Effective 1 April 2022

2021 Safety Report

Issued April 2022

Edition 58

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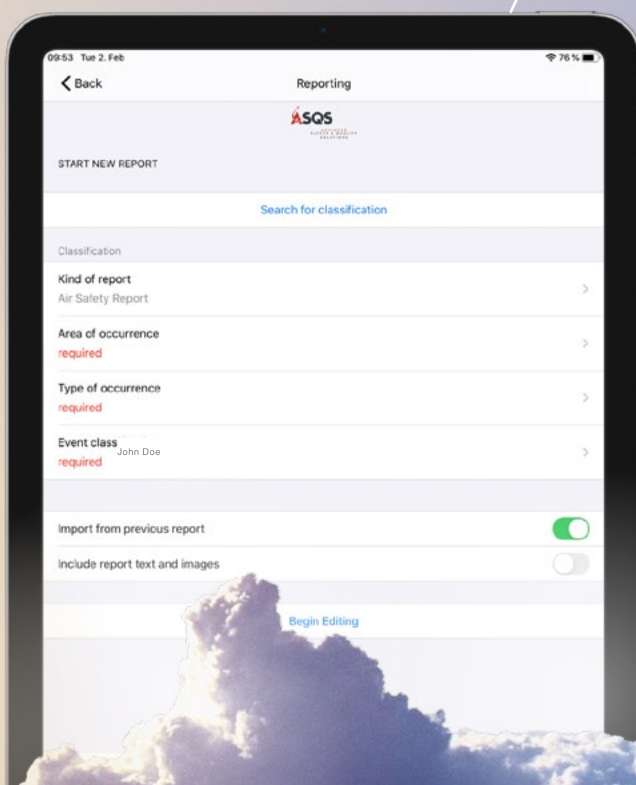

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International Air Transport Association
Montreal - Geneva

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Senior Vice-President's Foreword

Nick Careen
Senior Vice President Operations,
Safety and Security
International Air Transport Association

Dear colleagues,

The airline industry entered 2021 with hopes that availability of COVID-19 vaccines and testing would encourage governments to lift travel restrictions that placed enormous burdens on families, the global economy, and the air transport sector. Throughout the year, IATA strongly advocated for a more harmonized and data-driven approach to managing the pandemic across borders and an end to testing requirements for vaccinated travelers.

Unfortunately, despite evidence of the ineffectiveness of border closures and quarantines, much of the world remained closed to international travel last year. As a result, although domestic markets saw strong recovery, international passenger traffic was 75% below 2019, while the total number of flights was down 45% compared to pre-pandemic levels.

Throughout this period, IATA worked closely with our members, manufacturers, regulators and other stakeholders to ensure aviation's superb safety performance was not compromised. IATA worked collaboratively with industry safety partners to identify safety risks, and deployed safety risk assessments, extensive guidance material, and operational notices to highlight issues. IATA also launched safety enhancement initiatives, presenting best practices to address specific issues.

One such cooperative approach, developed in collaboration with EUROCONTROL, was focused on the importance of pilot response to TCAS alerts to resolve aircraft conflicts. Another was a study to mitigate the risks of unstable approaches, where IATA collaborated with our members, CANSO, IFALPA, IFATCA, ICAO, manufacturers, and other organizations.

Data is a core driver of evidence-based decision-making and allows IATA, on behalf of industry, to identify safety issues and emerging trends. It also ensures safety initiatives, delivering defined safety improvements, can be monitored for their effectiveness. IATA Global Aviation Data Management programs are central to this and enhancing our data collection is key to greater understanding of aviation hazards and safety risks.

Aviation is so safe that even one accident can skew the accident rate, and this is particularly the case when flight operations are reduced. But, despite the challenges posed by the pandemic, the 2021 IATA Safety Report shows that safety in the aviation industry is resilient, and the path to recovery is in sight.

Looking at the 2021 safety performance:

- The all-accident rate was 1.01 accidents per million flights, much improved over the rate of 1.58 in 2020 as well as compared to the 5-year average rate of 1.23.
- The total number of accidents decreased from 35 in 2020 to 26 in 2021 and was below the 5-year average of 44.
- The total number of fatal accidents increased to 7 in 2021 from 5 in 2020, while the number of fatalities declined to 121 from 132.
- IATA member airlines' accident rate was 0.44 per million flights, which was an improvement over the industry 5-year average accident rate of 1.23 and the 2020 rate of 1.58.

Senior Vice-President's Foreword (cont'd)

- Airlines on the IATA Operational Safety Audit (IOSA) registry, which includes all IATA member airlines, had zero fatal accidents in 2021 and zero jet hull losses.
- The industry's fatality risk increased from 0.13 in 2020 to 0.23 in 2021. But comparing the rolling 5-year average, 2012-2016, to the most recent 5-year period (2017-2021) shows a downwards trend from 0.24 to 0.14.
- 2021's 0.23 rate means, on average, a person would need to take a flight every day for 10,078 years to be involved in an accident with at least one fatality, or 12,151 years to face a 100% fatal accident.
- Runway excursions is a high-risk category (HRC), comprising 24% of all accidents pre-COVID. But the good news is, in 2021, for the first time there were no runway excursion accidents, according to IATA's historical database.

As the world transitions from the pandemic to managing COVID-19 as an endemic virus, recovering from this crisis, safely and sustainably, is critical. As highlighted in this report, where regional safety performance is cause for concern, IATA will focus coordinated actions to address the issues identified to bring the fatality risk in these regions in line with the rest of the world.

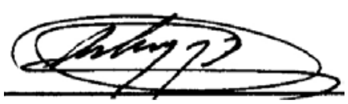
The IATA Safety Strategy has been developed to drive safety improvements to achieve the objective of a continuous reduction in the accident rate. To deliver on this goal, IATA will focus its efforts to:

- Emphasize the criticality of organizational safety culture, especially during times of change, through our Safety Leadership program.
- Evolve IOSA to deliver a risk-based approach to the IATA safety audit program, supported by a safety risk management framework, to capture, analyze and share identified industry safety risks.
- Utilize our communications platform, Safety Connect, to enable identified issues and emerging threats to be shared across the IATA community.

When considering emerging threats, it is clear the number of industry stakeholders continues to grow, and it is important to work with them effectively. Whether established sectors, such as telecoms, or new entrants, it is critical for early engagement. This was not the case with the rollout of 5G and, consequently, significant disruption was caused to operations as the industry tried unsuccessfully to communicate the safety risks associated with this new technology. This must be a situation we avoid in the future.

It is our privilege to offer you this 58th edition of the IATA Safety Report. I encourage you to share the vital information contained in these pages with your colleagues. I would like to thank the Accident Classification Task Force (ACTF), the Safety, Flight and Ground Operations Advisory Council (SFGOAC), the Safety Group (SG), the Cabin Operations Safety Task Force (COSTF), and all IATA staff involved for their cooperation and expertise, essential for the creation of this report.

Chair's Foreword



Captain Rubén Morales
Chair, IATA Accident Classification Technical Group

I want to begin this edition of the IATA Safety Report by sharing some positive news. 2021 shows the lowest all-accident rate recorded in our database since 2005, and the total number of accidents, fatal accidents and fatalities all declined against the five-year average. Also unprecedented is, for the first time in the past 17 years, the Accident Classification Task Force (ACTF) did not classify any runway excursion accidents. However, we cannot lower our guard because 2021 was another unique year in aviation history, with only 55% of the pre-pandemic traffic flown in 2019, but 16% higher number of sectors flown compared to 2020.

The ACTF has identified Loss of Control — In-flight (LOC-I) and Controlled Flight into Terrain (CFIT) as the two major causes of fatalities this year. In general, the industry should put more effort into addressing the main contributing factors to these types of accidents. Adherence to Standard Operating Procedures (SOP), manual handling skills, and monitoring and cross-checking are some of the areas that need to be improved. ACTF recommendations can be found throughout this report.

Three regions of the world recorded fatal accidents this year, AFI with three fatal accidents, CIS with three fatal accidents and ASPAC with one fatal accident. All the fatal accidents incurred during 2021 were associated with non-IATA members and airlines that are not on the IATA Operational Safety Audit (IOSA) registry. This highlights the important role that IOSA has on safety performance.

Human factors have been identified in most of the accident data. Identifying the sources of human errors is crucial to reducing their reoccurrence. However, remedial actions should not be focused only on the individual. Organizational aspects such as just culture policies and the willingness of the organization to learn and improve should also be carefully reviewed.

In this edition, we have included recommendations related to the restart of operations following COVID-19. I want to emphasize the importance of performing risk assessments, taking into consideration the impact on human performance related to the pandemic and accompanying reductions in flying hours.

I would like to thank the members of the ACTF, IATA staff and all other experts involved in the preparation of this report, which under the current travel restrictions, required flexibility, innovation and strong commitment to improve aviation safety.

2021 Safety Report Executive Summary

In 2021, there were 26 accidents versus 35 in 2020. However, the number of fatal accidents increased from five accidents in 2020 to seven in 2021. The number of fatalities declined from 132 in 2020 to 121 in 2020.

Government measures in response to the COVID-19 pandemic continue to severely impact the aviation industry and resulted in a substantial reduction in operations compared to pre-COVID levels. Just over 25 million flights were operated in 2021, an increase of 16% compared to 2020, but 55% below the 2019 figure.

The industry witnessed an improvement in the global accident rate in 2021, down from 1.58 per million sectors in 2020 to 1.01 in 2021. The full year 2021 demonstrates the lowest accident rate in the last 10 years. The five-year rolling average accident rate (2017-2021) of 1.23 was also the lowest when comparing the five-year averages going back to 2012.

Of the 26 aircraft accidents and 121 fatalities in 2021, IATA member airlines had zero fatal accidents. In 2021, IATA member airlines continued to trend lower than the industry at 0.44 accidents per million sectors versus 1.01 – a pattern also reflected in the five-year average.

Over the last decade, the industry continued its 10-year trend of declining fatal accident rates and fatality risk. In 2012, there were 15 fatal accidents that resulted in 416 fatalities. Over the past five years, there have been an average of seven fatal accidents per year for commercial aircraft (passengers and cargo) resulting in an annual average of 207 fatalities. IATA continues its focus on supporting aviation stakeholders to continuously reduce the industry fatality risk.

The accident categories in 2021 listed in order of the *number of fatalities* (with the number of accidents in brackets) **were:**

- Loss of Control — In-flight (3) with 75 fatalities
- Controlled Flight into Terrain (2) with 32 fatalities
- Other End State (2) with 14 fatalities

The top accident categories in 2021 listed by the frequency of *nonfatal accidents* were:

- Gear-up Landing/Gear Collapse (5)
- Tail Strike (4)
- In-flight Damage (3)
- Hard Landing (2)
- Runway Collision (2)
- Off-Airport Landing/Ditching (1)
- Other End State (1)
- Undershoot (1)
- Runway/Taxiway Excursion (0)
- Ground Damage (0)
- Mid-Air Collision (0)

Runway Excursions suffered zero accidents in 2021. This is a first according to IATA's historical database. Also, Ground Damage had zero accidents for the first time in over 15 years. However, after a year in which there were zero LOC-I accidents, there were three in 2021, resulting in 75 fatalities.

When considering accidents per region:

- Africa (AFI) had the highest accident rate with 5.66 accidents per million sectors followed by Commonwealth of Independent States (CIS) with 4.07 accidents per million sectors.
- CIS, AFI, and Asia-Pacific (ASPAC) operators suffered fatal accidents in 2021. One involved jet aircraft and six involved turboprops. The jet fatality risk for ASPAC operators is 0.33, down from 0.34 reported in 2020. The turboprop fatality risk for CIS is 31.90, up from zero in 2020 and for AFI the risk is 7.15, up from 6.10.
- 31% of the commercial air transport accidents in 2021 involved North American (NAM) operators followed by ASPAC operators with 19% of total accidents.
- IATA membership and IOSA accreditation for non-IATA members continued a strong correlation with improved safety performance. The accident rate for IOSA-registered carriers in 2021 was lower than the rate for non- IOSA carriers. (0.45 vs 2.86).
- The jet hull loss rate per million sectors in 2021 was 0.13 vs 0.16 in 2020. Middle East and North African (MENA) operators have reported zero jet hull loss accidents since 2015.
- The turboprop hull loss rate per million sectors in 2021 was 1.77 vs. 1.59 in 2020. European and North Asian operators have reported zero turboprop hull loss accidents since 2014 and 2015, respectively.

“Hazardous weather conditions, particularly strong and gusty winds and thunderstorms, often feature in aviation incidents and accidents worldwide. WMO is committed to working with IATA and other industry partners to minimize flight safety risk, both at airports and in airspace, through advances in science and technology as well as service delivery innovation.”

