop-out oxygen system as considerable quantities of fumes or smoke would be inhaled through the valves or holes in the masks.

No Smoking
A smoking ban should be introduced when fumes or vapors are present

Place dangerous goods item in polyethylene bags and stow
In the absence of emergency response kit, place the item in a polyethylene bag ensuring it is placed upright. Mop up the spillage using paper towels, newspaper, etc. Place the bags containing the item and any soiled towels in a catering or bar box on board, and position it as far away as possible from the flight deck and passengers.

Treat affected seat cushions / covers in the same manner as dangerous goods
Seat cushions, seat backs or other furnishings which have been contaminated by a spillage should be removed from their fixtures, placed in a polyethylene bag, and stowed away in the same manner as the dangerous goods item causing the incident.

Cover spillage on carpet / floor
Carpet which has been contaminated by a spillage and causing fumes despite being covered, should be rolled up and stowed in polyethylene bags.

Regularly inspect items stowed away / contaminated furnishings
Any dangerous goods, contaminated furnishings or equipment which have been removed and stowed away or covered for safety should be subject to regular inspection.

After landing, Disembark passengers and crew before opening any cargo compartment doors
Even if it has not been necessary to complete an emergency evacuation after landing, passengers and crew should disembark before any attempt is made to open the cargo compartment doors and before any further action is taken to deal with a dangerous goods incident. The cargo compartment doors should be opened with the emergency services in attendance.

Move passengers away from the area and distribute wet towels
Upon arrival, take the necessary steps to identify to the ground staff where the item is stowed. Pass on by the quickest available means all information about the item including, when appropriate, a copy of the notification to the pilot-in-command.

Conclusion

Over the years, several high-profile accidents of cargo and passenger aircraft have been caused by dangerous goods. Most of the causes can be traced to the inadequate application of established procedures. When adequately prepared, packed, and handled, dangerous goods represent a minimal risk in air transportation.

The growth of the transport of dangerous goods makes it necessary to create new tools to enhance safety. New packaging standards and developing a comprehensive dangerous goods reporting system are among the proposals expected to be considered by the International Civil Aviation Organization's (ICAO's) Dangerous Goods Panel (DGP). The centralized global reporting system would enable fast and reliable occurrence reporting and data sharing among states and ICAO. This would also allow those states that do not have adequate resources to develop local reporting tools and have equal access to this critical safety information with the same reporting capability as any other state. All the stakeholders must gather together to increase safety and allow others to benefit and learn from their own experiences and identify potential gaps and hazards as early as possible.

Read More: The latest edition of IATA's Dangerous Goods Regulations (DGR) is the 64th edition, effective from January 1, 2023, to December 31, 2023.

About the Author

Rintu is presently working as Dangerous Goods Training Manager with IndiGo Airlines. He has 18 years of Air cargo industry experience dedicated entirely in handling dangerous goods. In the past he has worked with several International Airlines in the Dangerous Goods department before becoming a full-time instructor. Rintu can be reached at chitrakar.r@gmail.com

Autonomous Taxiing, Takeoff, and Landing

ATTOL by Airbus

Prashant Prabhakar
Subject Expert
100 Knots

© Freepik

The Man Who Started It All

Over a hundred years ago, the first autopilot models were developed, installed, and used in aircraft. The same concept has persisted to the present day. It was in 1912 that the American inventor Elmer Ambrose Sperry and the German physicist Hermann Anschütz-Kaempfe proposed a system that would allow any moving vehicle to maintain a specific course. Its operation was based on connecting one or more gyroscopes and a compass to the vehicle's control elements. The new system achieved immediate worldwide recognition after its installation and use on several dozen U.S. Navy ships.

Autopilot in aviation has been around longer than you think. Indeed, in 1914, just 11 years after the Wright Brothers first ushered humanity into the aviation age, Elmer Ambrose Sperry's son, Lawrence Sperry, built a gyroscopic self-stabilization system into a Curtiss C-2. It was capable of keeping the aircraft straight and level and pointed in a consistent direction on the compass. He put on a spectacular public demonstration at the Concours de la Securité en Aéroplane (Airplane Safety Competition), the Seine just outside Paris to prove it.

