Airbus

A Statistical Analysis of Commercial Aviation Accidents 1958 - 2024

AIRBUS

Safety Publications

Safety first

The Airbus safety magazine

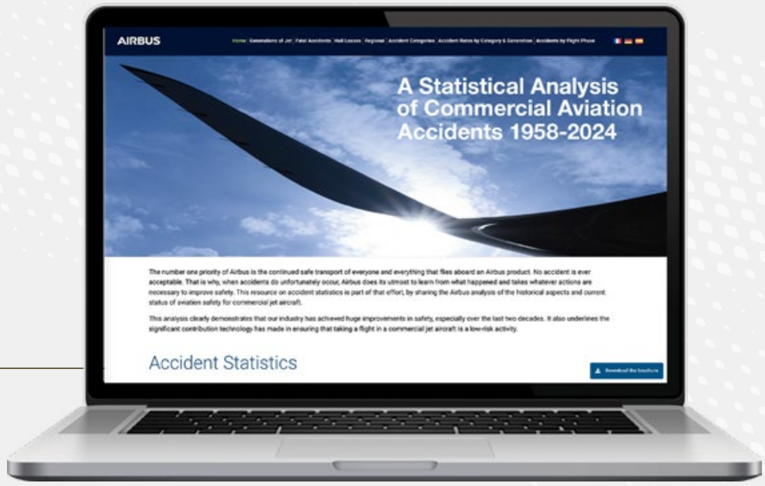
> Available in app and website versions

Safety first AIRBUS

Download on the App Store

GET IT ON Google Play

Visit us at
safetyfirst.airbus.com



Statistical Analysis of Commercial Aviation Accidents

> Also available in website version

Visit us at
accidentstats.airbus.com

AIRBUS

Contents

List of Graphs

Scope & Definitions

This publication provides the Airbus annual analysis of aviation accidents, with commentary on the year 2024, as well as a review of the history of the safety record for commercial aviation.

This analysis clearly demonstrates that the commercial aviation industry has achieved huge improvements in safety over recent decades. It also underlines the significant contribution that technology has made in ensuring that taking a flight in a commercial jet aircraft is a low-risk activity.

The goal of any review of aviation accidents is to help the industry further enhance the level of safety, therefore, an analysis of forecasted aviation macro trends is also provided. This highlights the key factors influencing the industry's consideration of detailed strategies for the further enhancement of aviation safety across the air transport system.

Scope of the Brochure

- **All Western-built commercial air transport jets that carry over 40 passengers (including cargo aircraft):**
  - Airbus: A220, A300, A300-600, A310, A318/319/320/321, A330, A340, A350, A380
  - Boeing: B707, B717, B720, B727, B737, B747, B757, B767, B777, B787
  - Bombardier CRJ series
  - British Aerospace: Avro RJ series, BAe 146
  - British Aircraft Corporation BAC-111
  - Comac C919
  - Convair 880/990
  - Dassault Mercure 100
  - De Havilland Comet
  - Embraer: E170, E175, E190, E195, ERJ 140, ERJ 145, ERJ 145XR
  - Fokker: F28, F70, F100, VFW 614
  - Hawker Siddeley Trident
  - Lockheed: L-1011
  - McDonnell Douglas: DC-8, DC-9, DC-10, MD-11, MD-80, MD-90
  - Sud-Aviation Caravelle
  - Vickers VC-10
  - Sukhoi Superjet

Note: Non-Western-built jets are excluded* due to lack of information, and business jets are not considered due to their particular operating environment.

- **Since 1958,** the first year with regularly scheduled transatlantic flights using commercial jet aircraft.
- **Revenue flights**
- **Operational accidents**
- **Hull loss** and **fatal types** of **accidents**

Source of Data

- The accident data was extracted from official accident reports, as well as ICAO, Cirium, and Airbus databases.
- Global Action Plan for the Prevention of Runway Excursions (GAPPRE) and Global Action Plan for the Prevention of Runway Incursions (GAPPRI) by EUROCONTROL.
- Flight cycle data is revised on an annual basis as further information becomes available from operators.

*except Sukhoi Superjet

Definitions

- **Revenue flight:** A flight involving the transport of passengers, cargo or mail. Non revenue flights such as training, ferry, positioning, demonstration, maintenance, acceptance and test flights are excluded.
- **Operational accident:** An accident taking place between the time any person boards the aircraft with the intention of flight until the time all such persons have disembarked, excluding sabotage, military actions, terrorism, suicide and the like. This does not include any accident that is unclassified or unknown until the official investigation determines otherwise.
- **Fatal accident:** An operational accident in which at least one person is fatally or seriously injured as a result of:

- being in the aircraft, or
- direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
- direct exposure to jet blast.

This excludes the injuries that are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding on the aircraft outside the areas normally accessible by the passengers and crews.

- **Hull loss:** An event in which an aircraft is destroyed or damaged beyond economic repair. The threshold of economic repair decreases with the residual value of the aircraft. Therefore, as an aircraft ages, an event leading to damage that was economically repairable years before may be considered a hull loss.

Definition of Accident Categories

The accident categories described are based on standard ICAO definitions.
The seven categories listed below are the accident types that are the cause of most accidents.

Runway Excursion (RE)
A lateral veer-off or longitudinal overrun off the runway surface, and not primarily due to SCF or ARC.

Loss of Control in Flight (LOC-I)
Loss of aircraft control while in flight, and not primarily due to SCF.

Controlled Flight Into Terrain (CFIT)
In-flight collision with terrain, water, or obstacle without indication of loss of control.

Abnormal Runway Contact (ARC)
Any takeoff or landing involving abnormal runway contact, not primarily due to SCF, leading to an accident. Hard landings and tail strikes are included in this category.

Undershoot/Overshoot (USOS)
Touchdown off the runway surface in close proximity to the runway. It includes offside touchdowns.

System/Component Failure or Malfunction (SCF)
Failure or malfunction of an aircraft system or component, related to its design, the manufacturing process, or a maintenance issue, and which leads to an accident. SCF includes those related to powerplant (SCF-PP) and those which are not powerplant-related (SCF-NP).

FIRE (F-NI and F-POST)
Fire or smoke inside or outside of the aircraft, in flight or on the ground, and regardless of whether the fire results from an impact (F-POST) or not (F-NI).

01 2024 & Beyond

Traffic and Accidents in 2024

In 2024, commercial jet traffic recovered to pre-pandemic operational levels, reaching almost 34 million flights, matching 2019 flight volumes. However, this year's recovery was marked with several fatal events.

Resurgent demand in both passenger and cargo sectors drove the recovery of commercial air transport volume to levels prior to the Covid-19 crisis. Compared to 2023, which recorded no fatal accidents and only one hull loss, 2024 saw 12 hull losses and four accidents with fatalities.

A runway collision involving an A350 and Dash-8 turboprop occurred in the first days of 2024, resulting in five fatalities on the Dash-8. All passengers on the A350 were safely evacuated. In November, a B737-400 freighter aircraft collided with terrain during its approach, causing one fatality. An A220 diverted mid-flight due to reported cabin smoke, with one fatality among seventy-nine persons onboard.

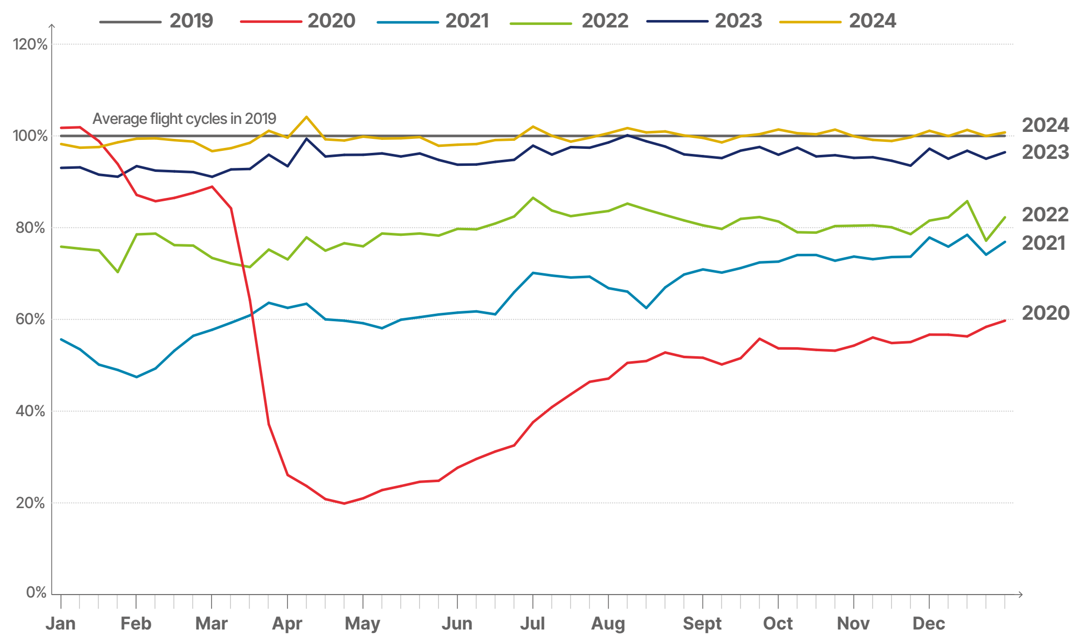
In the last days of 2024, a 737-800 aircraft made a gear-up landing, slid past the end of the runway, and collided with the ILS localizer antenna array installed on a concrete platform, causing 179 fatalities among the 181 people on board. Late in December, an Embraer 190 aircraft crashed after declaring an emergency.The cause of the emergency remains under investigation at the time of publishing and has yet to be classified.

The aviation industry's 2024 performance underscores the critical importance of continuous safety improvements and rigorous investigation protocols, leaving no room for complacency. While the year marked a significant operational recovery to pre-pandemic levels, the number of fatal accidents recorded in 2024 reveals persistent challenges in maintaining, and continuously improving, the aviation safety record year to year.

Addressing these challenges demands enhanced training, technological advancements, and collaborative international efforts to mitigate risks in commercial air transport.

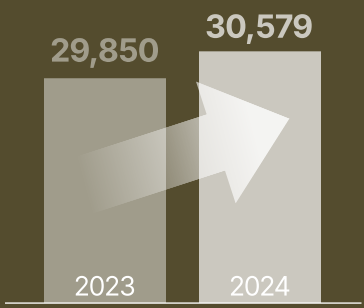
It is also important to recognize that safety statistics from a single year may not accurately reflect long-term trends. This statistical analysis of commercial aviation accidents uses accident rates calculated as a 10-year moving average to provide a more consistent comparison across industry recovery growth and cycles.