Greg Brock
Head, Services for Aviation
World Meteorological Organization (WMO)

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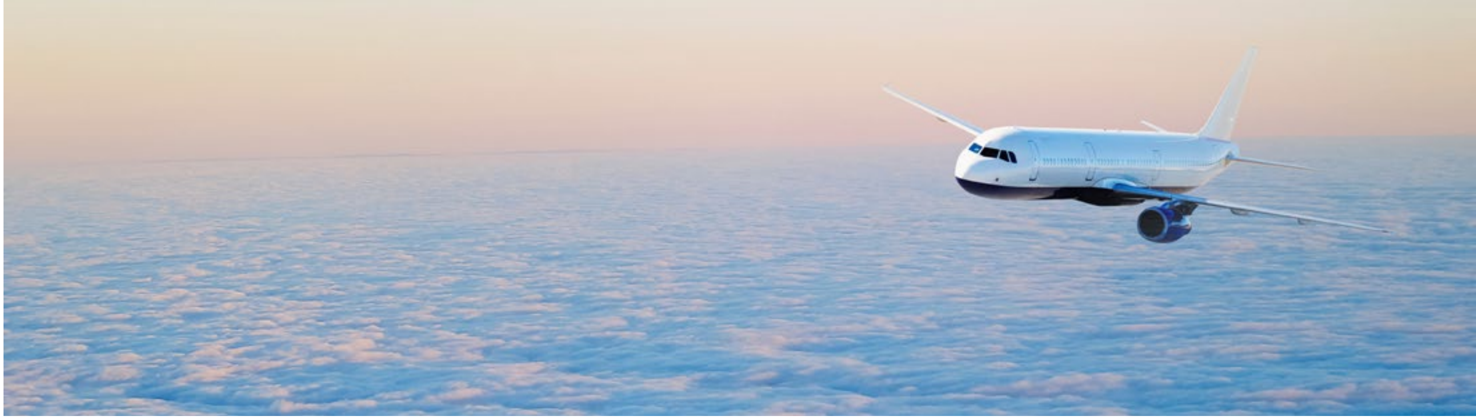

2021 IATA Safety Report

Safety is aviation's highest priority. More than 75 years ago, the global airline industry came together in Havana, Cuba, to create the International Air Transport Association (IATA). As part of IATA's mission to represent, lead and serve its members, the association partners with aviation stakeholders to collect, analyze and share safety information. It also advocates for global safety standards and best practices that are firmly founded on industry experience and expertise. A vital tool in this effort is IATA's annual Safety Report, which is now in its 58th year of publication. It is the definitive yearbook to track commercial aviation's safety performance, challenges and opportunities.

The IATA Safety Report has been IATA's flagship safety document since 1964. The report provides the industry with critical information, derived from the analysis of aviation accidents, to understand safety risks and propose mitigations. The 2021 Safety Report was produced at the beginning of 2022 and presents trends and statistics based on knowledge of the industry at that time.

The IATA Safety Report is a valuable tool as aviation works tirelessly to improve its already superb safety record. This report is made available to the industry for free distribution.

SAFETY REPORT METHODS AND ASSUMPTIONS

The IATA Safety Report is produced each year and is designed to present the best-known information at the time of publication. Due to the nature of accident analysis, certain caveats apply to the results of this report. First, the accidents analyzed and the categories and contributing factors assigned to those accidents are based on the best available information at the time of classification. Second, the sectors used to create the accident rates are the most up-to-date available from OAG at the time of production. Third, results of analysis from 2017–2021 reports are used as benchmarks for comparison; however, historical numbers presented in this 2021 Safety Report may not exactly match earlier editions due to data updates during the intervening period.

ACCIDENT CLASSIFICATION TASK FORCE

The Accident Classification Task Force (ACTF) was created to analyze accidents, identify contributing factors, determine trends and areas of concern relating to operational safety, and develop prevention strategies. The results of the work of the ACTF are incorporated in this annual IATA Safety Report. It should be noted that many accident investigations are not complete at the time the ACTF meets to classify the year's events and additional facts may be uncovered during an investigation that could affect the currently assigned classifications.

The ACTF is composed of safety experts from IATA, member airlines, original equipment manufacturers (OEMs), professional associations and federations as well as other industry stakeholders. The group is instrumental in the analysis process and produces a safety report based on the subjective classification of accidents. The data analyzed and presented in this report is extracted from a variety of sources. Once assembled, the members of the ACTF validate each accident report using their expertise to develop an accurate assessment of the events.

2021 ACTF members:

Capt. Ruben Morales
(Chair)
HONG KONG EXPRESS

Capt. Takahisa Otsuka
(Vice-Chair)
JAPAN AIRLINES

Mr. Xavier Barriola
AIRBUS

Mr. Nicolas Bornand
AIR FRANCE

Ms. Anara Nurpeissova
AIR ASTANA

Capt. Denis Kozbagarov
AIR ASTANA

Capt. Jeff Mee
ALPA

Mr. Paul Jouas
ATR

Mr. Sébastien Sellem
ATR

Capt. Jorge Robles
AVIANCA CARGO - TAMPA

Capt. Ivan Carvalho
AZUL BRAZILIAN AIRLINES

Capt. Sam Goodwill
THE BOEING COMPANY

Mr. Eric East
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Mr. Luis Savio dos Santos
EMBRAER

Mr. Paulo Soares Oliveira Filho
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Capt. Arnaud Du Bédat
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Capt. Gustavo Avila
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Mr. Martin Plumleigh
JEPPESEN/BOEING AVIATION SOLUTIONS

Capt. Peter Krupa
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Capt. Andreas Poehlitz
LUFTHANSA

Mr. David Fisher
MITSUBISHI HEAVY INDUSTRIES REGIONAL JET (MHIRJ)

Capt. HockKeat Ho
SINGAPORE AIRLINES

Capt. Nilesh Patil
SINGAPORE AIRLINES

Capt. Suha Senol
TURKISH AIRLINES

Capt. B. Pete Kaumanns
VEREINIGUNG COCKPIT

Mr. Greg Brock
WORLD METEOROLOGICAL ORGANIZATION

Mr. Yasuo Ishihara
HONEYWELL

Capt. Mark Searle
IATA

Mr. Gabriel Acosta
IATA

Ms. Anna Bernhardt
IATA

Ms. Hanada Said
IATA

2

Managing Safety in Aviation

IATA SAFETY STRATEGY

The IATA Safety Strategy has evolved since its launch in late 2020 by testing proposed concepts with IATA members and advancing the strategy so it adds value to ensure a targeted approach to delivering on the IATA Strategic Priority to reduce the all-accident rate in aviation. The three core pillars of Safety Leadership, Safety Risk and Safety Connect remain its focus, with swift progress made in all areas to deliver tools that enable completion of initiatives within each.

Safety Leadership - Recognizing the criticality of leadership to setting the strategic direction of an organization and supporting the growth of a positive safety culture, IATA has established a Safety Leadership Charter. The Charter presents key principles to support organizational leaders to engage all employees in safety conversations to support a resilient business during normal operations and at times of change. Additionally, Safety Talks from industry leaders will be presented in 2022 to promote the corporate benefits of an effective safety culture within each and every organization.

Safety Risk – The IATA Global Safety Risk Management Framework, a repository of aviation hazards and safety risks, is now accessible to all through the IATA website. The Framework is evolving from specific issues identified from the COVID-19 pandemic to provide intelligence, developed with IATA industry partners, to mitigate safety risks through generic Safety Risk Assessments, IATA Guidance Material, and documents created by other aviation safety practitioners.

Safety Connect – Creating a connected community of safety professionals and allowing the sharing of safety-critical information across the global airline industry are essential for continued progress in refining the industry approach to identifying, and managing, aviation hazards and safety risks. Safety Connect, currently open to all IATA members and those on the IATA Operational Safety Audit (IOSA) registry, has grown rapidly in 2021 and the benefits of this communications and collaboration platform are clearly being demonstrated.

Finally, 2022 will see IATA start the transition of IOSA to a risk-based audit program. This fundamental change to IOSA will provide significant opportunities to enhance the way audits are performed by focusing on areas where safety risks are greatest.

IATA ACCIDENT CLASSIFICATION TASK FORCE AND ACCLERATING THE LIFTING OF COVID-19 TRAVEL RESTRICTIONS

The ACTF, based on the accidents analyzed and classified in 2021 as well as discussions held by its safety experts, provides the following recommendations for the industry recovery in 2022. More information and recommendations on the restart can be found in Section 8 of this report.

The COVID-19 pandemic is having a huge impact on aviation and the air travel industry. As such, IATA has created the COVID-19: Resources for Airlines & Air Transport Professionals webpage with various resources to support airlines and other aviation stakeholders during the COVID-19 crisis and industry restart.

Most States have now reopened their borders, at least partially, or announced plans to do so. However, almost all countries have implemented extensive requirements that air travelers and airlines must comply with, with little or no coordination between countries or consistency in the measures being applied.

As the world transitions from the acute, pandemic phase of COVID-19 toward management of SARS-CoV-2 as an endemic virus, the aviation sector is preparing to move from the initial restart phase toward a focus on recovery. In the Ministerial Declaration of the International Civil Aviation Organization (ICAO) High Level Conference on COVID-19 (HLCC), States acknowledged that greater harmonization and alignment between countries is important to safely restore international connectivity, and support the safe recovery of air transport. Throughout 2021, IATA advocated on behalf of its members for the re-opening of borders based on science and risk-based analysis. At the Association's 2021 Annual General Meeting, IATA called for an end to inconsistent COVID-19 travel restrictions that have stalled the recovery of air transport while providing little benefit in terms of reducing the spread of COVID-19. IATA urged governments to implement simplified regimes to manage the risks of COVID-19 as borders re-open to international travel, including removing testing requirements for fully vaccinated air travelers. IATA noted that the rationale for travel restrictions that were put in place in the early days of the pandemic no longer exists, as COVID-19 is present in all parts of the world and is transitioning from a pandemic to endemic stage.

The document "From Restart to Recovery" published on the COVID-19 all resources webpage sets out a blueprint for aviation recovery in this next phase. Its objective is to simplify air travel in the context of COVID-19 by building on good examples that are being deployed around the world. The blueprint is focused on three key areas to make the international air travel experience simpler, more consistent and predictable:

- Adoption of simplified health protocols with travel barriers removed for fully vaccinated passengers and pre-departure antigen testing for non-vaccinated travelers.
- Implementation of digital solutions for the processing of health credentials, collection of traveler information and communication of travel requirements.
- Application of proportionate, risk-based COVID-19 measures with a continuous review process.

REDUCE OPERATIONAL RISK

IATA remains focused on its top safety priorities, which include Runway Excursions, Controlled Flight into Terrain (CFIT), Loss of Control–In-flight (LOC-I), Mid-Air Collision (MAC), among others, while continuing to promote the implementation of new safety initiatives. Based on analyses of accident data for commercial air transport operations, IATA and the ACTF have developed recommendations to address:

Restart of Operations

Loss of Control — In-flight (LOC-I)

Controlled Flight into Terrain (CFIT)

Mid-Air Collisions (MAC)

Runway Excursions (RE)

Unstable Approaches

Ground Damage

Tail Strikes

Human Factors

In-Flight Decision-Making

SUPPORT CONSISTENT IMPLEMENTATION OF SAFETY MANAGEMENT SYSTEMS

2021 continued to be a demanding year for global aviation due to the unrelenting COVID-19 pandemic. However, during these trying times, the trust and collaborative relationships between all aviation stakeholders have allowed the industry to be more agile and quick to respond to the almost daily challenges that arose. This responsiveness has certainly permitted some operators to remain in business.

Never has the notion of change management been more important, and it is fortunate that through the understanding and implementation of Safety Management Systems (SMS), operators have been able to keep a safety focus and identify and manage safety risks that have emerged as a result of the pandemic.

Recognized as a leader in developing and promoting a greater understanding of SMS, 2022 will see IATA start rolling out a multi-year SMS strategy that will not only keep the evolution and continuous improvement of safety management advancing, but will also provide the mechanism for operators to engage more directly with industry stakeholders and each other to influence the way forward. An additional focus area of the strategy is to ensure a consistent understanding between service providers and States on the intent and application of safety management requirements.

Also supporting the strategy are initiatives to develop and update IATA's SMS training portfolio, beginning with a new "Advanced SMS" training course that has been developed for individuals who have practical experience with SMS. Now available, the course is designed to strengthen one's ability to form defensible safety positions. New concepts that will shape safety management in the years to come will also be discussed.

IATA Global Safety Risk Management Framework

The upheaval and unprecedented change that COVID-19 created for the industry cannot be overstated. Managing the change and subsequent risks in a fluid environment can be challenging for even the most mature safety programs. During this time, IATA has developed a Global Safety Risk Management Framework (GSRMF) to capture, analyze and address new or emerging safety risks resulting from multiple alleviations, exemptions and new business models introduced by aviation since the start of the pandemic.

As we look forward to the industry restarting and flourishing, IATA will be leveraging the success of the GSRMF through a database solution available to all its member airlines to generate a global picture of safety risks where, in collaboration with its stakeholders, IATA may address safety issues on behalf of industry. The IATA GSRMF will capture, analyze, prioritize and implement safety improvement programs to address identified aviation safety risks. This will enable prioritization and delivery of aviation safety improvement programs for the benefit of reducing global accidents in aviation.

Safety Information Exchange and Protection

IATA continues to advocate for and focus initiatives on safety data and safety information protections, including the promotion of mechanisms in which safety information could be shared among all stakeholders for the purposes of maintaining or improving safety.

Work continues with States and ICAO through the Safety Management Panel to:

- Promote the importance of voluntary reporting systems, the value they bring to the various safety management programs and the criticality of protecting them, their sources and use.

- Promote the establishment of Collaborative Safety Teams (CSTs) with transparent and controlled governance plans as a way for States to support their State Safety Program (SSP) obligations while ensuring safety information is shared in a way in which the context is properly understood and the ICAO Annex 19 protections applied.

While IATA continues to advocate for safety collaboration between States and service providers, it allocates equal importance to safety collaboration among service providers to support more effective management of specific operational safety risks and strengthen integrated safety management, especially in relation to outsourced operations. Working under this framework, organizations can leverage other organizations' safety intelligence to jointly identify and manage common safety risks, supporting the advancement of integrated safety management.