First, he passed by the crowd with his hands clearly up in the air. Then, he did the same with an assistant standing on one of the wings, moving about to throw the weight balance off. Then he made a third pass where both pilot and passenger went out and stood on the wings. The crowd went bananas. Of course, Sperry won the competition,

earning him a prize of 50,000 francs and international recognition.

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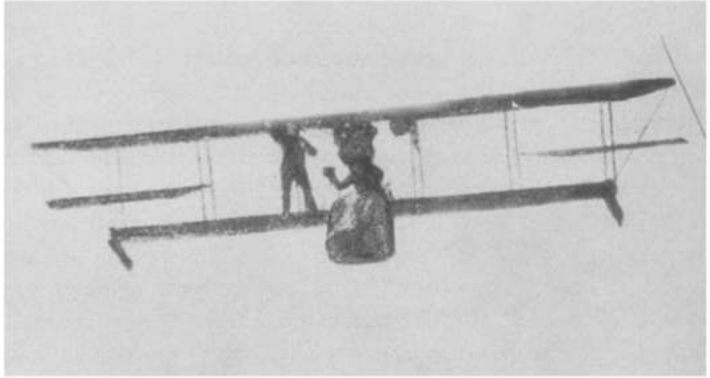
But Sperry was not satisfied. Through World War 1, he worked on several designs for a fully self-flying aircraft, including the Hewitt-Sperry Automatic Aircraft and the Curtiss-Sperry Flying Bomb, regarded by some as an early precursor of today's cruise missiles. These were only partially successful, partly because of the challenges during World War 1.

Sperry went on to invent the artificial horizon, which graces cockpits in modified forms to this day, and the Sperry autopilot (now a product arm of Lockheed Martin), is now "standard equipment on virtually every aircraft to hold the plane on the desired flight path."



Automation Today

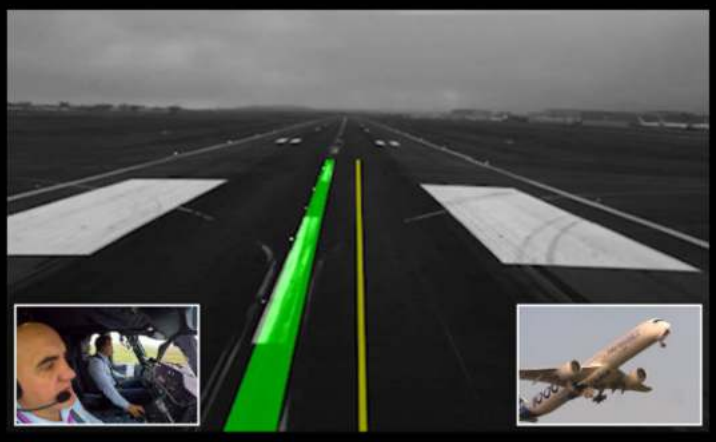
Indeed, the autopilot system is now flying your typical commercial airliner far more than the human pilots, sharp and starched through their jackets may be. Modern autopilots incorporate many capabilities that Sperry probably never even dreamed of, such as maintaining a programmed speed, accelerating or reducing the rate in a programmed way, following a programmed route plan, aligning the aircraft with the runway, and performing a fully automated landing. But the essence of the device remains the same.