World traffic in flight cycles per week

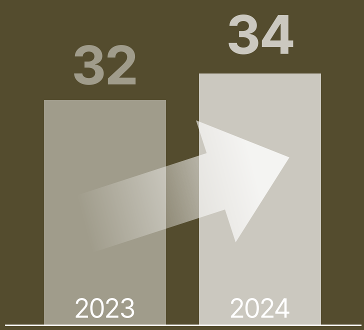


ALL- INDUSTRY COMMERCIAL JETS

Fleet & Traffic Evolution

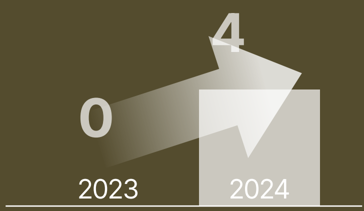


In-Service Fleet Aircraft
(including stored aircraft)

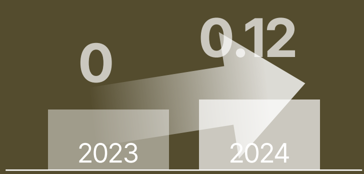


Flight Departures
(in millions)

Fatal Accidents

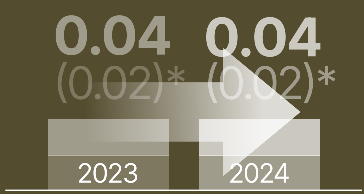


Fatal Accidents



Yearly Fatal Accident Rate
(per million flights)

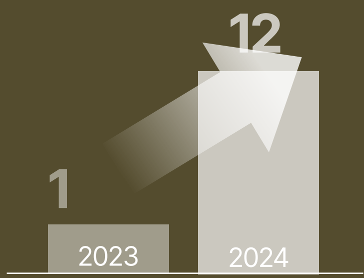
Gen3 Fatal Accident Rate
10yr Moving Average
(per million flights)



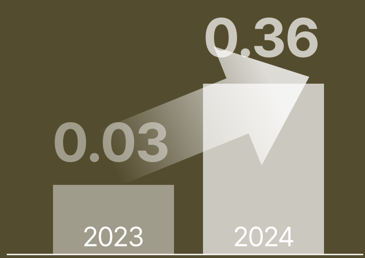
Gen4 Fatal Accident Rate
10yr Moving Average
(per million flights)

*exclude on-ground fatalities only

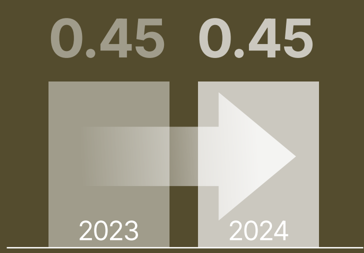
Hull Loss Accidents



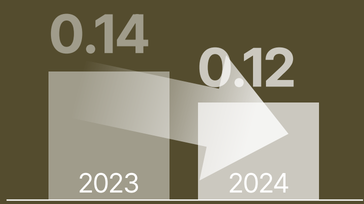
Hull Loss Accidents



Yearly Hull Loss Accident Rate
(per million flights)



Gen3 Hull Loss Accident Rate
10yr Moving Average
(per million flights)



Gen4 Hull Loss Accident Rate
10yr Moving Average
(per million flights)

Outlook for 2025 and Beyond

The global aviation landscape is one of resilience and transformation for 2025 and beyond. The future of aviation depends on continuous improvement, with an unwavering commitment to safety and innovation.

The outlook for 2025 unfortunately began with two events in January. A fire broke out in an A321 on the ground at an airport in South Korea, and there was a fatal collision in-flight between a CRJ-700 aircraft and a military helicopter close to Washington DC. These events illustrate how quickly aviation safety records can move toward a negative trend and why it is critical for all of us as aviation stakeholders to be exhaustively vigilant, avoiding the trap of complacency and always searching for solutions to further improve safety.

The commercial air transport sector has demonstrated remarkable adaptability in the wake of global disruptions, successfully navigating a complex operational environment. The industry's recovery to pre-Covid passenger traffic levels represents a significant milestone in operational resilience. This period of growth, however, is not without its challenges and increased operational volume introduces new safety considerations and emerging risks that demand anticipation, analysis and proactive management.

The substantial expansion of air transport needs to be supported by continuous talent acquisition and safety culture development initiatives across all organizations in the air transport system. Attracting and developing new professionals is key to maintaining the hard-won safety record, requiring an approach that prioritizes skill development, safety promotion, and ongoing knowledge transfer. Establishing an environment of trust, characterized by open communication and systematic reporting, is essential to maintaining, and going beyond the standards, that make commercial aviation one of the safest ways to travel.

As passenger volumes continue to rise and new aircraft enter service alongside legacy fleets, the aviation industry must remain committed to its core objective: creating a safe, efficient, and sustainable global transportation network that connects communities and drives sustainable economic progress.

Passenger traffic has recovered to pre-Covid levels, in line with recovery expectations
World air traffic (RPK versus equivalent month in 2019)

Evolution of the workforce to navigate the growth and safety challenges

Over the next two decades, commercial aviation operations face a complex and rapidly changing period driven by fleet renewal and increasing air traffic demand. The projected growth expected sees 42,000 new aircraft deliveries between 2024 and 2043, including 33,510 single-aisle and 8,920 wide-body aircraft.

This rapid development requires a comprehensive workforce strategy to attract new talent. The industry anticipates recruiting 2.26 million skilled professionals to manage this growth. The graph below shows a projection of the global workforce required for the next 20 years with a forecast by region.

- 690,000 technicians
- 620,000 pilots
- 950,000 cabin crew

Beyond these roles, additional personnel will be required in ground support services, air traffic control, and safety regulatory compliance.

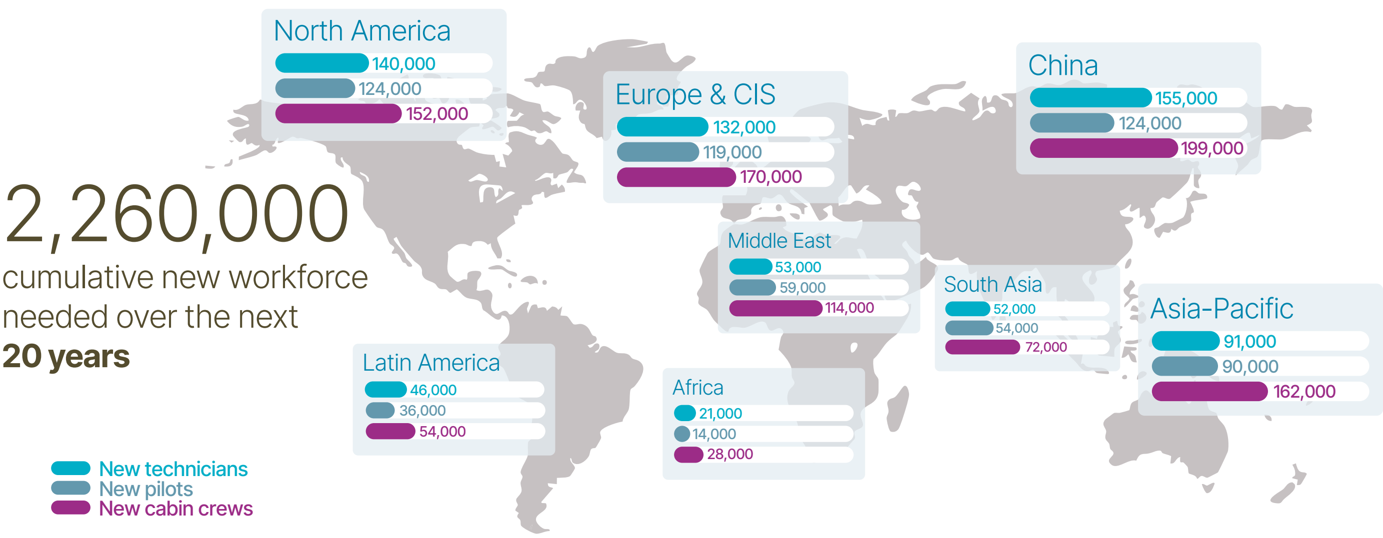
Growing the aviation workforce is not just about adding more people, it is also about quality and commitment. New professionals need careful training that goes beyond technical skills and builds a strong sense of safety responsibility. Collaboration is key to solving this challenge. The industry must find, develop, and keep talented people who can maintain high safety standards. By successfully managing this workforce change, aviation can continue to expand globally while keeping passengers safe.

Workforce needed 2024-2043

Technicians needed
690,000

Pilots needed
620,000

Cabin crew needed
950,000



10
L
10
R

Focus on Runway Safety

The approach and landing phases of flight have recorded the largest proportion of fatal accidents over the last 20 years. With the growth of the global fleet and air traffic set to continue for the next 20 years, the risk exposure will increase for runway incursion and excursion events.

The global aviation fleet and traffic growth means that runway safety remains a priority for aviation safety worldwide, as emphasised by the Global Action Plan for the Prevention of Runway Excursions (GAPPRE), and the Global Action Plan for the Prevention of Runway Incursions (GAPPRI). These documents are the result of consultation from more than 200 aviation experts from 80 organizations. They outline a unified call to action for all aviation stakeholders—airports, airlines, air traffic control, regulators, and manufacturers—to collaborate in reducing runway-related incidents through innovation, collaboration, and proactive risk management.

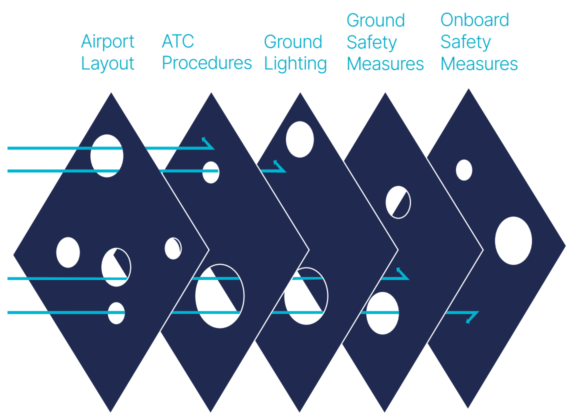
From the manufacturers' perspective, this is a driver to harness innovation and technologies that can enhance runway safety. The very first improvement was the prevention of runway excursion events. This continues with the development of real-time systems for braking performance, stabilised approach monitoring, and cockpit functions that will alert the flight when another aircraft is entering or present on the runway.

These onboard systems aim to improve situational awareness, mitigate risks of runway excursion or collision, and provide reliable guidance for operations under challenging conditions, such as wet runways or crosswinds.

Furthermore, manufacturers and all stakeholders must continue to support data-sharing initiatives to analyze safety trends and enhance predictive capabilities. Equally important is ensuring that training programs enhance the knowledge and skills of pilots to react appropriately to the alerts and use the information for proactive decision-making to avoid the risk of collisions or runway excursions.

Runway safety requires a collective commitment. By driving innovation, standardization, and training, airports, airlines, air traffic control, regulators, and manufacturers will not only help prevent incursions and excursions but also reinforce aviation's fundamental promise: safe, reliable journeys for all.

Global Action Plan for the Prevention of Runway Excursions (GAPPRE)
Global Action Plan for the Prevention of Runway Incursions (GAPPRI)



Example of reinforcing several categories of safety barriers to prevent a runway incursion or excursion event.

02 | Commercial Aviation Accidents 1958-2024

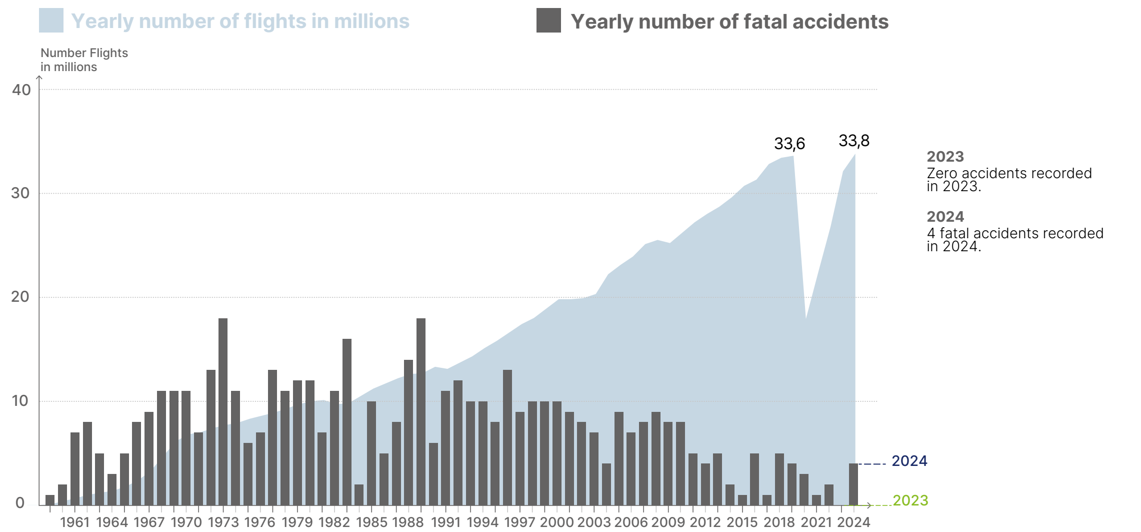
Evolution of the Number of Flights and Accidents

The number of accidents in 2024 increased compared with 2023.