Safety Culture – A Key Enabler of Effective Safety Management

It is generally acknowledged that establishing a positive organizational safety culture requires buy-in and continual application by all employees at every level; however, to remain effective, commitment and leadership from top executives is critical. It is particularly important now, as the industry restarts after the deepest crisis in its history, facing multiple short- and long-term organizational changes and challenges, ranging from a shortage of qualified personnel to gradual integration of technological advancements into aviation systems going forward. It is, therefore, critical for aviation executives to demonstrate safety leadership and their commitment to a positive safety culture within the organization to maintain the balance between safety and operational priorities for sustainable and safe operations.

The leadership team must ensure safety is a steadfast value, foundational to the culture of the organization, so it is always front-of-mind and part of the decision-making process, even when the organization is struggling to survive.

IATA strongly believes and continues to advocate, particularly in these challenging circumstances, the critical role of safety culture in enabling an effective SMS and promoting a more harmonized, hands-on approach to further strengthen safety culture across the industry. As such, guided by the IATA Aviation Safety Culture (I-ASC) survey findings, collected since 2016 from over 40 aviation organizations globally, combined with industry feedback collected in 2021, IATA will continue to focus its efforts on a key safety culture driver: safety leadership.

To bring further visibility to this topic, in October 2021, IATA and the Flight Safety Foundation (FSF) submitted a joint information paper on the importance of safety leadership to the ICAO HLCC. The information paper highlighted safety leadership's key role in enabling a positive organizational safety culture that drives an effective SMS and, consequently, a safer, more efficient, and resilient business, particularly in times of crisis.

To support the industry and its executives in achieving this goal, IATA, in consultation with its members and the wider aviation community, has developed a Safety Leadership Charter. The IATA Safety Leadership Charter is geared toward strengthening organizational safety culture through key leadership principles and supporting practical actions. These actions aim to facilitate an environment of organizational trust and build a sense of safety ownership among employees at all levels, as a core business value.

Additionally, IATA continues its collaboration with airlines and other industry stakeholders on measuring and understanding their organizational safety culture in the framework of its I-ASC survey. I-ASC helps organizations measure their employees' perceptions of safety and identify areas of excellence and actionable improvements through a quantitative and qualitative assessment of nine safety culture drivers.

Keeping a finger on the pulse of the organization through safety culture surveys is critical to better understand what is working and what can be improved, by hearing from employees directly involved in operations on a daily basis.

IATA safety leadership and safety culture activities aim to support IATA members and the wider aviation community in delivering a post-COVID industry restart with a clear focus on safety that promotes learning, understanding and continuous improvement of organizational practices and behaviors, and supports the effective management of safety risks by all aviation service providers and regulators around the world.

IATA Safety Issue Review Meeting

The IATA Safety Issue Review Meeting (SIRM) is a biannual industry meeting that is typically held each year in the spring and fall. Twenty-seven of these meetings have taken place to date, making the SIRM one of IATA Safety's longest running meetings. SIRM's success is predicated on providing an environment where participants feel comfortable in sharing their events, issues and solutions with their fellow safety professionals under the Chatham House Rule.

The SIRM brings together airlines and other industry stakeholders, such as OEMs and Ground Service Providers (GSPs). This multi-organizational collaboration has proven to be an effective means to leverage continuous improvement and is an originator to the emerging global information-sharing initiatives that are expected to grow significantly, albeit in a controlled and appropriate manner. The output of the SIRM meetings are bulletins summarizing the topics and issues presented during the meeting in a de-identified format.

Recognizing that the SIRM community would continue to be unable to meet in 2021 due to the ongoing pandemic and aiming to stay connected and support the industry, in June 2021, IATA produced a Second Edition of the Special COVID-19 SIRM Bulletin (First Edition, produced in October 2020), continuing to cover key risk areas identified by our members globally.

IATA invites the industry to read the Special SIRM Bulletins and consider contributing to future SIRM bulletins, and looks forward to hosting an in-person meeting at the earliest opportunity. For further information or questions, please contact irm-safety@iata.org

Fatigue Management

As the COVID-19 pandemic continues, we are still seeing airlines around the world having to cancel flights, suspend or modify operations and manage with limited resources every day. As such, fatigue may not be a risk that immediately comes to mind, with many crews working reduced hours with extended periods of time off between operational duties. However, managing fatigue is more important than ever in this current operational environment, as there are fatigue risks arising from previously unidentified areas. In addition to operational changes that influence fatigue, such as extended duty times and use of heavy crews to avoid layovers due to testing/quarantine requirements, use of first class or business class seats as rest facilities, and reduced staffing levels, physical and mental stresses, typically not seen on such a large scale, are also increasing the risk of fatigue.

The IATA Fatigue Management Task Force continues to advocate for airlines and flight crew to proactively identify fatigue risks and develops guidance to help them do so. Current initiatives include the development of a new IATA Fatigue Management webpage, making it easier to find relevant tools/information and providing the ability to connect with experts, as well as the development of a tool to assist operators in considering fatigue risk when they conduct a safety risk assessment. Look for both to be released by mid-2022.

To further support airlines, IATA transformed the in-class Fatigue Risk Management System (FRMS) course to a live virtual classroom format. Both formats of the FRMS course are available today.

Emergency Response Planning

Emergency Response Planning (ERP) protocols continue to evolve for member airlines, specifically in the context of COVID-19-related measures and changes to ICAO Annex 9 obligations for States and regulated operators. In addition, IATA continues to support the policies and implementation of ERP-related requirements through the annual ERP Forum, newly formed ERP Task Force, and a range of training and publication offerings.

In July 2021, IATA represented member airlines at the ICAO Facilitation Panel. IATA supported the elevation of an existing Recommended Practice for States to establish the required legal and regulatory framework in the provision of aircraft accident victims and their families. This proposal was presented to the ICAO Council in March 2022 for adoption and is expected to be applicable, via Amendment 28, in November 2022. IATA has established a working repository file to track government implementation internationally.

In June 2021, IATA hosted (virtually) the 2nd Annual IATA ERP Forum, attended by over 100 participants in partnership with IATA strategic partner organizations. The Forum resulted in several outcomes available here. Notably, the Forum supported the establishment of an IATA ERP Task Force as well as proposals to identify a specific traveler category when responding to "aircraft accidents", as defined in the IOSA Standards Manual (ISM), with respect to the Passenger Services Conference Resolution Manual (PSCRM).

In December 2021, IATA established an ERP Task Force made up of 10 member airlines and has initiated a provisional work plan focusing on addressing emerging member concerns, evolving IOSA ISM/ERP-related proposals, and formal outcomes/recommendations of the 2021 IATA ERP Forum.

IATA continues to support the industry with training and publications in the ERP domain. Since 2016, IATA has trained over 1,300 colleagues in one or more of the three ERP-related courses offered, including online versions. In addition, the IATA ERP Handbook content is being revised in 2022. Sections 620 and 633 of the 2022 Edition of the Airport Handling Manual (AHM) have been updated with the latest ERP developments, and the Security Management System (SeMS) Manual for 2021 has been further aligned with emerging ERP practices and guidelines.

IDENTIFY AND ADDRESS EMERGING/ EVOLVING SAFETY ISSUES

Since SMS relies on data to identify emerging risks, IATA is putting additional effort to improve not only industry access to data, but also its capability for automation for more efficient safety analyses.

This section provides key highlights and developments for emerging/evolving operational risks that have recently generated remarkable activity and media attention.

Cargo and Mail Safety and Lithium Batteries

In 2021, IATA's Cargo Department addressed dangerous goods and other cargo safety-related issues. These included the maintenance and revision of:

- Guidance for Vaccine and Pharmaceutical Logistics and Distribution, which was revised twice during 2021 to capture feedback from industry and regulatory authorities. The guidance document provides recommendations to all segments of the supply chain and includes details on the use of dry ice as a refrigerant and safety guidance on the handling of temperature-controlled containers (TCC).

- The Lithium Battery Guidance document is primarily aimed at shippers of lithium batteries and includes specific questions and answers on design-type testing requirements, the lithium battery test summary as well as packaging and transport provisions.

- Guidance on Battery-Powered Cargo Tracking Devices/Data Loggers is designed to aid manufacturers and shippers of data loggers and cargo tracking devices to understand the regulatory requirements that apply with respect to lithium batteries as well as electromagnetic radiation that may interfere with aircraft systems.

The SAE Aerospace G-27 Committee, which was established at the request of ICAO, continues its work to develop a performance standard that can be used to test packages containing lithium batteries. The objective of the standard is to qualify packaging for lithium batteries that, in the event of a thermal runaway of a lithium cell within the package, there would be no hazardous effects outside the package.

Through 2021, the SAE G-27 Committee continued work to progress the development of the performance standard. Due to the travel restrictions associated with the COVID-19 pandemic, this work was conducted remotely. IATA Cargo is represented by two voting members on the G-27 Committee.

There was a preliminary ballot of the committee members to identify areas that require more work. Based on the results of the ballot, it is unlikely the standard will be ready for a final ballot and possible adoption before late 2023. Even once the committee votes to adopt the standard, it still has to be submitted to SAE for final approval. Once SAE publishes the final standard, it remains for the applicable ICAO bodies, likely the Dangerous Goods Panel, Flight Operations Panel and Airworthiness Panel, to consider if the standard is suitable for adoption into the ICAO Technical Instructions or other relevant ICAO document.

The reporting and alert system of incidents involving undeclared and mis-declared dangerous goods in cargo that was implemented by IATA Cargo in October 2019 now has 43 subscribing airlines. In 2021, 19 reports were received of incidents involving undeclared and mis-declared dangerous goods in cargo. Ten of these reports involved undeclared lithium batteries. Alerts were issued to the subscribing airlines to enable the subscribing airlines to take appropriate action in accordance with their safety risk assessment. Airlines are invited to write to dangood@iata.org if they are interested in participating in the reporting and alert system.

The pandemic and travel restrictions again prevented IATA Cargo from running face-to-face dangerous goods and cargo workshops in the regions. In their place, there was a virtual event on dangerous goods and healthcare products for Middle East and North Africa (MENA) in March and another for Asia–Pacific (ASPAC) in September.

ENHANCE QUALITY AND COMPLIANCE

Regulations must evolve as the industry grows and technologies change. The IATA audit programs aim to increase global safety performance and reduce the number of redundant auditing activities in the industry.

IATA Operational Safety Audit

It has been two years since the beginning of the COVID-19 pandemic, and as many airlines proved their resilience throughout the period, likewise the IOSA program has proven its resilience over these challenging times. The program continued to provide safety assurance to the airline industry. A record 355 audits were performed despite the pandemic's impact on air travel, closed borders, quarantine measures, and other uncertainties. This has been achieved through the continuous confidence of the airlines in the IOSA program and its value to aviation safety.

IOSA Standards and Recommended Practices

In 2021, IATA continued to introduce numerous relief measures under the IOSA Support Program to manage the impact of the COVID-19 pandemic. Nevertheless, IATA also focused on the enhancement of the program and the development of the IOSA Standards and Recommended Practices (ISARPs).

In 2021, the new ISARPs (i.e., barriers intended to prevent incidents and accidents) have once more been introduced and revised where necessary by IOSA task forces comprised of industry subject matter experts (SMEs). These include the following changes to the IOSA Standards Manual (ISM), among others:

- Complete revision to the Flight Data Analysis (FDA) program provisions.
- A new standard to specify the installation of an autonomous distress position transmission system.
- In alignment with ICAO Annex 6, a new standard to specify that flights are not commenced or continued unless the intended airspace/airports of use have been assessed and determined to be safe for the planned operation.
- In alignment with ICAO Annex 6, a new standard to address unruly passenger behavior.
- An extensive revision to add cybersecurity to security threats that must be subjected to risk assessment and mitigation.

IOSA Audit Methodologies and Techniques

IOSA, as a renowned industry safety audit program, focuses on conformity with ISARPs and assesses the SMS effectiveness of airlines. The IOSA program intends to detect and improve barriers to accidents and incidents; hence, the effectiveness of the audit methodologies and techniques is essential. Accordingly, in 2021, a new mandatory observation for line maintenance operations was introduced to provide Aircraft Engineering and Maintenance auditors with an opportunity to observe line maintenance operations, review the use of Minimum Equipment Lists (MELs), and assess the repair status and physical status of the aircraft, as applicable.

Focus Area – B737 MAX Return to Service

The B737 MAX's return to service was identified by IATA as a focus area and included in the IOSA program. IOSA auditors audited airlines with B737 MAX aircraft and, where necessary, increased their sample size to ensure the B737 MAX's return to service is being managed properly with respect to relevant ISARPs.

IOSA Support Program

The Extenuating Circumstances for Audit Conduct option was phased out as of 1 May 2021. Starting from that date, airlines that ceased operations temporarily due to COVID-19-related reasons are suspended from the IOSA registry. In addition, upon demand by the industry, the requirement for submission of the IOSA operator questionnaire (SAR.F23) was continued. The questionnaire provides critical information to code-share partners and regulators alike. For airlines that have already undergone a first remote audit, a second remote audit option has been introduced if current government-imposed travel or entry restrictions continue to pose a limitation to onsite audits.

All IOSA Support Program rules and options are available in the IOSA Program Manual (IPM) Temporary Appendix and IOSA Auditor Handbook (IAH) Temporary Audit Procedures at www.iata.org/iosa.

IOSA Audit Results

This year, IATA is introducing a new section in the IATA Safety Report to present IOSA Insight (see Section 9). In 2021, a record 355 IOSA audits were conducted. These audits led to 3,353 corrective actions to improve failed barriers (ISARPs) that were built to prevent incidents and accidents. Please see Section 9 for statistics related to areas where corrective actions were implemented and for trends in SMS-related ISARPS, including the Hazard Identification Program, Safety Risk Assessment & Mitigation Program, etc.

IATA Standard Safety Assessment Program

Although most airlines had financial difficulties during the COVID-19 pandemic, by complying with the IATA Standard Safety Assessment (ISSA) program standards and recommended practices and maintaining their ISSA registry, the airlines proved that safety is their number one priority.