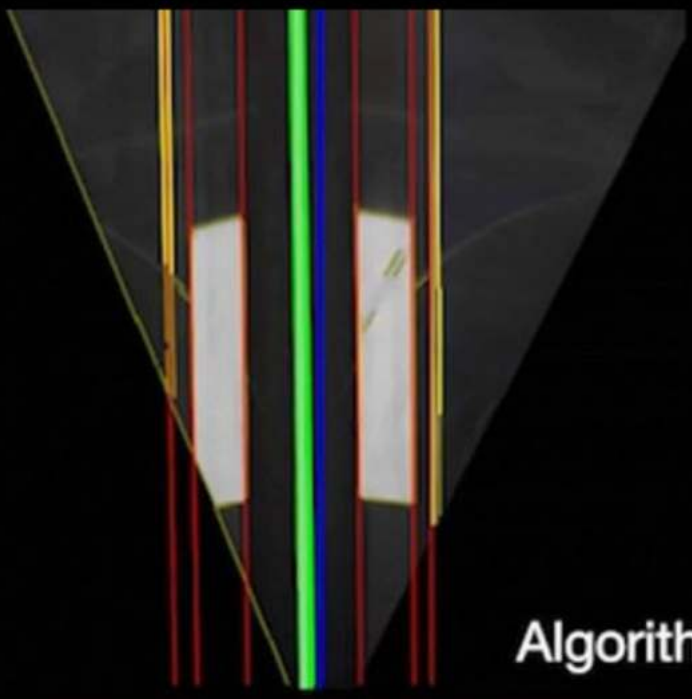
This is not because the pilots want to do less; they never joined the industry to put their feet up on the console and let the machine fly them. Pilots, for the most part, hand fly the airplane for Takeoffs and Landings when the weather conditions are suitable. But as weather conditions deteriorate, the autopilot does a better and safer job. Autoland systems have been around for quite some time now, and thanks to this technology, airlines can still operate during the winter months in northern India. These systems are not autonomous and require human programming, supervision, and onboard and external infrastructure like Instrument Landing systems (ILS) or GPS signals.

ATTOL Project

Airbus is concluding a two-year effort, the Autonomous Taxi, Take-Off and Landing (ATTOL) project, that featured two world-firsts for the aviation industry: fully automatic vision-based takeoffs and landings, controlled using onboard image recognition technology. The ATTOL project is a technological flight demonstrator initiative that first began at Airbus in June 2018, and aims to bring all these functions under the control of fully autonomous systems entirely built into the aircraft.

A fully autonomous system would be a huge step, says Airbus, to "help pilots focus less on aircraft operations and more on strategic decision-making and mission management."





Algorithm data

© Airbus

The ATTOL system relies heavily on computer vision and machine learning. It uses a raft of cameras, radar, and LiDAR to build awareness of its situation. A LiDAR (Light Detection And Ranging) sensor emits a light pulse toward the target, which is then reflected from the surface and returned to the sensor. Because LiDAR generates its own signal pulse, it does not depend. The receiver detects the incoming signal and calculates the distance the light has traveled. Using the position of the sensor, the direction in which the light was sent, and the distance calculated, it is then possible to derive the 3D class where the signal was returned.

The system was fitted to a full-sized Airbus A350-1000 airliner, capable of seating more than 400 passengers. It ran some 450-odd fully human-controlled flights to gather video data and fine-tune control algorithms before being sent out to handle business by itself.

Lidar, which measures distance using laser light to generate a highly accurate 3D map of the world, is considered by most in the autonomous vehicle industry critical to commercial deployment.

First Breakthrough

In January this year, Airbus performed the first fully-automated vision-based takeoff at Toulouse-Blagnac airport. At the end of June, Airbus announced that the project is now complete, with the ATTOL system having completed six fully autonomous operations, each including five takeoffs and landings plus plenty of taxiing around the airport in between. It's a successful conclusion to the ATTOL program. While it doesn't result in a commercial product, Airbus says it will continue research into the application of autonomous technologies going forward.

In total, over 500 test flights were conducted. Approximately 450 of those flights were dedicated to gathering raw video data to support and fine tune algorithms, while a series of six test flights, each one including five takeoffs and landings per run, were used to test autonomous flight capabilities.

The rapid development and demonstration of ATTOL's capabilities were made possible due to a cross-divisional, cross-functional, global team comprising Airbus engineering and technology teams, Airbus Defence and Space, Acubed (Project Wayfinder), Airbus China and ONERA under the leadership of Airbus UpNext.