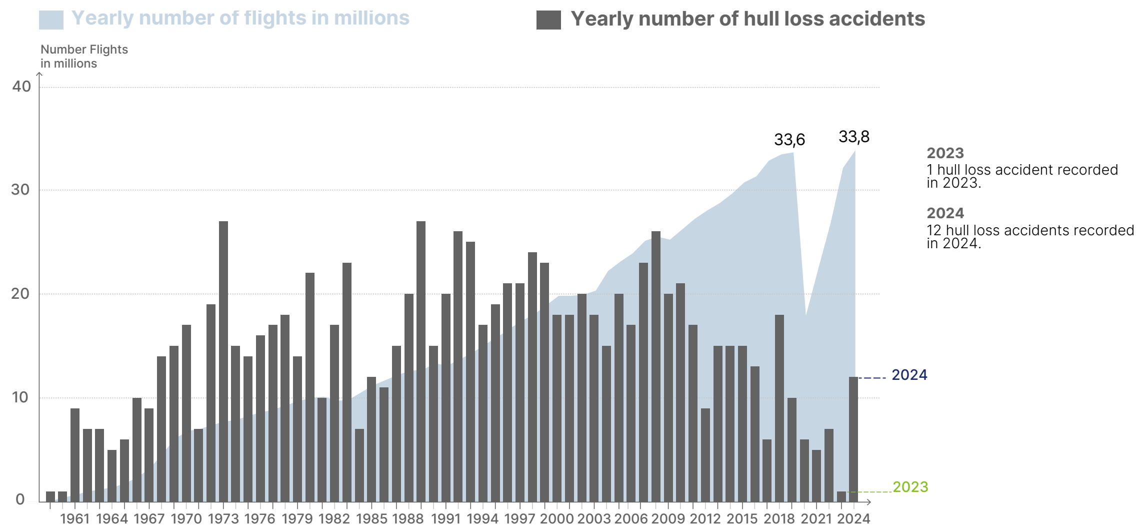
In 2024, the number of flights on commercial jet aircraft recovered to 2019 values. There were four fatal accidents on revenue flights in 2024, three of which were hull losses compared with 2023 when there were no fatal accidents and only one hull loss. There were also nine additional hull loss accidents recorded with no fatalities. In spite of this growth, the number of accidents is decreasing each decade.

As the number of accidents and flights will vary each year, accident rates are more relevant than reviewing the number of accidents per year when analysing trends.

Fatal



Hull loss

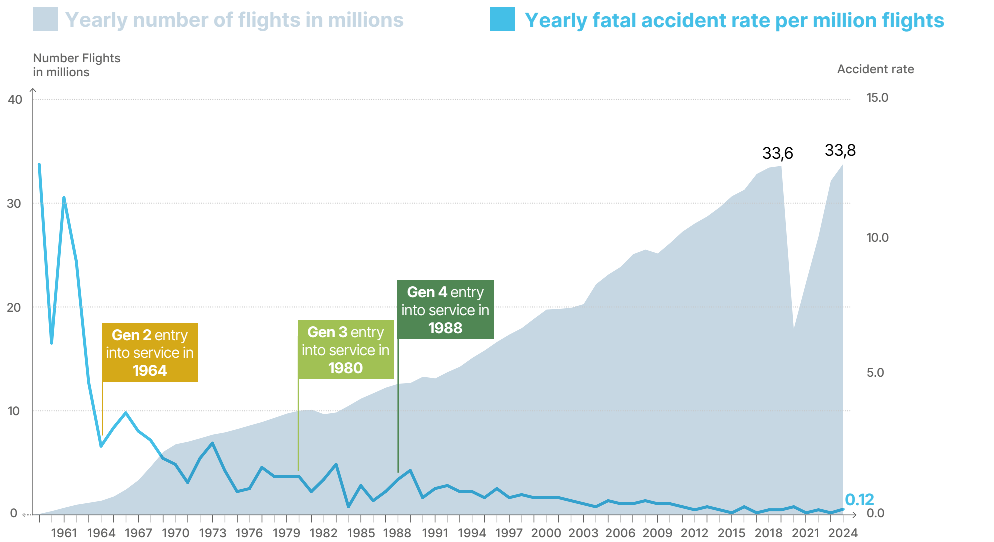


Evolution of the Yearly Accident Rate and Air Traffic

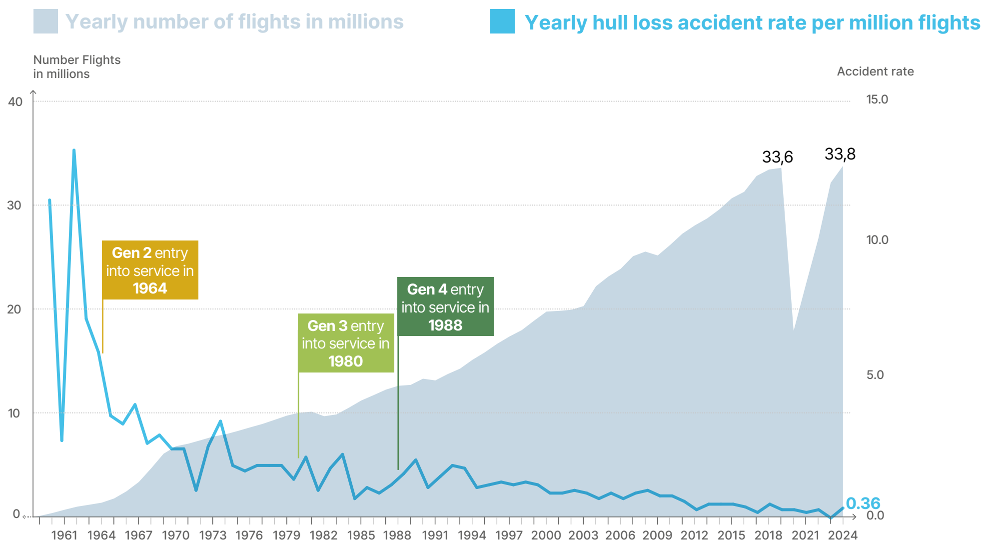
The rate of fatal accidents and hull losses is steadily decreasing over time.

There were far fewer flights in the 1960s, but a peak in the accident rates is shown due to the lower number of flights and the higher number of accidents recorded during this period. However, the volume of flights over recent decades is sufficient to show that the accident rate is continually decreasing with the introduction of new technologies on each generation of aircraft. More detailed information and analysis of the impact of these technologies is provided in this chapter and Chapter 3.

Fatal



Hull loss



Four Generations of Jet

Early Commercial Jets

Generation 1

From 1952
Dials and gauges in cockpit, Early auto-flight systems.
Comet, Caravelle, BAC-111, Trident, VC-10, B707, B720, DC-8, Convair 880/990

Glass Cockpit & FMS

Generation 3

From 1980
Electronic cockpit displays, improved navigation performance and Terrain Avoidance Systems, to reduce CFIT accidents.
A300-600, A310, Avro RJ, F70, F100, B717, B737 Classic & NG/MAX, B757, B767, B747-400/-8, Bombardier CRJ, Embraer ERJ, MD-11, MD-80, MD-90

More Integrated Auto-Flight

Generation 2

From 1964

More elaborate auto-pilot and auto-throttle systems.

Concorde, A300, Mercure, F28, BAe146, VFW 614, B727, B737-100/-200, B747-100/-200/-300/SP, L-1011, DC-9, DC-10

Fly-By-Wire

Generation 4

From 1988

Fly-By-Wire technology enabled flight envelope protection to reduce LOC-I accidents.

A220, A318/A319/A320/A321, A330, A340, A350, A380, B777, B787, C919, Embraer E-Jets, Sukhoi Superjet

Evolution of Commercial Jet Aircraft

Airbus aircraft flew 78% of the flights made by generation 4 commercial jet aircraft in 2024.

There were almost 34 million flight departures in 2024. Around 20 million flights were made by generation 4 commercial jets, more than 15 million of which were Airbus aircraft.

The largest percentage of flights in recent years were made using the latest generation 4 commercial jets, which have the lowest accident rate. As the percentage increases over the next decade, this should help to sustain further decreases in the overall accident rate for commercial air transport.

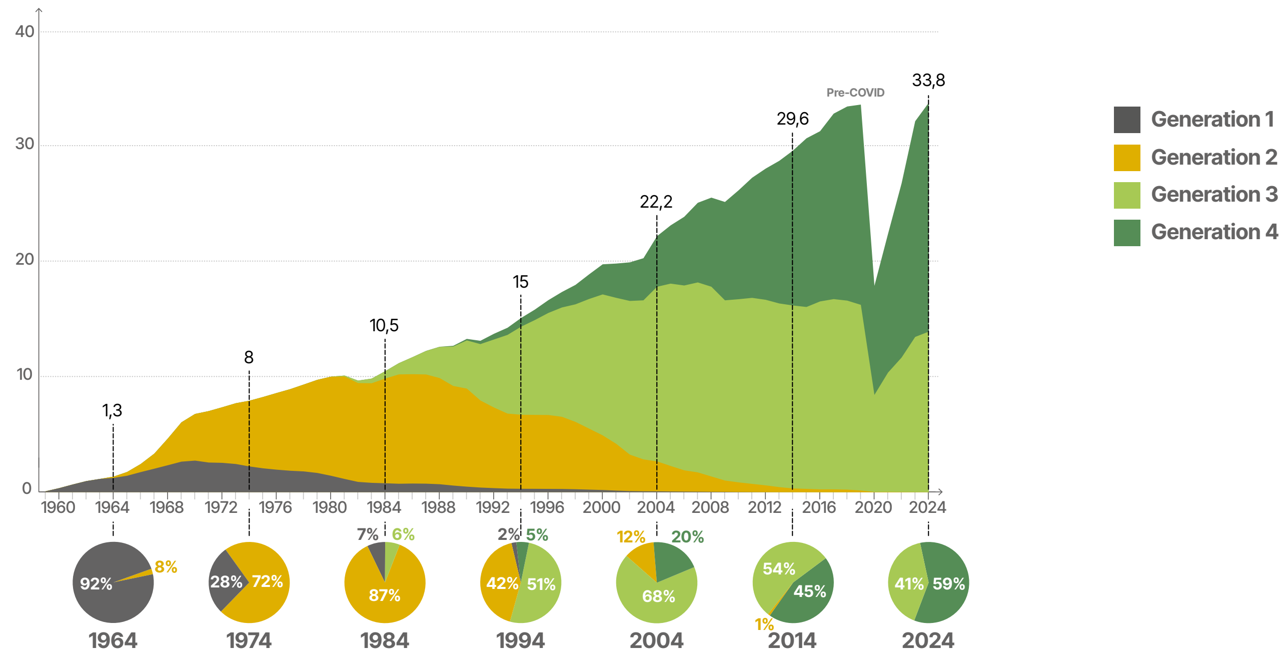
The continual reduction in accident rates shown on the previous pages has been achieved by an ongoing commitment of the commercial aviation industry to enable a safe aircraft to be safely operated in a safe air transport system.

A notable part of this success is due to effective regulation, a strong safety culture, and improvements in training. Technological advances are also a crucial enabler for enhancing the level of safety. In particular, technologies introduced in aircraft systems intentionally evolved with improving safety as their aim.

The first generation of commercial jet aircraft were designed in the 1950s and 1960s with system technologies, which were limited in their capabilities by the analogue electronics of that era. A second generation of aircraft quickly appeared with improved autoflight systems.The third generation of aircraft was introduced in the early 1980s. This generation took advantage of digital technologies to introduce glass cockpits with flight management systems and navigation displays, which significantly improved navigation capabilities and position awareness. Combined with the Terrain Awareness and Warning System (TAWS), these evolutions were key to reducing Controlled Flight Into Terrain (CFIT) accidents.

The fourth and latest generation of commercial jet aircraft first entered into service in 1988 with the Airbus A320 Generation 4 aircraft using fly-by-wire technology with flight envelope protection functions. These functions protect against Loss Of Control In-flight (LOC-I) accidents. Fly-by-wire technology is now the industry standard and it is used on every currently produced Airbus model, Boeing B777 and B787, Comac C919, Embraer E-Jets, and the Sukhoi Superjet.