ISSA Support Program

The ISSA Support Program was successfully implemented in 2021, when five operators benefited from the remote assessment option. Related feedback received was very positive, and all raised non-conformities were closed on time.

Seaplanes and Amphibians

In April 2021, IATA expanded the ISSA eligibility criteria to seaplanes and amphibian aircraft. All standards and recommended practices for seaplanes and amphibian operations are now provided in the ISSA Standards Manual (ISSM) Part II – Seaplanes and Amphibians (www.iata.org/issa). This expansion provides the opportunity to operators to evaluate their SMS through ISSA.

ISSA Standards Manual

During the revision cycle of ISSM Part I – Aeroplanes, Edition 4, new safety standards were introduced and relevant recommendations were upgraded to standards. Below is a summary of the changes:

- Some SMS-related recommendations were upgraded to standards.
- New standard about the usage of psychoactive substances was added.
- A standard related to identification and investigation of irregularities that might lead to an accident or incident was introduced.
- A standard related to monitoring, recording and evaluating the results of flight crew evaluations was added.
- As a part of requirements for crew members, a standard related to crew member qualification and currency prior to being assigned to duty was added.
- The standard related to go-around policy was revised and is now more comprehensive, including management support for flight crew go-around decision-making.
- Operators eligible for the ISSA program sometimes conduct their flights in uncontrolled airspace; therefore, a new standard related to operation into and out of uncontrolled airspace was introduced.
- A new standard about background checks of security personnel was added.
- A standard related to distance learning was introduced.

Collaboration with Airline Associations

In November 2021, IATA announced it had reached agreements with the Alaska Air Carriers Association, (AACA) and the Indonesia National Air Carriers Association (INACA) under which the associations will promote ISSA among the membership of their respective organizations.

Safety on the Ground

The experts participating in the Ground Operations Task Force continue to develop and enhance industry best practices for ground operations to make them safer, simpler and more efficient. In 2021, they were focused on the following areas: personal injuries, onboarding of staff, emergency and crisis management, operational supervision and simple ramp operation. All changes are reflected in AHM, Ed. 42 and IATA Ground Operations Manual (IGOM), Ed. 11.

Personnel Injury

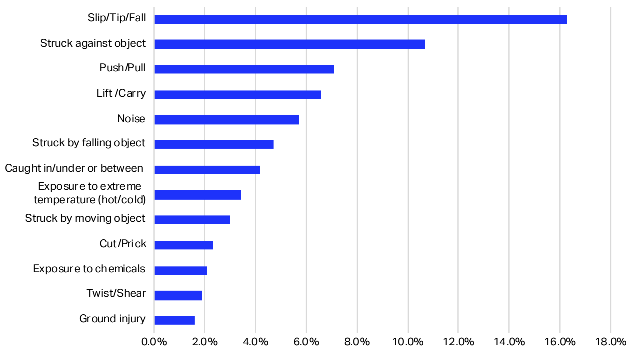
An injury prevention program has been initiated by analyzing data from Incident Data eXchange (IDX). The safety experts focused on the following injuries:

- Slips, trips and falls
- Lift, carry, push, pull
- Struck against an object
- Fall from heights

While the first three categories are the most frequent, the injuries are usually not severe. Nevertheless, their frequency significantly contributes to work absence and costs of healthcare treatment. On the contrary, injuries caused by falling from heights with severe or fatal impact are very rare.

Detailed analysis of the slips, trips and falls indicated that the majority of injuries happened while walking due to missteps and not paying attention; these types of injuries are difficult to prevent. The team focused on injuries caused during loading and offloading of aircraft, pushing/pulling Unit

Load Devices (ULDs) and baggage carts on the ramp and in the cargo hold, and when locking pallets. They analyzed the existing procedures within the AHM and IGOM to explore the possibility of engineering the risk out by making changes in the equipment.



Onboarding of Personnel

The onboarding of personnel during the ongoing pandemic is one of the most challenging activities that can have, in some cases, an impact on safety performance. The recurrent and/or refresh training need to be delivered to a significant number of personnel in a short period of time under various hygienic rules and operational restrictions. Such training is time-consuming and has significant costs. The training experts have worked on the enhancement of AHM Ch.11 to simplify and standardize the safe onboarding of staff returning to service.

The "Recurrent Assessment" has been introduced as an alternative to the traditional recurrent training. It provides flexibility to companies to assess the personnel's competency in the operational environment, target any issue with corrective actions as well as reduce the time of training. The passenger handling, general aviation and safety syllabi underwent complete review and enhancement. New training for non-operational safety or managerial functions has been introduced. The Ground Service Equipment (GSE) Maintenance Training Program has been moved from AHM 908 and aligned with AHM 1120 and AHM 1110.

Emergency and Crisis Management

AHM 620 Emergency and Crisis Management at the Airport has been developed and contains new guidance providing GSPs and airlines with the basic guidelines to establish an ERP at the airport, including practical tools and standardized checklists on how to structure, manage and execute an ERP aligned with the IATA Emergency Response Handbook. Changes to this subchapter resulted in changes to other AHM subchapters, including Emergency Assistance in AHM 820, yellow pages for Standard Ground Handling Agreement (SGHA) and ERP training in AHM 1110. The risk matrix published in AHM 640 Guideline for Pandemic Management has been updated to address additional risks identified during the pandemic and the restart of operations.

Operational Supervision

During the restart, industry personnel are facing significant challenges, instability, furloughs, stress, staff shortages, long absences from daily operations, daily operational changes, regulatory changes, and other or new risks. In such an environment, the need for thorough and additional supervision is substantial to prevent and reduce injuries and aircraft damage. IGOM Ch. 6 was entirely updated and provides industry standards for oversight in all operational areas with a main focus on supervisory level staff.

Simple Ramp

IATA has started the ramp simplification initiative, which will ensure processes documented in IGOM, specifically those addressing ramp activities (Ch. 3 and 4), are clear, consistent and can easily be adopted by the industry. The work includes:

- Review the entire ramp process and identify procedures that can be simplified or are missing.
- Include the ramp digital, environmental and automation procedures, where applicable.
- Restructure IGOM Ch. 3 and 4 into chronological order.
- Ensure the "new" defined ramp processes and procedures will drive the ground operations auditing standards in lieu of ISAGO Aircraft Handling and Loading (HDL) and Aircraft Ground Movement (AGM) disciplines.

IATA Safety Audit for Ground Operations

ISAGO is a global industry standard for the oversight and audit of GSPs. The ISAGO program started in 2008 in response to an industry request to address the safety risks and incident costs of ground operations.

The primary objective of ISAGO was to improve the safety of ground operations through a global oversight program on GSPs, driving implementation of management systems within a GSP organization and adoption of standardized operational procedures. The secondary objective of ISAGO was to provide an accepted cost-effective alternative and/or complementary ground operations oversight tool to the airlines' audits and inspections; hence, reduce audit duplication or time spent on oversight.

As at 31 December 2021, there were 195 GSPs in the ISAGO Registry and 272 Accredited Stations. There were close to 500 audit reports available to the airlines to complement their own oversight activities, which can also be used by airports and National Aviation Authorities (NAAs) worldwide.

In 2021, 293 audits were completed; 88 audits (30%) were done remotely, 245 audits (84%) were renewals. The COVID-19 pandemic significantly impacted airlines, airports and regulators, including ISAGO program capabilities to perform on-site audits. The impact might be long-lasting; therefore, with the introduction of the remote audit methodology, ISAGO continued to operate to provide safety assurance of ground operations to support and supplement operator oversight of their outsourced ground handling operations. The key areas, where the majority of findings were identified, are:

- SMS implementation with several types of deficiencies in safety assurance and safety risk management.
- Training programs and records.

- Ongoing management control of documentation.
- Quality assurance.
- Oversight of external suppliers.

On average, 210 audits are completed every year. There are 60 accredited members of the IATA Charter of Professional Auditors (CoPA) who perform audits with an average of 10 findings per report. Prior to COVID-19, the average number of findings per report was 20, which reduced to 10 during the years 2020-2021 due mainly to implementation of the ISAGO Support Program, which reduced the number of Ground Operations Standards and Recommended Practices (GOSARPs) to be audited.

The ISAGO audit reports can, if recognized by the regulatory authority, compensate for the lack of an operator's own oversight audits. In addition, the ISAGO audits and resulting audit reports provide assurance that contributes to the SSP, supplementing the airport certification and licensing requirements.

Top 10 2021 findings:

ORM 1.1.3	45	SMS integrated and implemented throughout the organization to manage safety risks
ORM 1.3.11	22	Safety assurance program, including detailed audit planning and sufficient resources
ORM 1.3.4	21	Safety risk assessment and mitigation program, including implemented and integrated processes
ORM 3.1.1	20	Management and control of internal and external documentation
ORM 4.3.1	16	Training program ensures trained and competent staff perform basic and specific SMS duties
LOD 2.4.1	15	Dangerous goods – notification to Pilot in Command (PIC)
ORM 1.4.3	15	Objectives and measures for operational safety performance
ORM 1.3.8	13	Closure of internal findings raised from Quality Assurance (QA) program and station Quality Control (QC) program
LOD 3.1.2	11	Accessibility of operational documentation at all stations with load control operations
ORM 1.3.7	11	Safety assurance program, including detailed audit planning and sufficient resources
ORM 1.6.1	11	Oversight of external suppliers

Ground Support Equipment

In the area of GSE maintenance, work continued in developing a comprehensive maintenance checklist for each GSE type to ensure a minimum safety requirement is defined. "Green" GSE benchmark methodology has been developed for CO_2 emission and noise reduction to be launched in 2022.

A risk assessment for the essential system requirements for the operation of autonomous GSE airside has been initiated and will be addressed in the following phases:

- Point-to-point driving
- Fine skilled maneuvering within the Equipment Restraint Area (ERA) and other restricted areas
- Autonomous operations/operational functionality

Ramp Digitization

A new delay coding schema structured in a three-layer format, compatible with Timestamps Turnaround and focused on identifying servicing issues was developed and launched. A digital Timestamp Turnaround standard was developed and is to be implemented by systems whereby the entire turnaround processes/tasks can be benchmarked and analyzed to determine the root causes of turnaround bottlenecks and inefficiencies. In addition, a comprehensive digital load control standard was developed and published in AHM to be used by aircraft manufacturers, airlines and Departure Control System (DCS) providers with the scope of removing much of the possibility of human error in the DCS configuration of aircraft data necessary to perform load control.

SUPPORT EFFECTIVE TRAINING

IATA Training and Licensing participates in the development of new training standards and publishes, with the support of the Pilot Training and Licensing Task Force (PTLTF), guidance materials and best practices for regulators and industry to implement these new standards. Additionally, IATA offers consultancy services to provide practical support for the implementation of the standards related to Competency-Based Training and Assessment (CBTA) programs, including Evidence-Based Training (EBT). Contact us for more information.

IATA is committed to the Total Systems Approach (TSA), which advocates for the application of CBTA principles across all aviation disciplines in general, and to a pilot's entire career in particular. Hence, the defined competencies for pilots and instructors/evaluators should be consistently applied through pilot aptitude testing, initial (ab initio) training, type rating training and testing, command upgrade, recurrent training (including EBT), as well as instructor and examiner selection and training.

IATA also produces guidance materials to address specific areas of pilot training, such as Upset Prevention and Recovery Training (UPRT) and flight crew monitoring: IATA Guidance Material and Best Practices for the Implementation of UPRT, 2nd Edition; Guidance Material for Improving Flight Crew Monitoring, 1st Edition.

COVID-19 Guidance and Best Practices

To support the industry through the COVID-19 crisis, IATA has been advocating to States for operator training and pilot license validity extensions, which in 2021 transitioned to the targeted exemptions system to address specific training capacity limitations.

IATA has been proposing CBTA solutions, adapted to the status of pilot populations with regard to ICAO's training and operational standards, for the industry to manage the end of the alleviations period while ensuring a safe and efficient restart of operations. In support of this, the following guidance materials and papers were published in 2020/2021, all of which are available for free download here:

- Guidance for Post-COVID Restart of Operations: CBTA Training Solutions, Edition 2
- Virtual Classroom Instruction: Ensuring the quality of training when classroom instruction is delivered via virtual classroom
- ATO-AOC Partnership, including Instructor Provisioning - COVID-19 Return to Operations

Provisions

IATA Training and Licensing is represented and actively involved in the work of the recently reactivated ICAO Personnel Training and Licensing Panel (PTLP), with the goal to develop, maintain and address the evolving needs for provisions and guidance materials for personnel licensing, approved training organizations and simulation training devices in the context of the global expansion of CBTA.

To support a globally harmonized CBTA expansion, in 2021 IATA published the "White Paper - Competency-Based Training and Assessment (CBTA) Expansion within the Aviation System", and the "Competency Assessment and Evaluation for Pilots, Instructors and Evaluators Guidance Material".

Instructors and Evaluators

Given the essential contribution of Instructors and Evaluators (IEs) to flight safety, IATA considers it important to enhance the level of competency of IEs globally. To support this competency enhancement, IATA published in 2021 the second edition of the Guidance Material for Instructor and Evaluator Training, which was endorsed by ICAO and EASA. This second edition has permitted, specifically, to:

- Define with more accuracy the IE competencies requiring special emphasis during training, depending on different IE duties (e.g., Flight Instructor, Type Rating Instructor).
- Address the qualification of IEs transitioning from traditional training to CBTA programs.

Evidence-Based Training

EBT was the first recurrent training program to apply the principles of CBTA for safe, effective and efficient airline operations. The aim of an EBT program is to identify, develop and evaluate the key competencies required by pilots to operate safely, effectively and efficiently in a commercial air transport environment by managing the most relevant threats and errors based on evidence collected in operations and training.