So, we've come a long way since aviation's golden age of invention in the nineteen-teens. However, there's still going to be room behind the stick for human pilots for some time yet.

Conclusion

Equipping aircraft with autonomous capabilities, especially those implemented using machine learning (ML) technologies, will greatly enhance the operational effectiveness of piloted aircraft by aiding pilot decision-making and workload management. This has the potential to bring benefits such as improved mission capability, faster-than-human reaction times, decreased operating cost with a reduction in the need for human interaction during mission operations, and increased safety to aircraft.

Source: Airbus, NewsAtlas

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Flying Private

Tanya Singh
Arrow Aircraft

© Jacob Mathers

Why Travel Private?

Private jet charter or "air taxi" is the ultimate in bespoke air travel. And keeping in mind that an extravagant travel experience is unquestionably important for the allure, it's the flexibility and personalization/customization that drives most customers to fly privately. For senior executives on a tight schedule, the efficiency benefits of a private jet can be quite compelling. I agree, that one cannot detach the "luxury" segment attached to business aviation, but most of our clientele hire business jets to actually save on time & thus be more efficient with their work meetings.

Personalized Itinerary

Oftentimes, people from outside the industry are unclear about the ways in which private jets differ from commercial airlines, but there are end number of things that can be done when you fly private, which otherwise won't be possible. The most important of them is the fact that in business aviation, the itinerary fits around you – not the other way round. Another important factor that plays in is the fact that when you fly private, you choose where to land. That implies smaller airports, islands, or mountain runways. Or no airport at all? That's when helicopters come in. Usually, you have to check in at least two hours before for most airline flights due to long queues and waiting time. But general aviation terminals, or FBO's – as most

commonly known in the West, are a different experience altogether. You can usually board within 30-40 minutes of your arrival.

Exclusive Culinary Experience

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Another privilege offered by air taxi operators is the exclusive culinary experience provided on-board. Airline meals – even in first class – can leave you feeling not as satisfied as one would like, however, on a private flight, you choose what you want to eat and drink, and when you would like it. From a specific brand of herbal tea to restaurant-quality dinners to traditional Indian street food – we'll arrange your perfect menu.

Pet Paradise

And last but not the least, this one is for pet lovers like myself – when you charter an aircraft, your pet can travel in the cabin with you which greatly reduces stress and health risks for animals, especially on long flights.

Domestic General Aviation in India

Humble Beginnings

The Indian air taxi market has seen many ups and downs over the decades, just like any other industry. But has surely seen a general positive upwards trend, which most people might not have expected from the average Indian clientele back in the days when this industry began. Hawker Beechcraft was one of the first entrants in India in the early 1950s. India's civil aviation is now believed to be among the fastest growing aviation markets globally and contributes an estimated $72 billion to the country's GDP (Wings India 2022).

However, this wasn't the case when the industry pioneers started out. Back in the late 90s or even early 2000s, most commonly used machines were turboprops like the Beechcraft family. This was also due to the fact that aviation infra wasn't as advanced back in those days, as it is now. Turboprops are cost-efficient machines and can be operated easily in the Indian terrain. The industry picked up a bit by the late 2000s, when Gulfstreams & Bombardiers entered the Indian aerospace, but the trend slowed down as the great recession hit India in 2009-10 following the footsteps of the world economy. It took some time for the business aviation market to get back on track.

Shift to Bigger Jets

Few years after the 2009-10 recession, there was a significant boost in the number of mid-sized or super-mid-sized jets purchased by Indian operators. Most common machines purchased post the recession were Cessna Citations, Hawkers & Falcon 2000s along with a few Legacy 650s.