Yearly number of flights per aircraft generation (in millions)



Percentage of Aircraft Traffic by Aircraft Generation Over the Years

Evolution of Accident Rates

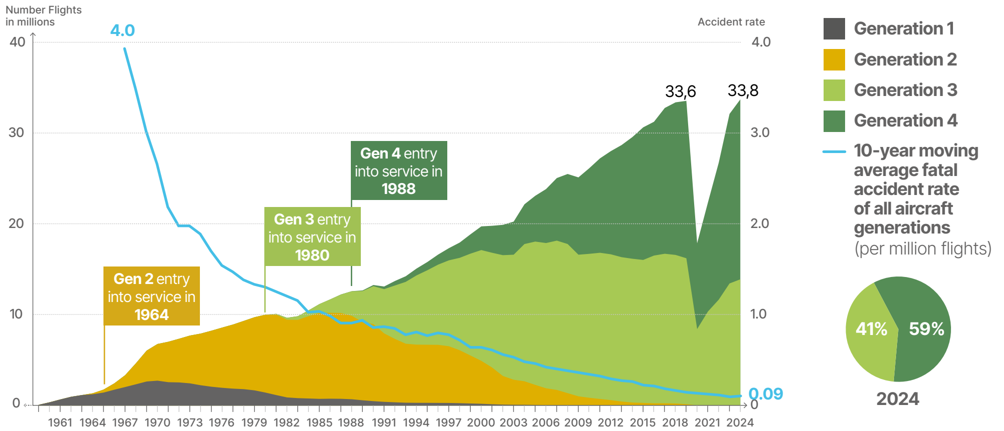
The continual reduction of accident rates over the years has been achieved by constant commitment of the commercial aviation industry to enable a safe aircraft to be safely operated in a safe air transport system.

The 10-year moving average accident rate provides a clearer picture of an overall trend. A notable part of this success is due to effective regulation, a strong safety culture, and improvements in training. Technological advances are also a crucial enabler for enhancing the level of safety. In particular, technologies introduced in aircraft systems intentionally evolved with improving safety as their aim.

The graphs below show the 10-year moving average fatal accident and hull loss accident rates of all aircraft generations (per million flights) and the evolution of the air traffic for each aircraft generation over the year.

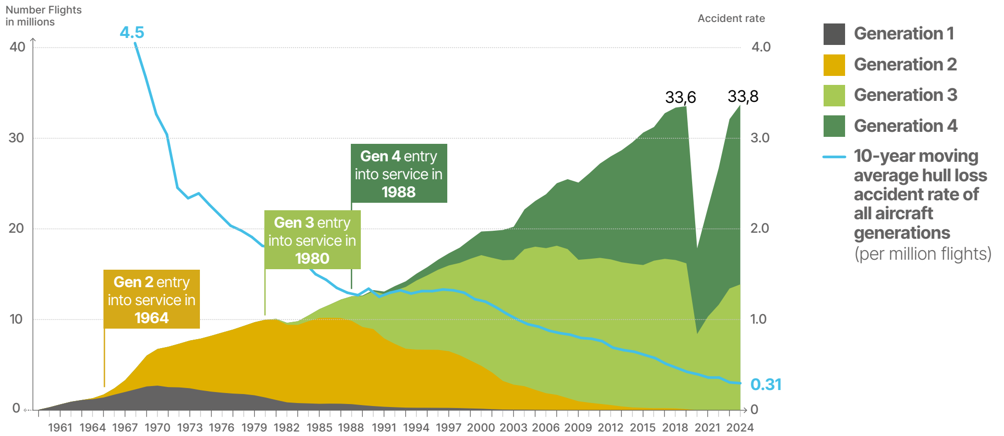
Fatal

10-year moving average fatal accident rate of all aircraft generations (per million flights) **and yearly number of flights per aircraft generation** (in millions)



Hull loss

10-year moving average hull loss accident rate of all aircraft generations (per million flights) **and yearly number of flights per aircraft generation** (in millions)



How Technology Helped Reduce Accidents

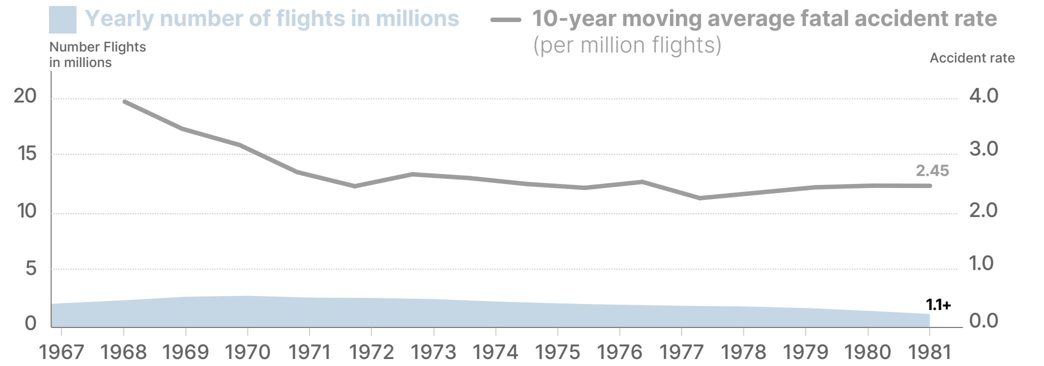
Generation 1

Early Commercial Jets

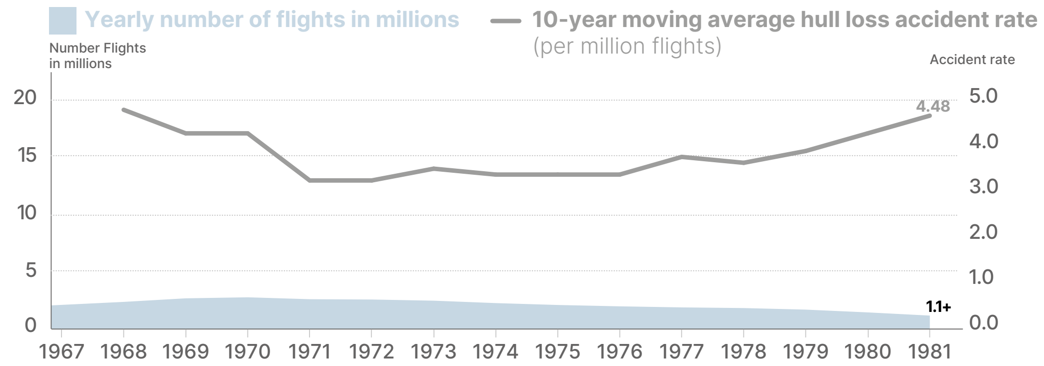
From 1952

Dials and gauges in cockpit, Early auto-flight systems Comet, Caravelle, BAC-111, Trident, VC-10, B707, B720, DC-8, Convair 880/990

Fatal



Hull loss



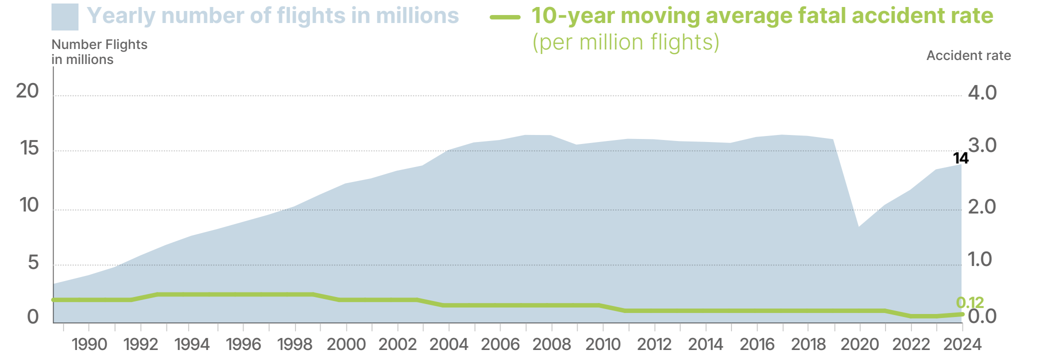
Generation 3

Glass Cockpit & FMS

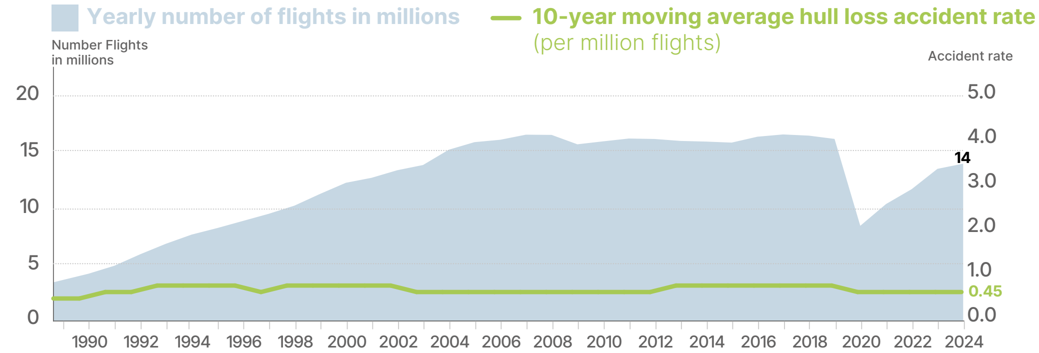
From 1980

Electronic cockpit displays, improved navigation performance and Terrain Avoidance Systems, to reduce CFIT accidents A300-600, A310, Avro RJ, F70, F100, B717, B737 Classic & NG/MAX, B757, B767, B747-400/-8, Bombardier CRJ, Embraer ERJ, MD-11, MD-80, MD-90

Fatal



Hull loss



Statistics over the life of each aircraft generation show a significant improvement in the level of safety, notably since the introduction of generation 3 aircraft, further enhanced by the latest generation 4 aircraft.

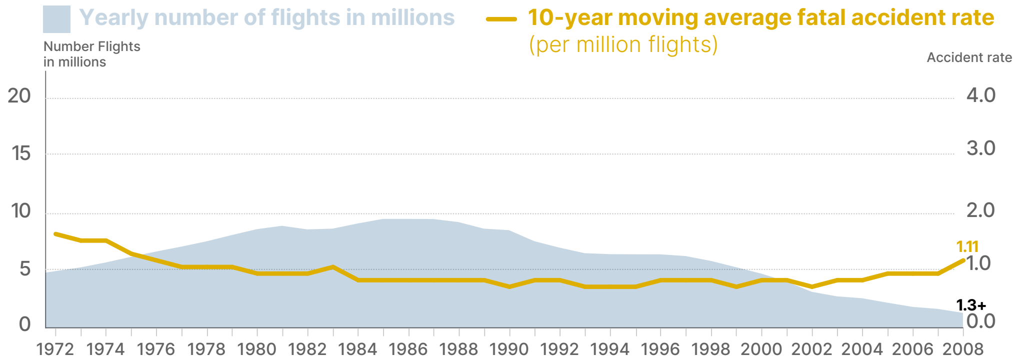
A comparison of the 10-year moving accident rates by generation of aircraft clearly illustrates the value of commercial aviation industry investments in technology to improve safety.
The graphs below show the evolution of air traffic on each generation of jet aircraft. The 10-year moving average (per million flights) accident rate per aircraft generation has been notably reduced since the introduction of generation 3 and safety has been further enhanced with generation 4 jets.