The revision by IATA of the EBT Data Report, 1st Edition (2014), which constitutes the foundation of the EBT curriculum endorsed by ICAO in Doc 9995, has led to the publication of Amendment 2021 to the EBT Data Report, 1st Edition. The analysis results presented in this Amendment largely corroborate the training topics prioritization of the original EBT Data Report to manage the most common threats and errors encountered in flight operations. Nevertheless, some recommendations are made in the Amendment, either to elevate some training topics to essential components of the EBT program design, or to modify the frequency of certain training topics within the EBT curriculum.

Technicians

IATA was part of the drafting team that led to publication by ICAO in 2021 of the First Edition of Doc 10098 Manual on Competency-based Training and Assessment for Aircraft Maintenance Personnel. The manual provides guidance on the approach of applying CBTA to aircraft maintenance personnel in accordance with Part III of the PANS-TRG (Doc 9868).

IATA is actively participating in the Aviation Maintenance Technical Personnel stream proceedings of the ICAO PTLP working group, which is focused on CBTA for Maintenance.

The aim of the Aircraft Maintenance Personnel (AMP)-focused work in the PTLP is to ensure awareness and smooth implementation of the CBTA approach with its maintenance trainee-centric fundamentals.

ADVOCATE FOR IMPROVED AVIATION INFRASTRUCTURE

Air Navigation Service Providers (ANSPs) are a critical component in the aviation supply chain. They are responsible for providing the safe, efficient and cost-effective Air Traffic Management (ATM) and air navigation infrastructure for airline operators. In 2022, several critical ATM and air navigation infrastructure areas identified as needing improvement remain. IATA continues working with member airlines, key partners such as ICAO, the Civil Air Navigation Services Organization (CANSO), State regulators and ANSPs to ensure ATM operations maintain the required level of safety and efficiency, while maintaining a positive cost-benefit business case and supporting the reduction of CO_2 emissions.

COVID-19 Impacts on Air Traffic Management

The operational and financial impact of COVID-19 on the aviation industry has been unprecedented. Operational working environments continue to change along several vectors. In addition to flight schedule disruptions, new regulations for short- and long-term parked aircraft, biosafety measures, and increased aircraft maintenance and flight planning challenges, airlines have been expected to keep track of the ever-changing restrictions and changes to government health protocols.

In response to these challenges, IATA initiated and continues to maintain an information-sharing dashboard to provide operators with a single location where they can find aviation operational information related to COVID-19 published by States. The automated dashboard displays Notice to Airmen (NOTAM) information on airspace and airports, by ICAO region and Flight Information Region (FIR). In addition, IATA is able to assist operators by responding to specific questions related to COVID restrictions. The questions are received via email and distributed to the appropriate IATA SME in the region. In addition, operators may request assistance via the IATA Tactical Operations Portal (ITOP), which is monitored and supported by IATA Liaison Desk personnel.

Rocket Launches and Commercial Space Operations

IATA continues to be concerned over the lack of progress on the development of regulatory provisions specific to commercial space activities. Although, it has been suggested that these operations should remain free of provisions to not constrain innovation, low orbit operations and recoverable vehicles that transit through civil operational airspace have a direct impact on civil operations. The goal should be to develop provisions and best practices that will permit the integration of space operations into current operations, thereby ensuring the continued safety of all stakeholders.

Unauthorized Use of Unmanned Aircraft

IATA worked with industry partners to develop guidance material to assist States, airports and ANSPs in developing local procedures for handling events of unauthorized use of unmanned aircraft. The guidance material focuses on a collaborative risk assessment approach when making decisions about response to an event and recovery to normal operations after an event has been contained. The guidance material is available online here.

Global Navigation Satellite Systems Interference

Since last year's IATA Safety Report, IATA continues to receive concerning reports on harmful interference to Global Navigation Satellite Systems (GNSS). GNSS are a cornerstone of daily flight and ATM operations, providing fundamental position and timing information to aircraft safety systems (e.g., Ground Proximity Warning System—GPWS), air traffic services satellite communications, aircraft navigation (Global Positioning System—GPS and Performance-based Navigation—PBN) and Automatic Dependent Surveillance-Broadcast (ADS-B) applications. Effective protections of GNSS signals and robust and timely mitigations of harmful interference to GNSS are, therefore, necessary.

IATA, in cooperation with the International Federation of Air Traffic Controllers' Association (IFATCA) and the International Federation of Air Line Pilots' Associations (IFALPA), has raised awareness and recommendations on this safety-critical issue to the 40th ICAO Assembly. Resulting from the strong support by the Assembly and an urgent request by the ICAO Council, in August 2020, ICAO issued a State Letter emphasizing the need for:

- Reinforcing Communications, Navigation and Surveillance (CNS) systems' resilience to interference.
- Preventing use of illegal interfering devices.
- Increasing collaboration with radio regulatory and enforcement authorities.
- Reinforcing civil-military coordination to address interference risks associated with GNSS testing and conflict zones.
- Increasing coordination between aviation and radio-regulatory authority and military.
- Retaining essential conventional navigation infrastructure for contingency support in case of GNSS outages.
- Developing mitigation techniques for loss of services.

Additionally, the issue of harmful interference to GNSS has been brought to the attention of and for actions by the International Telecommunication Union (ITU), the United Nations' specialized agency for information and communication technologies and the global authority on radio spectrum protections.

Protection of Aircraft Radar Altimeters from Interference

Radar altimeters (Radalts), operating at 4.2-4.4 GHz, are the only sensors on board a civil aircraft that provide a direct measurement of the clearance height of the aircraft over the terrain or other obstacles (i.e., Above Ground Level – AGL - information). The Radalt systems' input is required and used by many aircraft systems when AGL is below 2,500 ft. The Radalts also play a crucial role in providing situational awareness to the flight crew. The measurements from the Radalts are also used by Automatic Flight Guidance and Control Systems (AFGCS) during instrument approaches, and to control cockpit displays of crew information from critical systems, such as Predictive Wind Shear (PWS), Engine-Indicating and Crew-Alerting System (EICAS), and Electronic Centralized Aircraft Monitoring (ECAM). Any failures or interruptions of these Radalts can lead to incidents with catastrophic outcomes, potentially resulting in multiple fatalities.

Radalts are installed in all types of aircraft, including:

- Commercial transport aircraft
- Business and regional general aviation airplanes
- Transport and general aviation helicopters

Noting the safety-critical roles of aircraft Radalts in protecting the safety of flights and the traveling public, it is necessary that governments robustly protect the integrity of Radalts in service. It is the responsibility and in the best interest of governments to ensure any deployments of 5G technologies do not cause interference to the incumbent Radalts and to consult with aviation agencies and authorities, incorporating aviation recommendations and fully addressing aviation safety concerns.

IATA Meteorological Project

IATA's Meteorological (Met) Project seeks to achieve two objectives:

- Develop a global real-time objective aircraft-sensed turbulence data-sharing platform for airline operational use to mitigate the impact of turbulence.

- Improve weather forecasts by expanding the existing World Meteorological Organization (WMO) Aircraft-based Meteorological Data Relay (AMDAR) program to airlines from data sparse areas through the WMO IATA Collaborative AMDAR Program (WICAP).

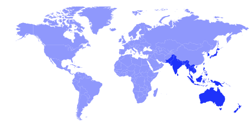
IATA has developed a turbulence data-sharing platform, IATA Turbulence Aware (ITA), to consolidate, standardize and enable access to worldwide real-time objective turbulence data collected from multiple airlines around the globe. The primary purpose of the ITA system, which became operational on 1 January 2020, is to provide airline pilots, dispatchers and operations center personnel with real-time, very detailed turbulence awareness. The platform supports a global industry shift toward data-driven turbulence mitigation. The ITA platform provides an open solution to industry that enables any operator to share their data within a global turbulence repository; the aim being that carriers will have access to each other's real-time turbulence data so greater situational awareness, both pre-flight and in-flight, can be achieved.

Turbulence data within the platform is integrated into third-party vendor weather, flight planning, trajectory and alerting tools for operational use by airlines in the program. IATA also provides a Turbulence Aware Viewer tool, which may be used by dispatchers and in flight by pilots. The tool provides a visualization of real-time turbulence data over the previous four hours along with a long-term accessible archive. Post-flight analytics and manual historical data extraction are all possible via the viewer tool for analysis of turbulence, wind, temperature and in-flight turbulence safety events.

The overall benefits of IATA's Met Project are to improve airline safety performance by decreasing turbulence-related injuries, optimize fuel burn and gain additional operational efficiencies through more accurate flight planning based on improved forecast and real-time turbulence, wind and temperature data.

REGIONAL INSIGHT

Asia-Pacific Region (ASPAC)



During 2021, as part of a broader review of Regional Coordinating Group (RCG) priorities, the Asia-Pacific Safety Strategy was explicitly aligned with the three pillars of the IATA Safety Strategy: Safety Leadership, Safety Risk and Safety Connect.

The Safety Leadership pillar was promoted at a regional safety symposium and at several regional ICAO meetings, along with the implementation of Positive Safety Culture; unfortunately, a concept that is still not well established in some areas of the region.

ASPAC has been very active supporting the Safety Connect initiative. Safety Connect was launched with the cooperation of five regional airlines representing new business models in five different countries. Various safety-related publications and documents are being shared on this platform.

Restart and Recovery

ASPAC continues to experience operational restrictions that are hampering the ability of airlines to recover to anything even close to pre-pandemic levels. Border closures, long quarantine periods for vaccinated travelers, and local lockdowns throughout the region, all helped ensure very subdued levels of airline activity in 2021. Many operators went through 2021 with operational personnel furloughed and minimum staffing levels.

Despite the low operational activity, ASPAC operators continued contributing to the IATA Global Aviation Data Management (GADM) programs – IDX and Flight Data Exchange (FDX) – with 25 new operators engaged across both programs (17 new operators in IDX and 8 new operators in FDX).

Safety Trends and Statistics

It is pleasing to note that ASPAC operators are major contributors to FDX, with one-third of global flights analyzed by FDX in 2021 shared by operators from the region.

At a high level, FDX analysis indicates that ASPAC operators rate better than the industry average in terms of un-stabilized approaches, go-arounds and Traffic Alert and Collision Avoidance System Resolution Advisory (TCAS RA); however, the region must address issues related to Enhanced Ground Proximity Warning System (EGPWS) alerts.

Implementing Programs and Safety Interventions to Address Safety Issues

Throughout 2021, the IATA regional team continued to work with the Asia-Pacific Regional Aviation Safety Team (APRAST) in the ongoing development of Safety Enhancement Initiatives (SEIs) focused on the top three risk areas, along with active encouragement of their implementation by States. The ASPAC regional team supports the periodic review of SEIs conducted by APRAST to ensure currency/relevancy is maintained.

The IATA regional team continued monitoring regional airspace activities in conjunction with the ICAO regional office and State regulatory authorities.

The IATA Safety Strategy and a positive culture initiative were both promoted at several ICAO webinars and forums, including the ICAO Cooperative Development of Operational Safety and Continuing Airworthiness Programme South-East Asia (COSCAP-SEA), the ICAO South East Asia Regional Aviation Safety Team (SEARAST) and the ICAO Regional Airspace Safety Monitoring Advisory Group (RASMAG).

The IATA ASPAC regional team has been particularly active in promoting ISSA in the region. The team targeted small operators in Indonesia, Maldives, Nepal and Philippines in cooperation with the respective national airline associations.

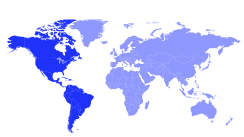
Emerging Risks and High-Risk Categories

COVID-19 restrictions and the resulting low activity levels of airline operators have contributed to new safety risks:

- Unruly passenger incidents are increasing — Complex health rules, flight cancellations and rescheduling, and changing quarantine and entry requirements are some of the contributing factors.
- Mental wellbeing of operational personnel — Long inactivity periods, furloughed personnel returning to work, extensive quarantine periods (some crew members are reported to have experienced 200 days of quarantine over a 12 month period), and uncertainty about the future are factors contributing to the emerging risk.
- Increased numbers of basic mistakes by operational personnel — The lack of practical experience of personnel returning to work after long periods out of work, slow responses during routine tasks, and a lack of situational awareness are some of the contributing factors.
- Staff undertrained or not trained — Border closures and long quarantine periods continue to limit the access of regional operators to simulators and training centers.
- Operational personnel shortage — Pilot and ground staff shortages may eventually impact industry growth and recovery in the region, particularly in States where there is a dependence on expatriate workers. In many cases, experienced staff have retired early and are unlikely to return.

ASPAC Aircraft Accidents

The Americas Region



Reduction of fatality risk in the Pan-American region and continued improvement of the safety performance in the North Atlantic and South Atlantic regions remain very high priorities in addressing the region's challenges.

To continuously address these challenges, the Regional Coordinating Group (RCG) of IATA focuses on a data-driven approach to enable the strategic and tactical implementation of initiatives, which collaboration with States and industry stakeholders remains key toward achieving the level of vigilance needed for safety improvement.

North Atlantic and North America

The safety performance of the North Atlantic (NAT) High-Level Airspace (HLA), as measured and monitored by the NAT Systems Planning Group (SPG) for 2020, showed overall 67% better performance in key performance indicators (KPIs). The vertical collision risk estimate for 2020 was estimated to be 19.7 x 10-9 fatal accidents per flight hour (fapfh). However, with Strategic Lateral Offset Procedure (SLOP), the risk reduced to 5.5 x 10-9 fapfh, which continues to highlight the importance of SLOP in minimizing the risk of collision in the airspace. Application of SLOP by operators continues to show majority utilization of the centerline options, whereas the benefit of the procedure is derived more from the even distribution of all three options (centerline, one nautical mile (NM) or two NM right of centerline) by operators. The lateral collision risk for 2020 was estimated to be 3.6 x 10-9 fapfh. The vertical and lateral collision risk estimates were lower in 2020 compared to 2019.