But what caused this shift from relatively smaller aircraft to more spacious ones? Probably the fact that an average Indian corporate client wanted to fly with all his/her board members in order to discuss confidential matters and prepare for meetings. Also, because these aircraft have longer range and can fly directly to the Middle East & South East Asia where the bulk of Indian corporates have business ventures in. Or simply because one could afford to buy a bigger and much more expensive machine. In fact, Airbus invested in a "billionaires' study" where it concluded that in some cultures, in particular, the ultra-rich generally likes to travel with a larger entourage than most private jets allow. Both Boeing & Airbus now have specialized departments dedicated to converting their aircraft into highly-customized private jets.

Further, although India is a cost-sensitive market, it is now becoming more value and experience driven. Business executives who travel extensively, understand the value of time savings that can be derived by chartering a private aircraft as compared to travelling by commercial airlines. They use private jets as a business tool which helps them become more productive. With the upcoming boost in the number of start-ups in our nation, more and more millennials and Gen Zs are starting to become our direct consumers. We have noticed as this generation is very well travelled globally, they are aware about the convenience and utility of business jets. They also focus more on the experience factor over other things. These are the consumers who have a huge disposable income and wish to create special moments which can be captured for their social media, with influencers and bloggers playing a huge role. So a couple might want to have an exclusive dinner in the sky and post it on their Instagram, these moments become a part of a permanent memory for which one cannot attach any monetary value.

Women in Domestic Aviation

The industry has also seen a significant change in the influx of female players since early 2000s. Women pilots have played a central part in the development and success of the global aviation industry over the past century. Though various solutions had been promoted to increase the percentage of female pilots, not much was done to promote female management leaders in this industry. However, the Indian aviation market has a decent female representation ranging from charter brokers to instructors to aircraft operators to senior managers. Aviation offers freedom, confidence and monetary gains which help in diminishing the gender parity & uplifting women in general. For instance, the sales representative of the company I work for (Arrow Aircraft Sales & Charters) is a woman who's been in the industry for over 10 years now and has dealt with numerous fixed wing and rotary wing machines.

Fractional Ownership

As far as the future of this industry is concerned, I believe India is bound to go through an upward trend and will also see an increase in the "fractional ownership" concept. With more and more people realizing the value of time, privacy and status, this industry is bound to develop beyond what one can comprehend now. The role of regulatory bodies is also increasingly facilitating us operators to bring this change. Moreover, with the advances in financing options available, it'll become easier for potential buyers to buy an aircraft or a chopper. The role of helicopters will also enhance connectivity between tier 2 & tier 3 regions and in general uplift the deprived conditions of the rural India. However, the business aviation industry in India needs strong support on the maintenance (MRO) side too, because of lack of quality maintenance, the Indian fleet loses ground in the re-sale market. Also, I believe reforms are needed for the ease of entry of first type certified machines in India. The terms laid down are quite stringent and cumbersome, which discourages buyers to introduce new models in the Indian market. Another challenging part for the industry players, in the coming future, would be to tackle the ever-complexed web of brokers and air taxi operators and to operate in a sustainable manner without hurting the environment.

© Trac Vu

Arrow Aircraft

Arrow Aircraft is a leading private aviation company which has significantly contributed to business aviation sector in India. The company provides world class solutions for aircraft sales, acquisitions, charters and operational management programs. Apart from this, the company is also deeply invested in the pilgrimage sector and provides Heli shuttle services to Kedarnath, Amarnath & Machail Mata Yatra. The reputation of Arrow Aircraft has enabled it to partner with global aerospace companies for exclusive sales & business development activities. Our business philosophy is based on trust, integrity and dependability and has a hands-on approach to execute projects with flawless precision. Having such diversified experiences, Arrow Aircraft is well positioned for future growth in business aviation.

About the Author

Tanya is a graduate of Warwick Business School, UK. Post which, she worked for a PR firm handling various big hospitality brands including one of the major players in the Indian aviation. Growing up, she was fortunate enough to travel the world and grasp different cultures & traditions. She considers herself a history and political buff who loves all things socio-politics. Currently Tanya works in the glamorous field of General Aviation, handling commercials & marketing along with PR at Arrow Aircraft Sales & Charters.

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