Generation 2

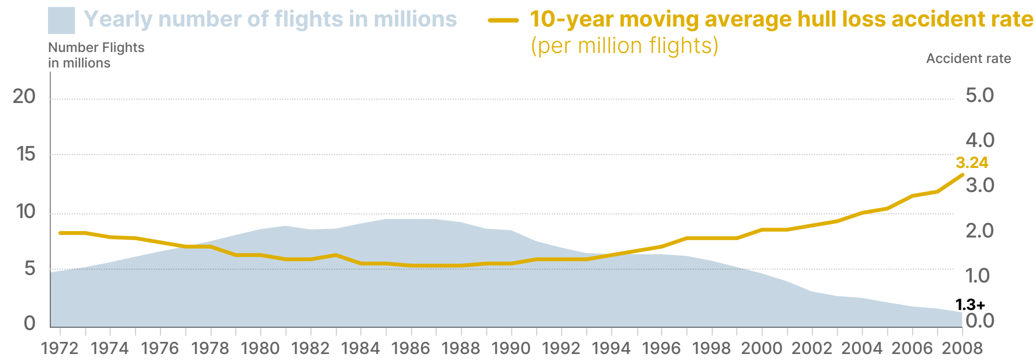
More Integrated Auto-Flight

From 1964
More elaborate auto-pilot and auto-throttle systems Concorde, A300, Mercure, F28, BAe146, VFW 614, B727, B737-100/-200, B747-100/-200/-300/SP, L-1011, DC-9, DC-10

Fatal



Hull loss

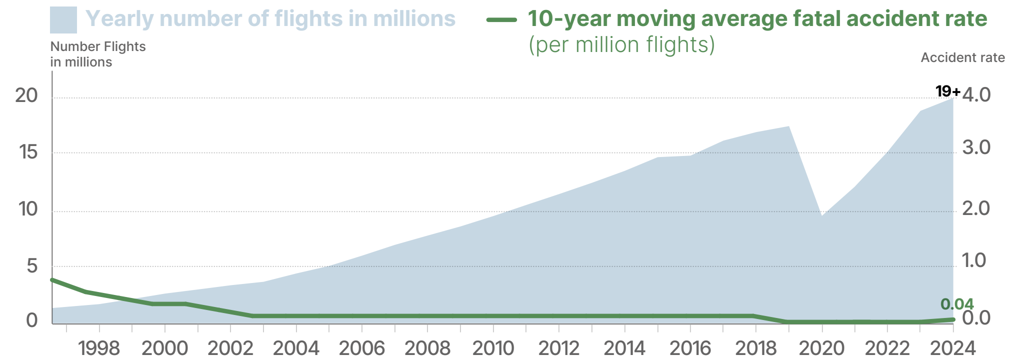


Generation 4

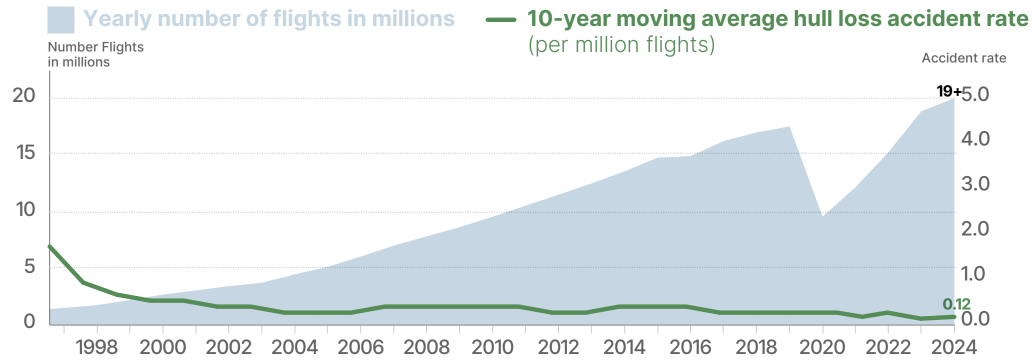
Fly-By-Wire

From 1988
Fly-By-Wire technology enabled flight envelope protection to reduce LOC-I accidents A220, A318/A319/A320/A321, A330, A340, A350, A380, B777, B787, C919, Embraer E-Jets, Sukhoi Superjet

Fatal



Hull loss



Evolution of Accident Rates by Aircraft Generation

Advances in technology have helped to reduce accident rates for each generation.

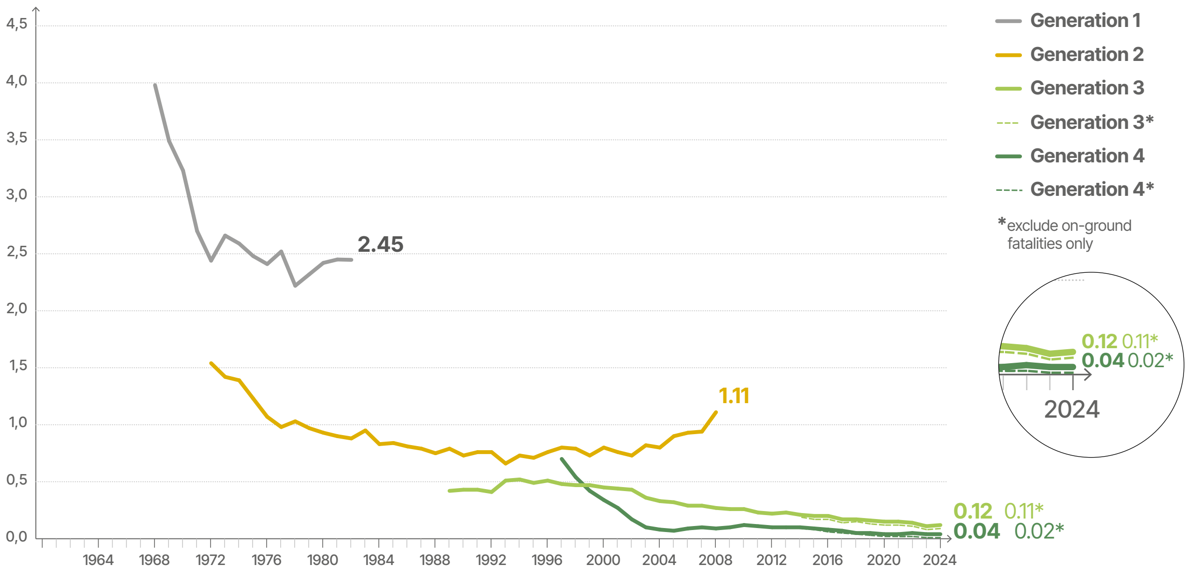
Calculating the 10-year moving average accident rate provides a clearer picture of an overall trend. The data shows when an aircraft generation has recorded more than 1 million flights in a year and begins from the tenth year after the entry into service of each generation.

For example, the 10-year moving average accident rates for generation 4 commercial jet aircraft are shown from 1997, which was the tenth year in service for the A320 aircraft.

The 10-year moving average accident rates for today's generation 4 aircraft are around three times lower than the rates recorded for generation 3 aircraft.

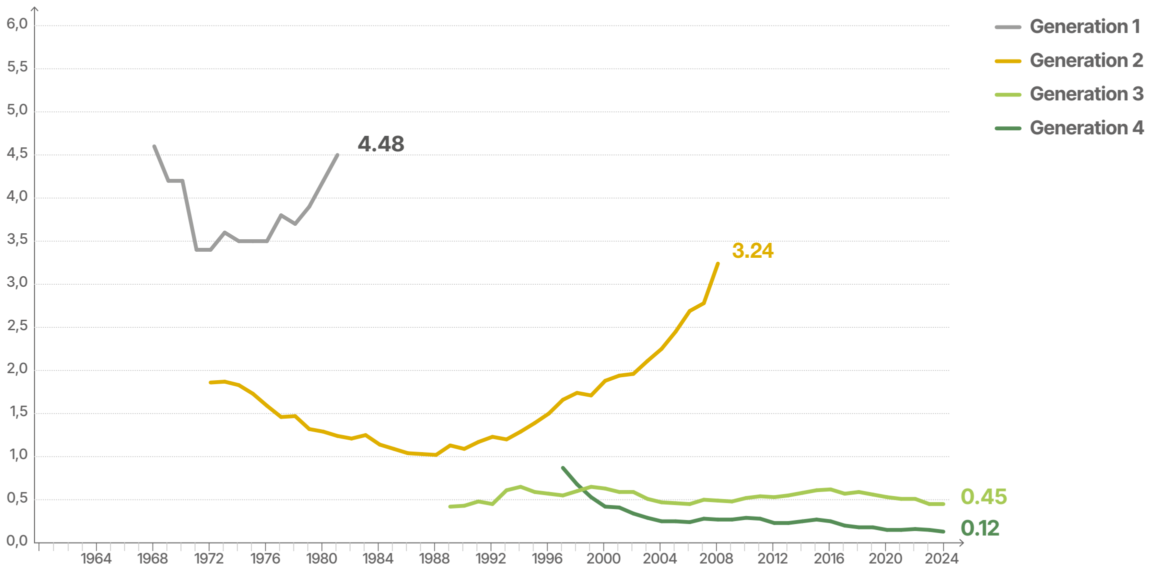
Fatal

10-year moving average fatal accident rate (per million flights) per aircraft generation



Hull loss

10-year moving average hull loss accident rate (per million flights) per aircraft generation



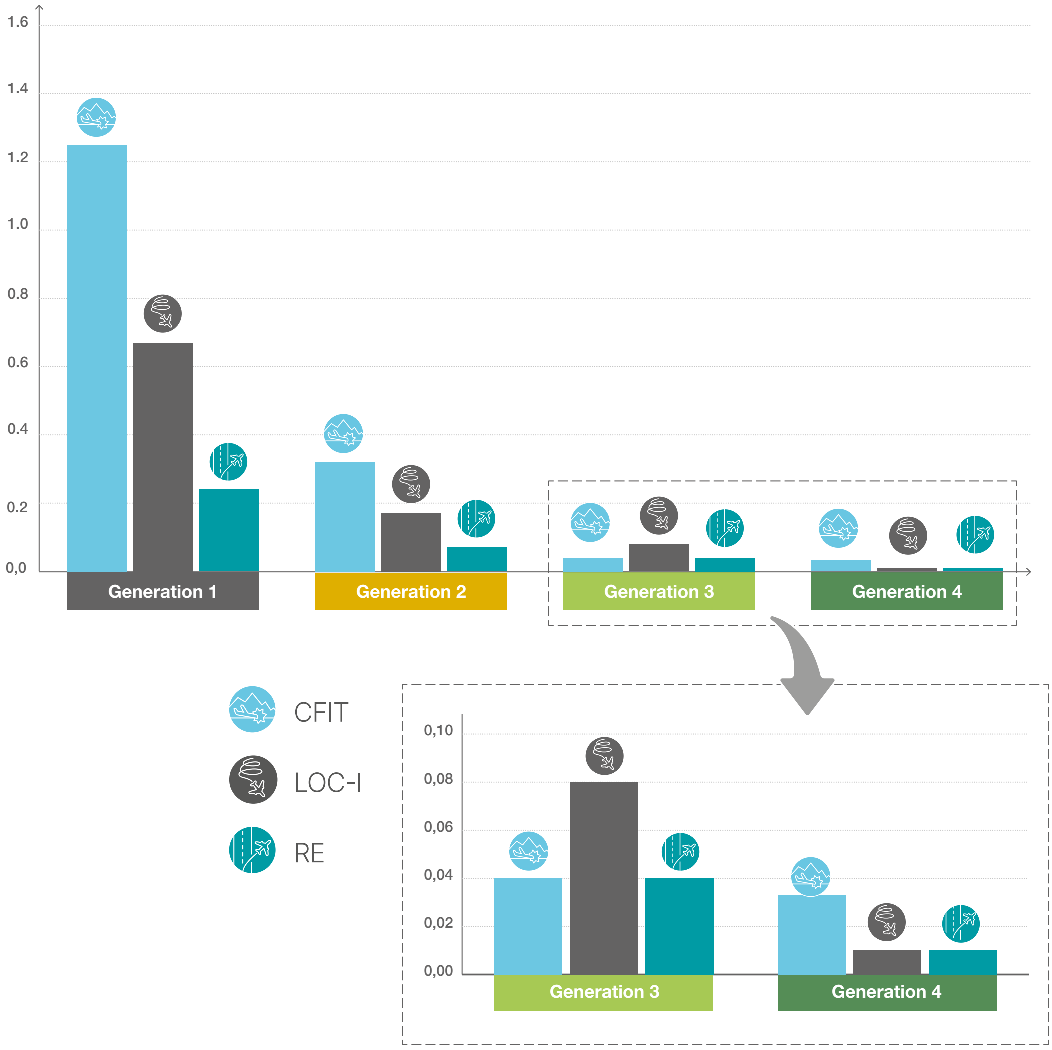
How Technology Addressed the Major Causes of Accidents

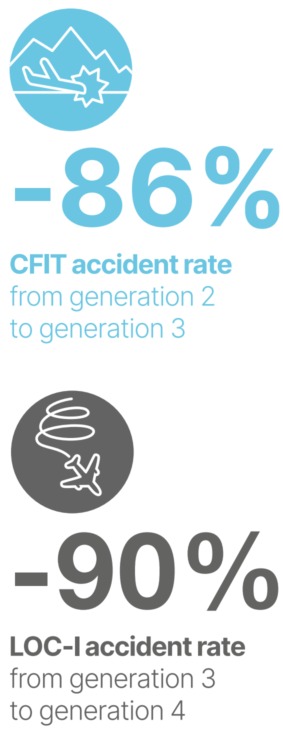
Accident rates were further reduced with the introduction of new technologies on each generation of aircraft.

The introduction of the Flight Management System (FMS), improved navigation displays, and the Terrain Awareness and Warning System (TAWS) with generation 3 aircraft significantly reduced the number of CFIT fatal accidents when compared to the previous generation 1 and generation 2 aircraft.