In the North American (NAM) region, proactive management of risk through identification and control of existing and emerging safety issues continues in collaboration with several stakeholders, such as the United States of America Commercial Aviation Safety Team (CAST), to reduce risk system-wide with a data-driven approach. Some of the key safety enhancements (SE) and the associated brief mitigations are as follows:

- SE120 – Terrain Awareness and Warning System Improved Functionality
  - Ensure a GPS signal to the Terrain Awareness Warning System (TAWS) box, upgrade to latest software available from the OEM, and update TAWS terrain/obstacle database.
- SE194 – Standard Operating Procedures Effectiveness and Adherence
  - Ensure adherence to critical SOPs through monitoring.
- SE227 – Air Carrier Procedures for Takeoff Configuration
  - Assess current SOPs through proactive monitoring.
- SE183 – Cockpit Moving Map Display and Runway Awareness System
  - Implement systems for enabling moving map display and/or runway awareness systems to provide crews with situational awareness for ground operations.

SEs continue to be monitored for overall system improvement and work continues toward addressing future risk.

Latin America and Caribbean

Latin American and Caribbean (LATAM/CAR) efforts continue to focus on the top four areas of risk: CFIT, MAC, LOC-I and Runway Excursion, and is led by the Regional Aviation Safety Group – Pan America (RASG-PA). Dependence on the GADM program remained a critical aspect in monitoring the region's safety performance in coordination with Collaborative Safety Teams (CSTs) and being able to drive the IATA Regional Coordinating Group objectives toward implementation of the safety priorities. While the RASG-PA continues to focus its works from a regional perspective, the work of CSTs in countries such as Brazil and Mexico, among other countries in the region, remains an instrumental part of keeping heightened vigilance in the region's risk footprint and addressing them with a tailored approach utilizing various data sources, including GADM. The use of GADM to monitor implementation of the airspace redesign Phase 1, with the developed Safety Performance Indicators (SPIs) in Mexico, continues to be integral to monitoring improvement to the identified safety issues. As an example, one of the SPIs being monitored, after the redesign, during the period of April to November 2021, is the Unstable Approach (UA) rate, which showed a decreasing trend due to the implementation of some of the mitigations that were recommended as part of the redesign.

Americas Insight Analysis

Fatality risk in the Pan-America Region showed a decreasing trend across the five-year period analyzed (2016-2020). However, the three-year moving average of the highest-risk accident category for the region showed LOC–I slightly above the world average. CFIT and Runway/Taxiway Excursion were below the world three-year moving average. Overall, MAC serious incident and accident data showed a downward trend.

It is important to highlight that incident data for some countries in the region continue to show opportunities for safety improvements. Eight states/territories in the Pan-America Region are below the 60% level of Effective Implementation (EI) for the ICAO Standards and Recommended Practices according to the ICAO Universal Safety Oversight Audit Program (USOAP) Continuous Monitoring Approach (CMA). Accordingly, ICAO USOAP Critical Elements (CEs) showing the lowest percentage of EI in the region remain: CE7 - Surveillance Obligations and CE8 - Resolution of Safety Concerns.

Auditing standards remain a vital part of an airline's operational safety and efficiency process to ensure the transport of passengers and goods safely. The region's partnership with the Latin American and Caribbean Air Transport Association (ALTA), Air Transport Association of Canada (ATAC), and a new partnership with Alaska Air Carriers Association (AACA) enabled outreach and awareness to operators regarding the ISSA program for operators seeking to improve their operational safety and efficiency processes. The region's operators continue to see nonconformity with SMS practices, as required by IOSA, dealing with the management of safety risks associated with aircraft operations.

The technical risk estimates for 2020 satisfy the goal of not exceeding the Target Level of Safety (TLS) in Reduced Vertical Separation Minimum (RVSM) airspace for the Caribbean and South America regions. It is important to highlight that, while the overall technical risk estimate for 2021 did satisfy the TLS goal, there were a few FIRs that did not attain the goal. Additionally, in RVSM airspace, lack of coordination between facilities remains a major contributing factor to the events recorded.

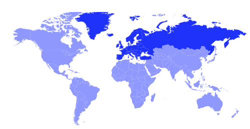
In the NAT region, communication to a greater degree is based on satellite-based data links, also referred to as Controller-Pilot Data Link Communications (CPDLC) with high-frequency radio being utilized less often. This leads to ATM and operations that are fundamentally different in concept to typical domestic operations, with a greater focus on strategic rather than tactical techniques.

The Americas region is collaborating with South Atlantic (SAT) area industry stakeholders in continuing efforts to improve the safety and efficiency of the SAT area. As part of the improved coordination needed for the SAT, a joint task force (Atlantic Coordination Group) was formed to support improvements concerning interoperability and safety oversight, including enhancement of efficiency in the Europe/South America airspace corridor.

NAM Aircraft Accidents

LATAM Aircraft Accidents

Europe Region and Commonwealth of Independent States



COVID-19 Recovery – The "New Normal"

The European Region (EUR) has been strongly impacted by the COVID-19 pandemic since 2020. In 2021, although the aviation industry had already started to accommodate the "New Normal", operations were still dependent on measures taken collectively by European Union (EU) States or by individual governments. One of the IATA priorities was to ensure swift measures were taken to avoid negative impacts on flight and ground operations caused by a lack of infrastructure, providers, appropriate staff, etc.

We continued our cooperation with the European Aviation Safety Agency (EASA) in the COVID-19 consultation processes, advocating for a more performance-based approach in the relevant safety directives on cleaning and disinfection (e.g., more performance-based aircraft cleaning and disinfection intervals and a cooperative approach to physical distancing measures at airports to avoid bottlenecks with increased traffic).

IATA EUR has also participated in all relevant regulatory consultations on diverse topics of interest for airlines, including Unmanned Air Vehicles (UAVs)/drones, Third Country Operators (TCO) regulation revision, aircraft continuing airworthiness, the digitalization of the European aviation industry, etc.

Based on airline inputs, IATA was also working at the local level with individual State authorities and airports to ensure bottlenecks created by specific infrastructure or COVID-related checks (e.g., checks of passenger locator forms, COVID certificates, types of trip) are managed properly and the situation is improved.

To support the industry in its COVID-19 recovery, two IATA virtual safety symposiums were organized in June 2021 in EUR, one mainly for the western part of the region focusing on SMS effectiveness, management of change and skill fade issues; the other was for the eastern part of the region, with a number of topics related to the industry recovery. At both events, the new IATA Safety Strategy was presented. In addition, IATA organized a dedicated webinar for non-EASA airlines on Safety Assessment of Foreign Aircraft (SAFA) and EASA Part-TCO-related issues and contributed to the COVID-19 Recovery events organized by ICAO, EASA and the Interstate Aviation Committee for the CIS area.

Meanwhile, as the emergency shifted toward the "new normal," some of the European regulatory activities postponed due to COVID-19 were resumed in 2021. One of them was the future EU Ground Handling Regulation that had been deprioritized in 2020. IATA has been participating in all stages of the rulemaking activity, and it is IATA's goal to use all advocacy options to ensure the regulation will improve flight safety with minimal regulatory burden and full recognition of industry standards and programs.

IATA EUR has continued to represent the airlines at EU forums for the assessment of conflict zones and on operations in/around conflict zones. It is vital that proportionate measures are continuously taken in dynamic situations and airlines are provided with information to develop their specific risk assessments.

Some of the emerging safety issues that were under the spotlight in EUR were GNSS interferences, 5G in C-band interferences with Radalts, and use of digital documents instead of paper to carry on board. IATA is in active engagement with the necessary stakeholders to support its member airlines with the mitigation of these issues.

Operating safely is vital for the industry and with this intent IATA EUR has developed and supported the issuance of an IATA Operational Notice - Nicosia FIR communication procedures.

IATA Safety Programs

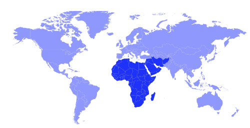
In 2021, the focus in EUR for the IATA auditing programs was on ensuring airlines and GSPs could benefit from the IOSA and ISAGO Support Programs. The introduction of the remote audit option allowed a significant number of operators to renew their registrations regardless of the travel and quarantine restrictions in individual States. The main issue in 2021 was with handling initial audits, where the requirement that they should be conducted wholly on-site remained, which blocked some of the initial audits in countries with stricter government-imposed restrictions. It was reassuring to notice, however, that two airlines in EUR managed to join the IOSA registry even in this challenging period. Hopefully, the temporary introduction of a hybrid initial audit in 2022 will allow more airlines to join the IOSA registry.

IATA EUR continued its efforts to encourage States to consider utilization of IATA's audit programs to complement their safety oversight activities. In 2021, IATA signed a Memorandum of Understanding (MoU) with the Romanian Civil Aviation Authority on the use of IOSA for safety oversight. One of the conclusions of the second meeting of the ICAO European Aviation System Planning Group in December 2021 was that ICAO EUR/NAT Office would take actions to invite States to consider the extent of a possible inclusion of ISAGO in their SSP and air operator regulatory activities as a complementary safety assurance measure.

2021 showed a significant increase in airlines' interest in joining the safety information exchange programs of IATA GADM. EUR was leading in numbers, with 28 new members in IDX and 16 in FDX. In the period of reduced flights and increased safety risks due to COVID-19, more airlines realize they should not be relying on their internal statistics only; therefore, safety information-sharing has become more crucial than ever.

EUR Aircraft Accidents
CIS Aircraft Accidents

Africa and Middle East



Operations and security in the region caused by geopolitical tensions resulted in an unstable environment throughout 2021. The Africa and Middle East (AME) region accounts for 7 of 10 published FAA Special Federal Aviation Regulations, and 6 of 8 advisory/prohibition NOTAMs published.

COVID-19 highlighted several safety risks as IATA AME supported the aviation community in restarting and normalizing operations. The focus for the year was to continue to support members to achieve a continuous reduction in operational safety risks, taking in to account geopolitical tensions and COVID-19.

Regional Aviation Safety Groups for Africa and Indian Ocean (RASG-AFI) and Middle East Region (RASG-MID)

The IATA regional team continues to provide significant contributions to both the RASG–MID and RASG-AFI, occupying the Vice-Chair position of both groups; creating a strong presence to drive the interests of IATA's airline members operating within the region.

The RASG Safety Reports identified regional safety priorities and risks, as well as efforts to continue to focus on the top areas:

- Loss of Control — In-flight (LOC-I)
- Runway Excursion (RE)
- Abnormal Runway Contact (ARC) during landing
- Mid-Air Collision (MAC)
- Controlled Flight into Terrain (CFIT)
- Runway Incursion (RI)

RASG-MID

The following emerging safety risks were identified:

- GNSS outage
- COVID-19 pandemic
- Safe operations of UAS (drones)
- Impact of security on safety

RASG-AFI

Two areas of safety activity were revised to better align with the goals of the Global Aviation Safety Plan (GASP):

- Abuja safety targets
- Structure of the Safety Support Teams serving under the RASG

Safety enhancement initiatives to address RE-related accidents remained a top priority for the most predominant high-risk category of occurrences; therefore, a multi-stakeholder special project was initiated in AFI to focus on helping States upgrade runway safety standards at international airports. Additionally, IATA supported ICAO awareness workshops on both CFIT and LOC-I in Q4 of 2021.

Due to the reported increase in Unstable Approaches, briefings were provided to the States and regional operators. Also, promotion across the region was made to ensure the adoption of ICAO Global Reporting Format (GRF) requirements.

Regional Safety Engagements/Programs 2020-2021

AFI ATS Incident Analysis Group (AIAG/18)

The AFI Air Traffic Service (ATS) Incident Analysis Group (AIAG) is a multi-stakeholder collaboration aimed at identifying and addressing the primary and secondary causal and contributory factors for aviation safety occurrences in the AFI region. The AIAG provides specific and general recommendations to all AFI States, ANPSs, airports, airspace users, etc., as applicable, based on the AIAG analysis results, that should be implemented to reduce the number of occurrences to zero or as low as reasonably possible. The AIAG activities form part of the regional RVSM scrutiny activities and the statistics and outcomes feed the AFI collision risk assessment.

AIAG18, which took place virtually over four days in July 2021, was attended by 16 AFI CAAs/ANSPs, 7 airspace users, and 6 international organizations including ICAO and IATA. The AIAG19 results, when published, are expected to show significant improvement in the reduction of Loss of Separation (LoS) events across AFI in 2021 compared to 2020.

GNSS Outages/Vulnerability

Predominantly in the MENA region, GNSS interference continues to be a risk during the enroute phase of flight between the interface of the Middle East and Europe. Safety reports collated to date identify the majority of GNSS/GPS interference is reported in the Ankara and Baghdad FIRs followed by the Nicosia and Beirut FIRs.

ICAO RASG-MID released guidance material related to GNSS vulnerabilities to mitigate the safety and operational impact of GNSS service disruption. The guidance mandates pilots to report GNSS interference and ANSPs to issue appropriate advisories, NOTAMs and/or other measures to mitigate the effect of interference.

IATA AME regional office continues to work closely with all concerned stakeholders (States, ICAO and ITU) on measures to ensure effective reporting of GNSS interferences and on developing mitigation measures to reduce the effects of the interference.