The benefits of fly-by-wire technologies and energy management systems, which were first introduced on generation 4 aircraft, show a lower rate of LOC-I and RE accidents when compared with the previous generation 3 aircraft. More detailed analysis about the influence of these technologies on reducing the accident rate is introduced in Chapter 3.

Average fatal accident rate (per million flights) per accident category 1958-2024





03 Commercial Aviation Accidents Over the Last 20 years

Evolution of the Yearly Accident Rate

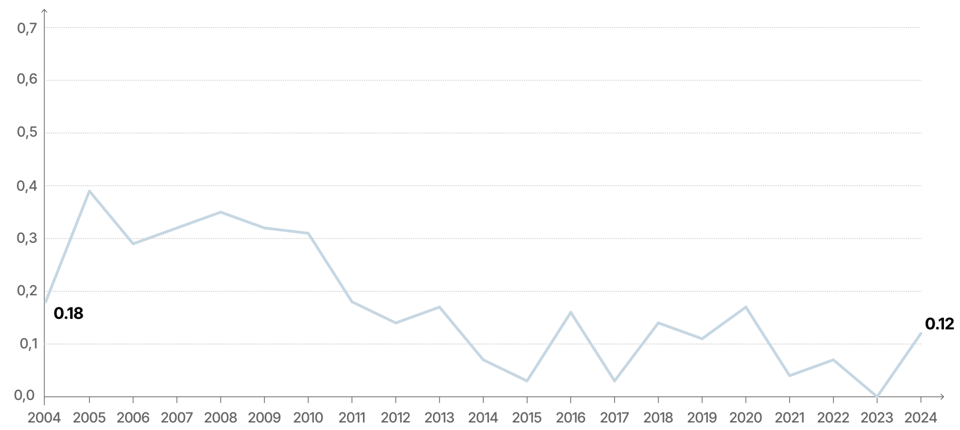
In the last two decades, a reduction in fatal and hull loss accidents was achieved across the commercial aviation industry.

In 2024, there was an increase in the accident rate due to four fatal accidents, three of which were hull losses. There were also nine additional hull loss accidents with no fatalities. The increase can be partially attributed to the growth in air traffic and the challenges that poses for the industry.

Despite the reduction of the yearly accident rate in the last 20 years, rates recorded for the years affected by the pandemic show a varying range. This may be partially attributed to the variability of the number of flights recorded in each year. This also shows that the accident rate for a single year is not indicative of an overall safety trend.

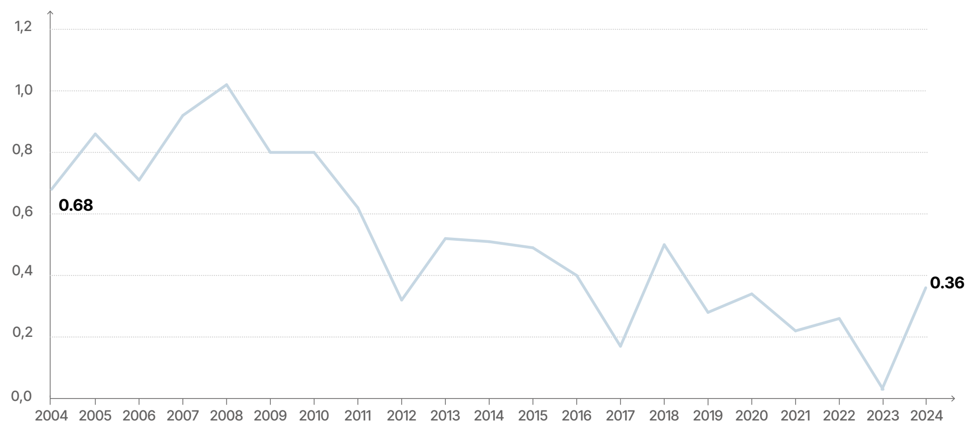
Fatal

Yearly fatal accident rate per million flights



Hull loss

Yearly hull loss accident rate per million flights



Evolution of Accident Rates by Aircraft Generation

Generation 4 aircraft accident rates are 3 times lower than generation 3 aircraft accident rates.

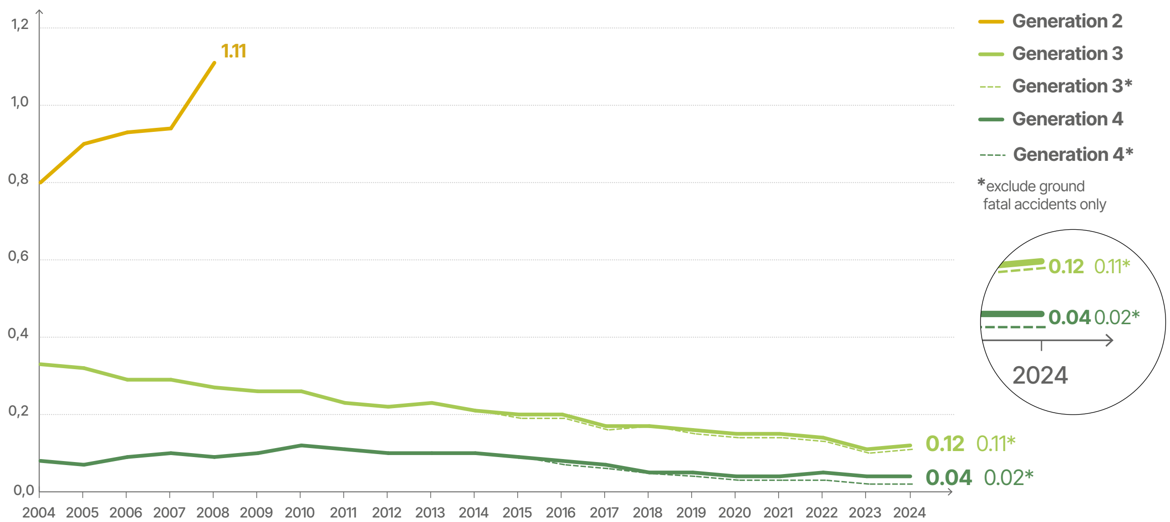
Generation 3 aircraft technology helped to reduce accident rates by introducing glass cockpits with navigation displays and flight management systems. Generation 4 aircraft technology helped to further reduce accident rates by introducing fly-by-wire technology, which made flight envelope protection possible.

The accident rate for both generation 3 and 4 aircraft remained low in 2024. Generation 4 commercial jet aircraft flew 59% of the flights in 2024 and this figure will continue to increase over the next decades.

The overall accident rate for commercial air transport should continue to decrease due to the noticeably lower rate of generation 4 aircraft.

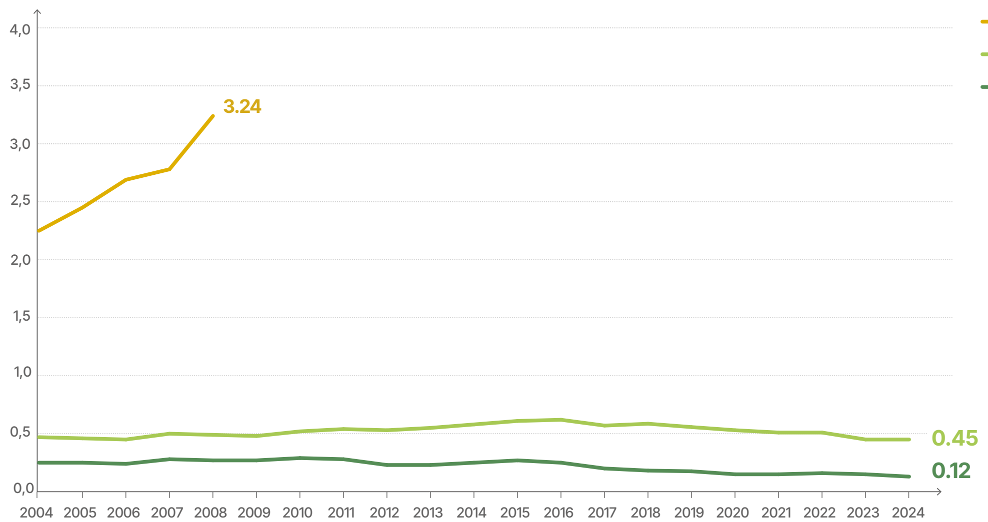
Fatal

10-year moving average fatal accident rate (per million flights) per aircraft generation



Hull loss

10-year moving average hull loss accident rate (per million flights) per aircraft generation



Accidents by Flight Phase

Definitions of Flight Phases

The flight phases described below are based on standard ICAO definitions:

- **Standing:** The phase of flight prior to pushback or taxi, or after arrival, at the gate, ramp, or parking area, while the aircraft is stationary.
- **Taxi:** The aircraft is moving under its own power prior to takeoff or after landing. This phase includes the taxi to runway, the taxi to takeoff position and the taxi from runway until the aircraft stops moving under its own power.
- **Takeoff:** From the application of takeoff power, through rotation and to an altitude of 35 feet above runway elevation or until gear-up selection, whichever comes first. This phase includes rejected takeoff.
- **Initial climb:** From the end of the takeoff phase to the first prescribed power reduction, or until reaching 1000 feet above runway elevation, whichever comes first.
- **Enroute:** From completion of initial climb through cruise altitude and completion of controlled descent to the Initial Approach Fix (IAF).
- **Approach:** From the IAF to the point of transition from nose-low to nose-high attitude immediately prior to the flare above the runway.
- **Landing:** The phase of flight from the point of transition from nose-low to nose-up attitude, immediately before landing (flare), through touchdown and until the aircraft exits the landing runway or when power is applied for takeoff in the case of a touch-and-go landing, whichever occurs first.

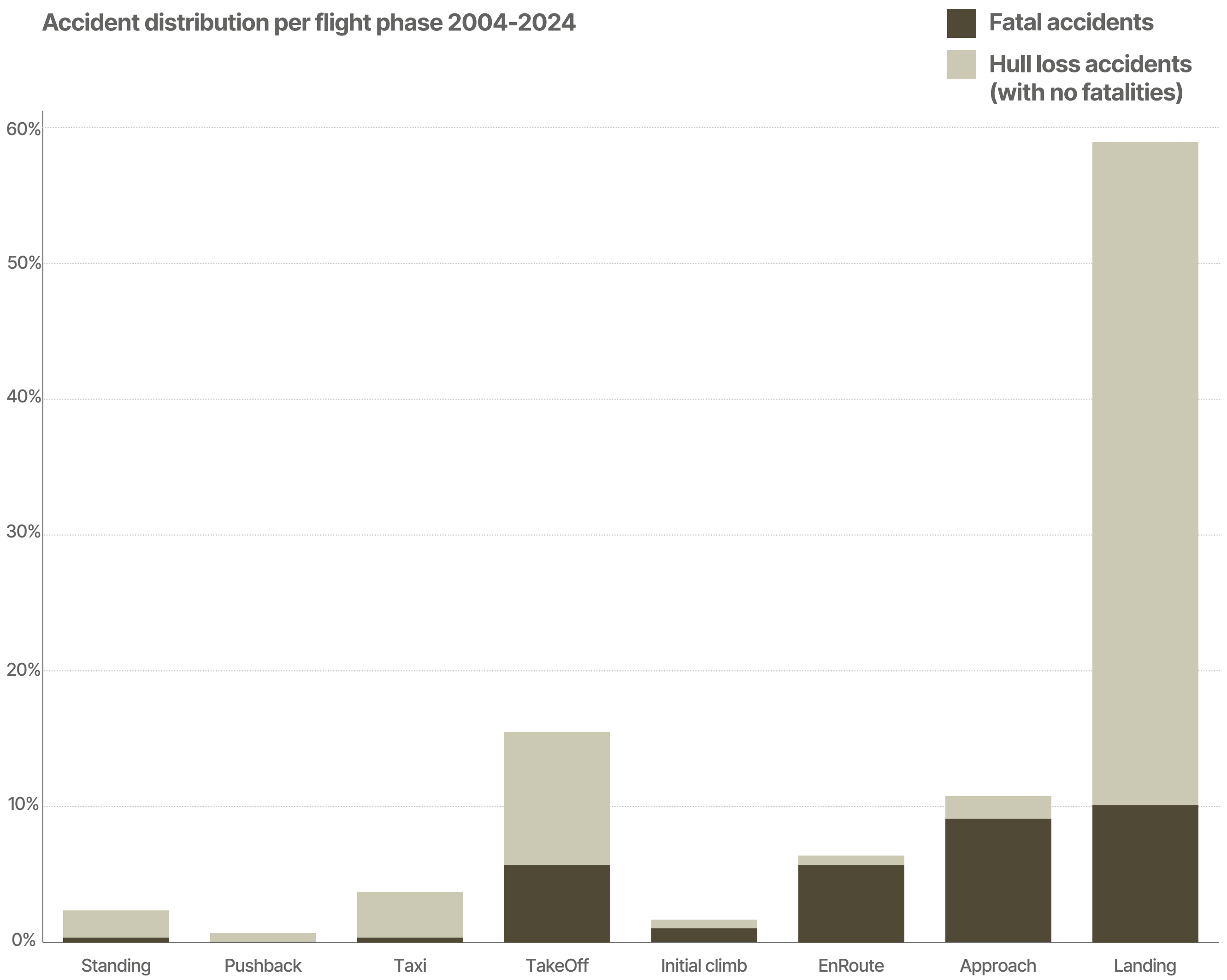
Most of the accidents over the last 20 years occurred during approach and landing phases.