COVID-19 Pandemic

The COVID-19 pandemic was addressed in a proactive manner as an emerging safety risk in the ICAO MID 10th Annual Safety Report and will be included in the priorities for 2022.

The IATA Regional Operations, Safety & Security (OSS) team has been fundamental in the continued work of the ICAO MID Regional Recovery Planning Task Force (RPTF), leading workstream (WS) 4: Air Navigation Services and Air Traffic Management as well as providing material and contributing input into WS 1: Public Health Requirements, WS 2: Operational Safety Measures, and WS 3: Airport and Passenger Facilitation.

Geopolitical Tensions - Safety, Security, Operations

Safety and Flight Operations:

- Operational disruptions affecting safety and flight operations continue to be prevalent in AME. 2020-2021 saw disruption to the aviation community over Afghanistan, Mali, Ethiopia, South Sudan, Iraq, Iran, Guinea, and the ongoing conflict between Yemen, Saudi Arabia and the UAE. Government, military, and/or deliberate or unlawful act may occur in any State at any time and pose risks to civil aviation. It is, therefore, important for stakeholders across the region to work together to share the most up-to-date conflict zone risk-based information possible to assure the safety of civilian flights, and to ensure robust regional and State contingency plans are in place and can be implemented in a timely manner.
- In 2021, the AME Regional OSS team strengthened their contingency coordination effort, introducing a virtual 'ops desk' to provide operational support and problem resolution to IATA members.
- Communication and coordination activities were migrated to IATAs ITOP Global Contingency Portal in 2021.
- The ICAO AFI Regional Contingency Plan was amended in 2021, driven by input from IATA member airlines and lessons learned from previous events.
- In 2022, the MID Region 2014 Contingency Coordination Team (CCT) will undergo a thorough review through the reestablishment of the MID ATM Contingency Planning Adhoc Action Group.

Security

- A series of three Aviation Security (AVSEC) webinars, in partnership with MedAire and Dragonfly, were conducted for Afghanistan between July-October 2021, briefing both AME members and global airlines on risks to operations.

- AVSEC webinars and a taskforce for monitoring drone and IED threats to aviation were delivered as a response to regional concerns.

Technical Panel Program

The OSS Technical Panel Program has grown from strength to strength in 2021 despite the constraints brought about by COVID-19. The program was established to develop and build relationships with States and ANSPs in a semi-informal 'round table' environment. The intent to:

- Openly share and discuss challenges of a safety and operational nature.

- Build a trust framework.

- Work toward a common set of goals that meets both airspace user and airspace provider requirements.

In 2021, 17 Technical Panels were conducted, capturing a total of 33 States across the AME Region and driving regional efforts for improvement.

Somalia

The regional team has continued with regular engagements with the Somalia Civil Aviation Authority (SCAA) under the umbrella of the Technical Panel program to support the safe transition from Class G to Class A Airspace. Through collaborative efforts, IATA, ICAO Eastern and Southern Africa (ESAF), and the SCAA have recently established the Somalia Airspace Special Coordination Team (SASCT) to ensure a safe, smooth transition. The Safety and Flight Operations team is complemented by a team of six IATA member airlines. Transition to a controlled ATC environment is expected by the 2nd quarter of 2022.

Aeronautical Information

The COVID-19 pandemic amplified regional deficiencies in Aeronautical Information Publications and their impact on safety and flight operations. Throughout the course of 2021, the regional team forged strong relationships with States as well as other stakeholders such as data houses and international organizations (e.g., International Federation of Aeronautical Information Management Association-IFAIMA, IFALPA, CANSO) toward achieving improvements across the entire region to create a safer and more predictable operating environment.

By the end of 2021, 80% of MID Region States were participating in the MID AIM Forum, and 81% of AFI States were participating in the AFI AIM Action Group along with three data houses, Group EAD, ICAO, IFAIMA, CANSO and IFATCA as well as six AME RCG member airlines. Work will continue throughout 2022 to improve aeronautical information.

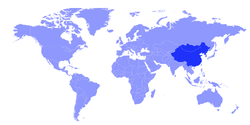
Global Aviation Data Management

The Regional Office continues to promote and encourage subscription to FDX and IDX by carriers in the region. Significant progress has been achieved with 37 IDX and 27 FDX airlines participating from the region.

AFI Aircraft Accidents

MENA Aircraft Accidents

North Asia Region (NASIA)



OSS NASIA keeps close cooperation with member airlines and other stakeholders to implement the IATA Safety Strategy in the region.

Implementing the IATA Safety Strategy

OSS NASIA implements the IATA Safety Strategy in the region, which mainly includes:

- Advocate for the IATA Global Safety Risk Management Framework to get more stakeholders to access it.

- Participate in the Unstable Approach Analysis Project Team arranged by IATA Headquarters.

- Keep sharing dynamic safety information to member airlines and other stakeholders under COVID-19 restrictions.

- With support from IATA headquarters, the Safety Connect site in the Chinese language was established.

Supporting Airlines during COVID-19

Two sessions of the webinar – IATA Best Practices in Mitigating COVID-19 Risks - were delivered by IATA and attended by 400+ participants from airlines, airports, GSPs and CAAs in NASIA region. The first session focused on ground and airport operations, while the second focused on airline and flight operations. For better participant interaction, OSS NASIA translated the IATA operational guidance material into Chinese and shared it with the participants.

Establishing a WeChat Subscription Account

The WeChat subscription account – IATA Safety & Operations - was established in 2021, posted 18 articles and got 100+ followers. All the articles were about the latest industry information from around the world that was collected by IATA NASIA, as well as news releases regarding safety and operations events in NASIA region that were organized by IATA.

Promoting Global Aviation Data Management

GADM made continuous progress in 2021. Seven airlines and two GSPs joined the program, including from the Chinese mainland, Hong Kong and Chinese Taipei. While the concept of safety information exchange is being gradually accepted by the stakeholders, more GSPs are showing interest in GADM for improved ground operations safety.

Supporting Global Reporting Format Implementation

The implementation of a new GRF is a global action and directly related to runway safety. To create awareness and support implementation of GRF, a series of seminars, webinars and workshops were held by ICAO, IATA, Airports Council International (ACI) and stakeholders from NASIA were invited to join these events by OSS NASIA. And, since the beginning of 2021, OSS NASIA stayed in close contact with the member airlines and shared their technical queries to ICAO headquarters to get support.

Enhancing the Service of IATA China Air Traffic Flow Management Liaison Desk

OSS NASIA maintained its China Air Traffic Flow Management (ATFM) Liaison Desk service to all airlines during COVID-19, including:

- Respond to airline queries regarding crew restrictions.
- Assist with airline requirements to adjust pre-flight plans.
- Cooperate with IATA FAA Liaison Desk and other IATA regional offices to use the Global ITOP platform to distribute dynamic operational information, operational notices and respond to airline queries.
- Assist airlines to get temporary pre-flight approvals during tense situations in some Asian countries that effected airline operations.

Promoting IOSA and ISAGO

The IOSA audits in NASIA were primarily conducted remotely given the COVID-19 situation and the associated travel restrictions around the world. Also, the initial audits were suspended in China and North Asia due to COVID-19. OSS NASIA kept close coordination with the airlines in the region on a daily basis to address the issues regarding IOSA operations. Meanwhile, five sessions of IOSA Airline Auditor Training were delivered by IATA remotely and supported by OSS NASIA.

OSS NASIA assisted IATA headquarters to deliver Internal Training courses for one GSP in April and applied for extended exemption for the renewal audit for two GSPs in November. Due to the isolation policy of COVID-19, the renewal audit was completed by means of a joint audit for the six GSPs in Hong Kong, China, in December.

Promoting Flight Operation Safety

By coordination between OSS NASIA and CAAC, the Pilot Professionalism Lifecycle Management System (PLM) has successfully included the development of CBTA/EBT. In October and December, two special training courses for EBT data report analysis and EBT initial instructors/inspectors were delivered, respectively.

OSS NASIA worked with EUROCONTROL and IATA Europe to collect the Point of Contact information from NASIA region to establish the Airlines' Dispatch Office Phone Directory, which will be used by ATC on the tactical level in case of a Prolonged Loss of Communication (PLoC) between pilot and ATC.

Promoting Cabin Safety

OSS NASIA started to translate the IATA Cabin Operations Safety Best Practices Guide into Chinese. This is considered to be very important guidance material in the domain of Cabin Safety and Operations.

NASIA Aircraft Accidents

IATA SAFETY CONFERENCE

Dubai, United Arab Emirates

25 - 27 October 2022

EMERGING **STRONGER**

Emirates

IATA

www.iata.org/safetyconference

3

Decade in Review

AIRCRAFT ACCIDENTS AND FATALITIES

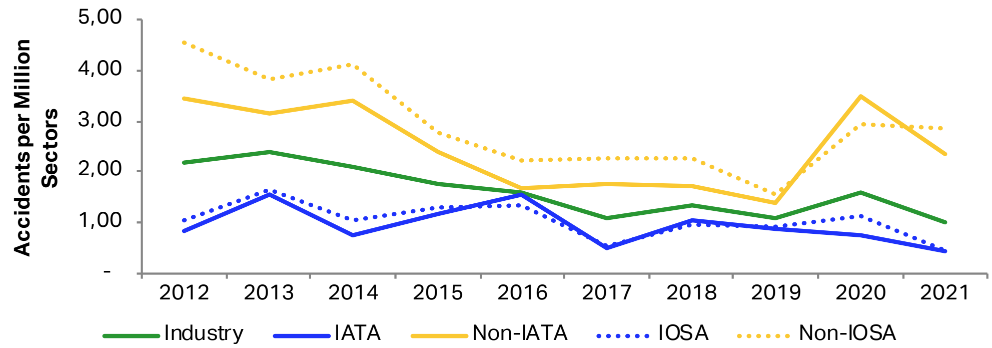
This section presents yearly accident rates for the past 10 years for each of the following accident metrics: all accidents, fatality risk, fatal accidents and hull losses, as well as general statistics on the number of fatalities and accident costs.

The data found in Section 3 can be viewed in the Interactive Microsoft file found here. The interactive file includes data from Section 3 in tabs 2 and 3: Accidents Rates and Fatality Risk. You can also access these tabs from the Excel home page, tab 1.

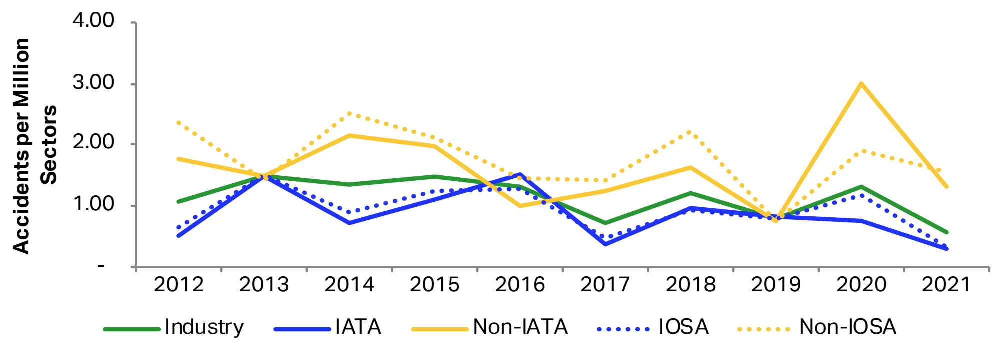
ALL ACCIDENTS

'All Accidents' is the most inclusive rate, including all accident types and all severities in terms of loss of life and damage to aircraft.

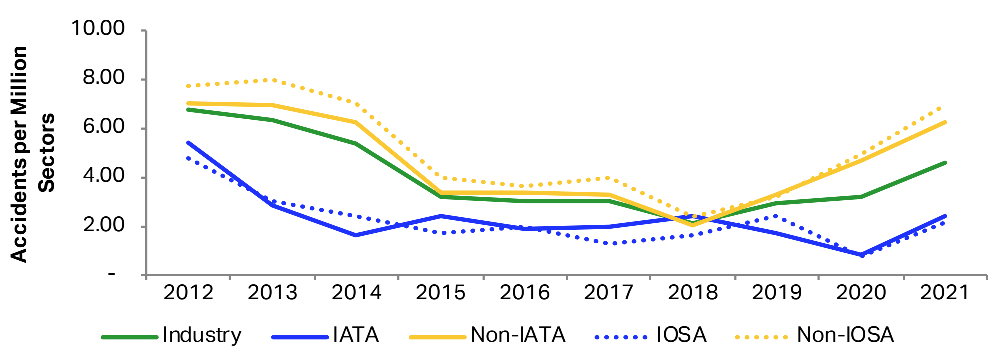
Jet & Turboprop Aircraft



Jet Aircraft



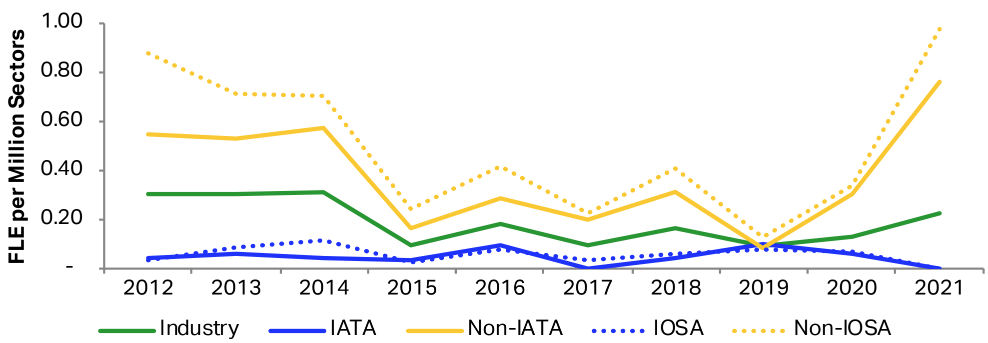
Turboprop Aircraft



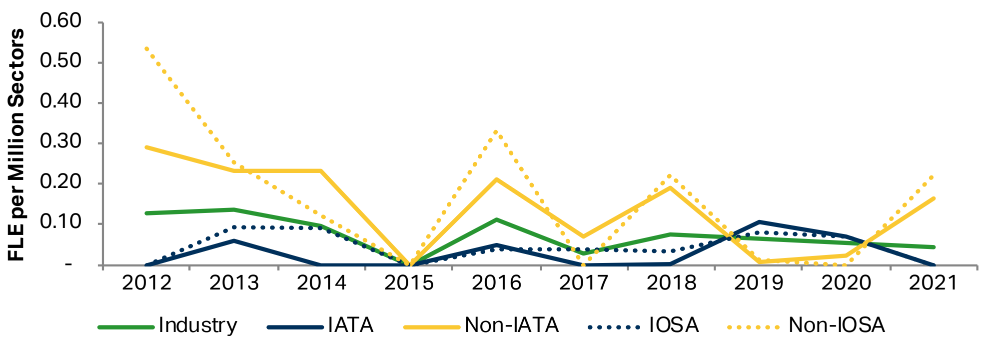
FATALITY RISK

Fatality Risk: Full-Loss Equivalents (FLE) per million sectors. For a definition of 'full-loss equivalent', see Annex 1.