Of the nine hull loss accidents without fatalities recorded in 2024, seven occurred at landing and two occurred during takeoff. A significant proportion of accidents recorded over the last two decades occurred during takeoff, approach, and landing phases.

Approach and landing are highly complex flight phases, which place significant demands on the crew in terms of navigation, aircraft configuration changes, communication with Air Traffic Control, congested airspace, and degraded weather conditions.

This combination of high workload and the increased potential for unanticipated events can create a complex interplay of contributing factors, which may lead to an accident.

Accident distribution per flight phase 2004-2024



Accidents by Accident Category

The biggest cause of fatal accidents over the last 20 years was Loss Of Control In-flight (LOC-I).

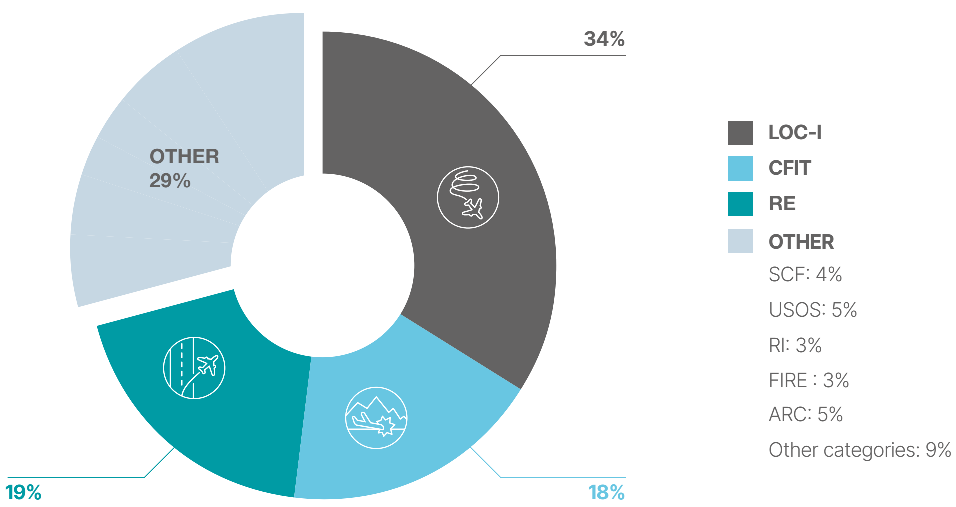
LOC-I accidents have significantly reduced for generation 4 aircraft enabled by fly-by-wire technologies.

CFIT accidents are the second largest category of accidents. The number of these accidents is decreasing with the continued development of navigation and Terrain Awareness and Warning System (TAWS) technologies, which are available on both generation 3 and generation 4 aircraft.

Runway Excursions (RE), including lateral and longitudinal types, are the third major cause of fatal accidents and the primary cause of hull losses. Emerging technologies, both energy-based and performance-based, show promising trends for preventing longitudinal RE accidents.

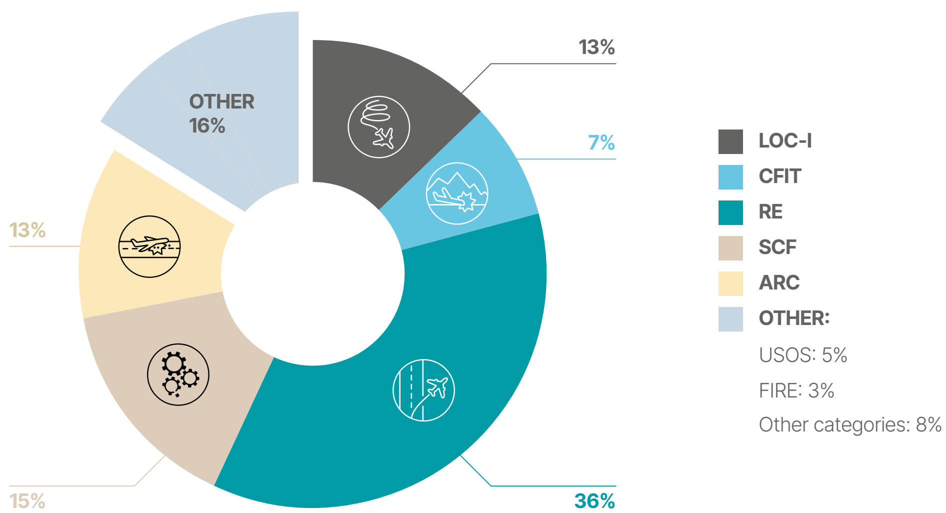
Fatal

Fatal accident distribution per accident category 2004-2024



Hull loss

Hull loss accident distribution per accident category 2004-2024



Evolution of the Main Accident Categories

The fatal accident rate for CFIT accidents reduced by 95%, and the LOC-I fatal accident rate reduced by 73%.

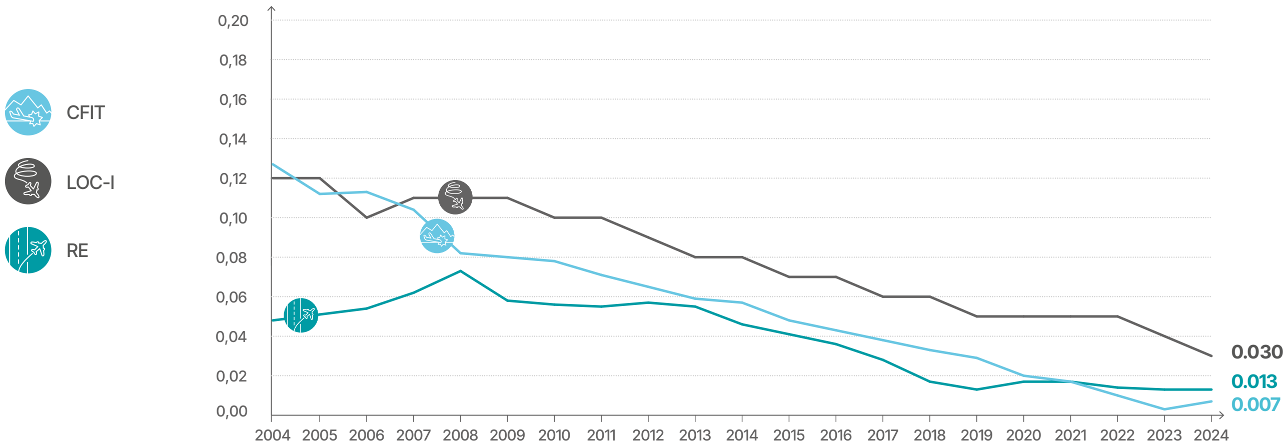
The proportion of flights flown by aircraft equipped with Flight Management System (FMS) and Terrain Awareness and Warning System (TAWS) technologies, which help to prevent CFIT accidents, has grown from 68% to 99% over the last 20 years.

59% of all flights in 2024 were made using generation 4 commercial jet aircraft equipped with fly-by-wire enabled technologies. The rate of LOC-I accidents is 90% lower for generation 4 aircraft when compared with generation 3 aircraft. As the proportion of flights made using generation 4 aircraft continues to grow, the rate of LOC-I accidents is expected to further decrease.

New technologies to address the causes of RE accidents were first deployed on Airbus aircraft in 2007. The number of Airbus aircraft equipped with RE prevention technologies today represents approximately 15% of the in-service fleet, contributing to the overall decreasing trend for hull losses due to RE accidents.

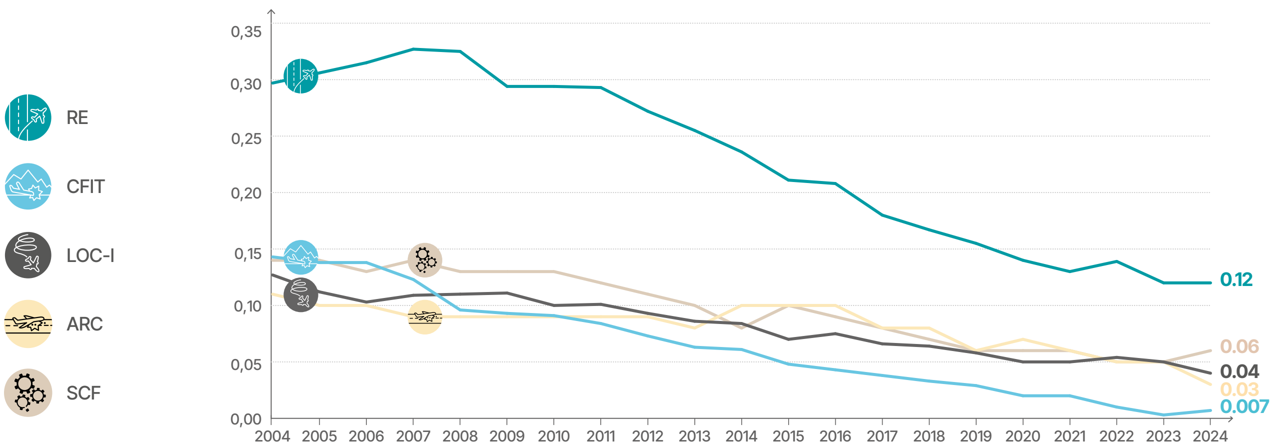
Fatal

10-year moving average fatal accident rate (per million flights) per accident category



Hull loss

10-year moving average hull loss accident rate (per million flights) per accident category



Controlled Flight Into Terrain (CFIT) Accident Rates

The introduction of glass cockpits, FMS, and TAWS on generation 3 aircraft has helped to reduce the CFIT fatal accident rate by 86% compared with generation 2 aircraft.

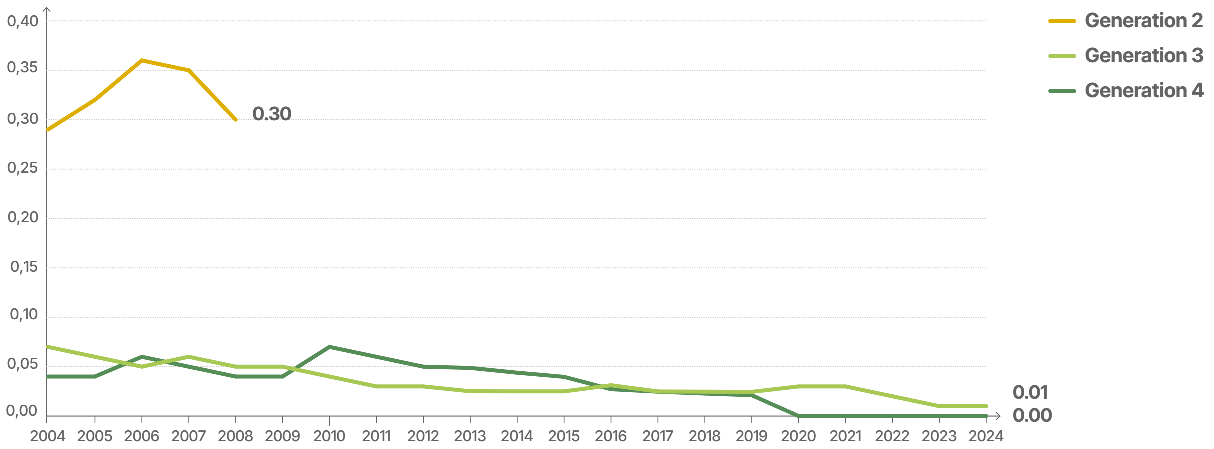
Technologies to reduce CFIT were introduced progressively with Terrain Awareness and Warning System (TAWS).

Glass cockpits installed on generation 3 aircraft improved navigation performance due to the introduction of a Flight Management System (FMS) and navigation displays that helped to further reduce the CFIT accident rates.

There were no fatal or hull loss CFIT accidents recorded for generation 4 aircraft in the last decade. Therefore, the 10-year moving average rate is zero for this generation in 2024.

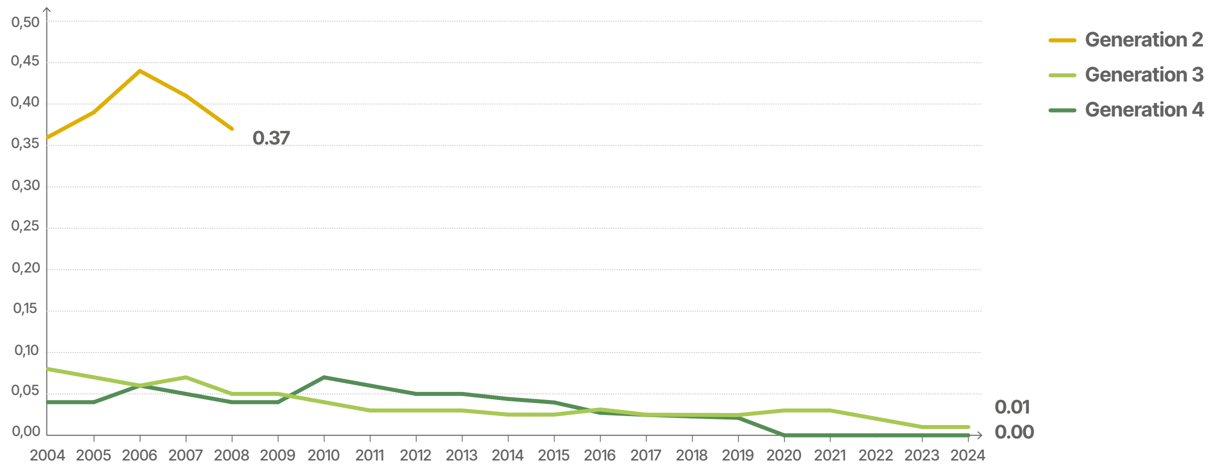
Fatal

10-year moving average CFIT fatal accident rate (per million flights) per aircraft generation



Hull loss

10-year moving average CFIT hull loss accident rate (per million flights) per aircraft generation



Loss Of Control In-flight (LOC-I) Accident Rates

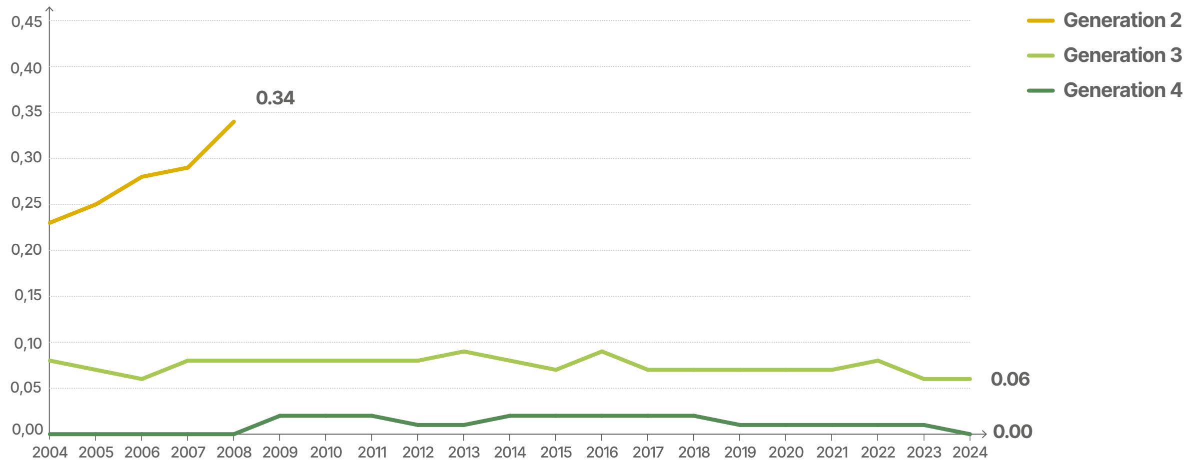
Flight envelope protection introduced with generation 4 aircraft has helped reduce LOC-I fatal accident rates by 90% compared with generation 3.

Generation 4 aircraft have accumulated over 30 years of in-service experience since the A320 aircraft first entered into service in 1988. This represents more than 272 million accumulated flights by the end of 2024, which is a strong statistical basis illustrating the significant safety benefit of fly-by-wire enabled and flight envelope protected aircraft to address LOC-I accidents.

There were no fatal LOC-I accidents recorded for generation 4 aircraft in the last decade. Therefore, the 10-year moving average rate is zero for this generation in 2024. The rate of LOC-I hull loss accidents is around 89% lower for generation 4 aircraft when compared with generation 3 aircraft.

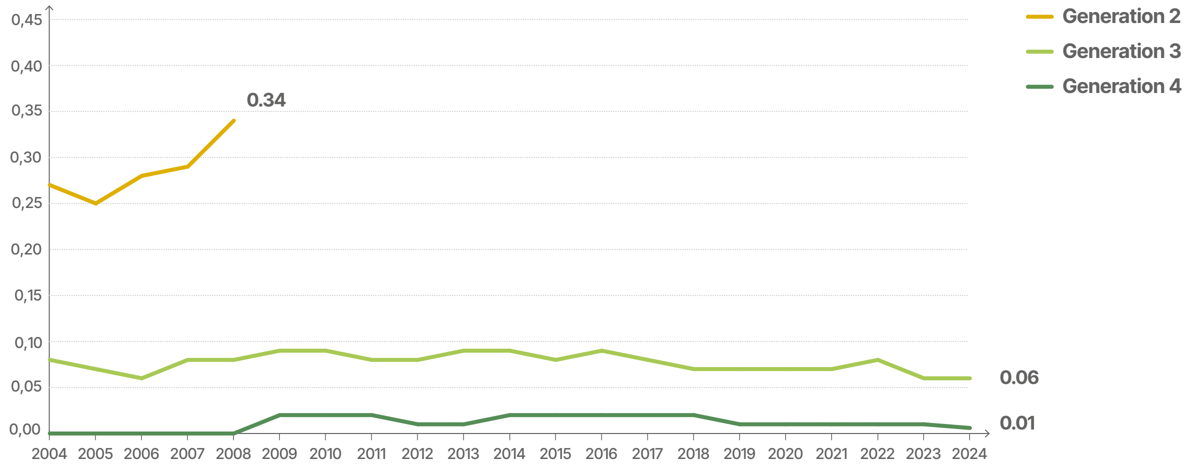
Fatal

10-year moving average LOC-I fatal accident rate (per million flights) per aircraft generation



Hull loss

10-year moving average LOC-I hull loss accident rate (per million flights) per aircraft generation



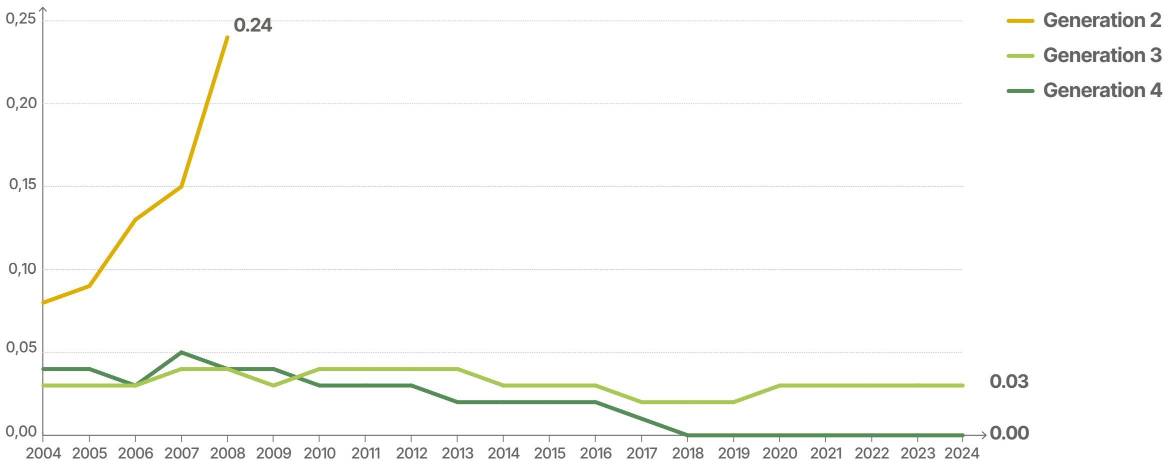
Runway Excursion (RE) Accident Rates

Technologies to reduce RE accidents have been available for over 17 years.

Most longitudinal RE accidents are related to aircraft energy management. An improvement in RE accident rates should be expected with the introduction of real-time energy and landing performance-based warning systems, such as the Runway Overrun Protection System (ROPS) available for Airbus aircraft. In 2024, the number of aircraft equipped with ROPS increased to 15% of the worldwide fleet.

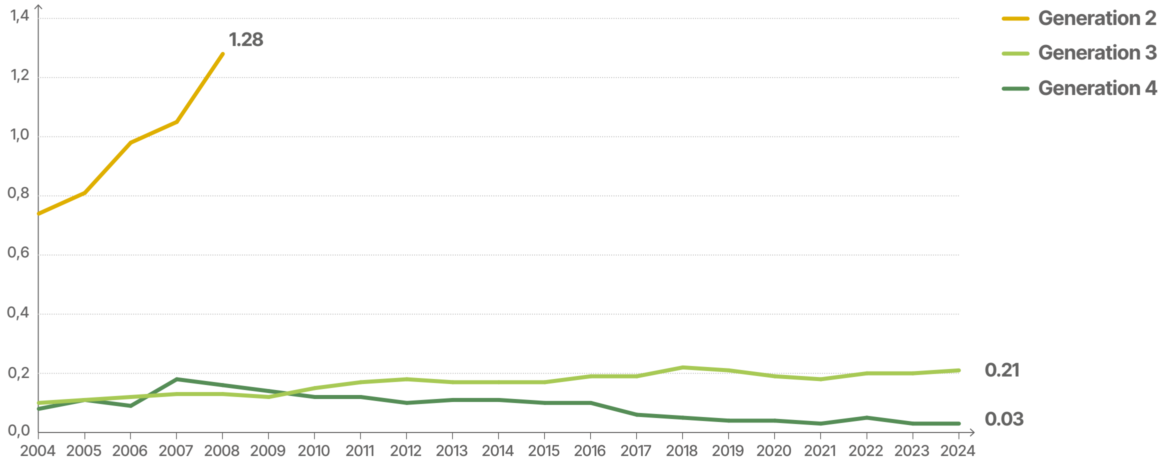
Fatal

10-year moving average RE fatal accident rate (per million flights) per aircraft generation



Hull loss

10-year moving average RE hull loss accident rate (per million flights) per aircraft generation



AIRBUS

AIRBUS S.A.S. 31707 Blagnac Cedex, France

February, 2025. Concept design by Airbus Multi Media Studio 20241325. Photos by Airbus, Borja García de Sola, Jean-Vincent Reymondon, Alexandre Doumenjou, Getty Images.

Reference X00D17008863 Issue 9.

Printed in France by Art & Caractère.

This brochure is printed on Symbol Tatami.
This paper is produced in factories that are accredited EMAS and certified ISO 9001-14001, PEFC and FSC CoC. It is produced using pulp that has been whitened without either chlorine or acid. The paper is entirely recyclable and is produced from trees grown in sustainable forest resources.

The printer, Art & Caractère (France 81500) is engaged in a waste management and recycling programme for all resulting by-products.

FSC www.fsc.org MIXTE Papier | Pour une gestion forestière responsable FSC® C018766

IMPRIM'VERT