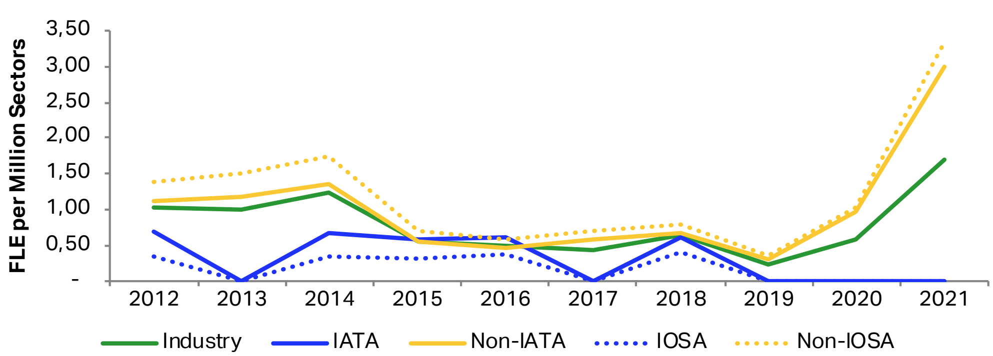
Jet & Turboprop Aircraft



Jet Aircraft



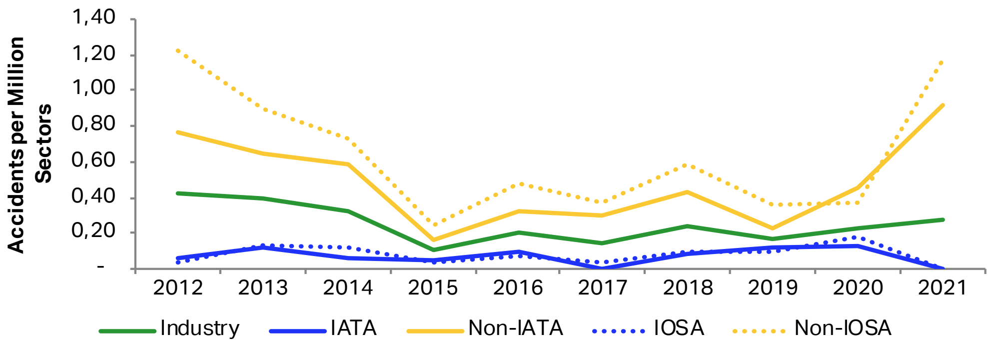
Turboprop Aircraft



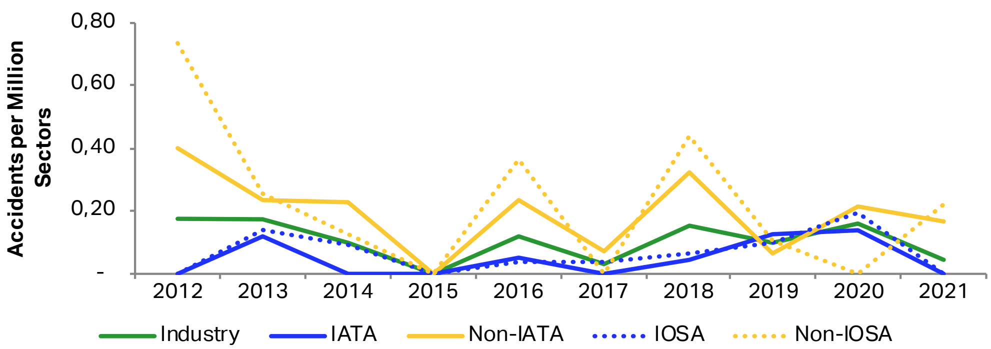
FATAL ACCIDENTS

Fatal Accidents are those where at least one person on board the aircraft perished as a result.

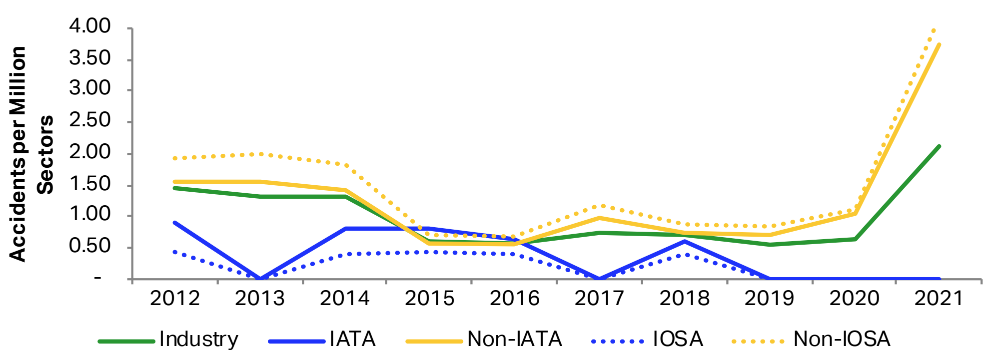
Jet & Turboprop Aircraft



Jet Aircraft



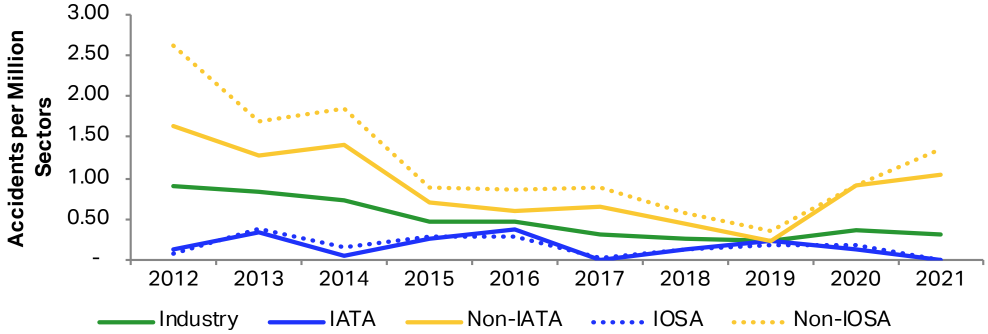
Turboprop Aircraft



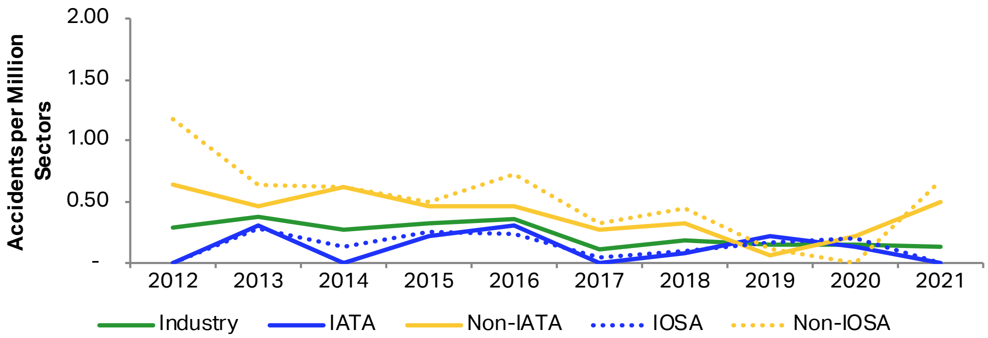
HULL LOSS

'Hull Loss' refers to the aircraft being damaged beyond repair or the costs related to the repair being above the commerical value of the aircraft.

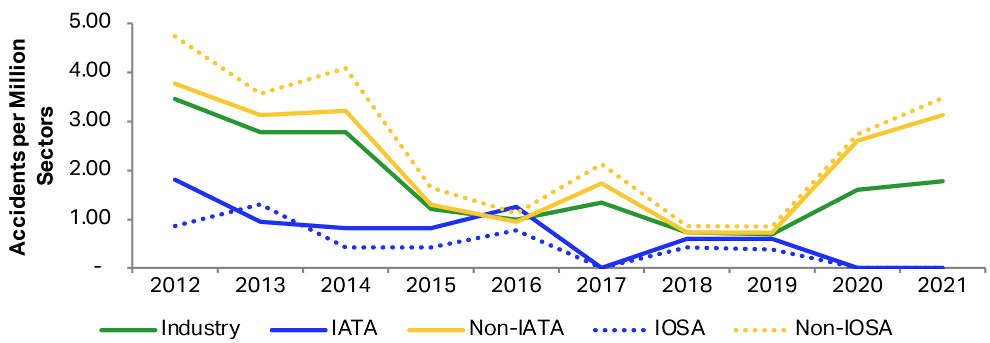
Jet & Turboprop Aircraft



Jet Aircraft



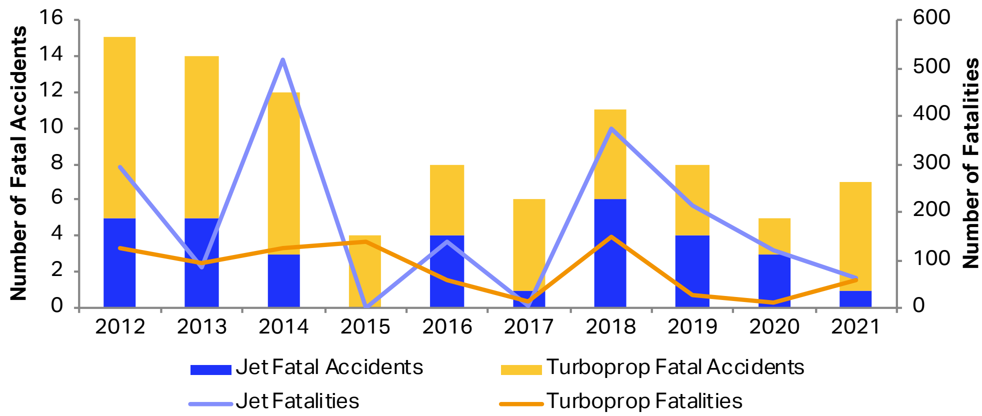
Turboprop Aircraft



FATALITIES

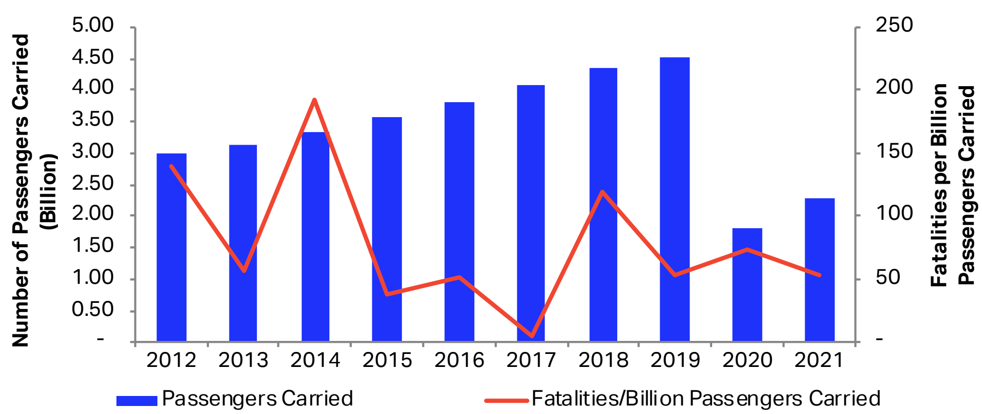
The graph below shows the total number of fatalities (line and vertical right axis) and the number of fatal accidents (stacked bar and vertical left axis) split between aircraft propulsion. The reader needs to be aware that the data is not being normalized by the aircraft flight count; therefore, discretion should be used. This data should be interpreted and applied with reference to the accident rate graphs presented on the previous pages.

Number of Fatalities and Fatal Accidents



The graph below shows the number of passengers carried over the year and a ratio metric related to the number of fatalities by the number of passengers carried in a specific year. The sharp drop in 2020 is due to the COVID-19 pandemic.

Number of Passengers Carried and Fatality Ratio per Passenger Carried



Passengers Carried Data Source: IATA / Industry Economic Performance

4

2021 in Review

COMMERCIAL AIRLINES OVERVIEW

FLEET SIZE AND SECTORS FLOWN

	Jet	Turboprop	Total
World Fleet	29,281	3,396	32,677
Sector Landings (Millions)	22.9	2.8	25.7

Source: OAG, ch-aviation
Note: World Fleet includes in-service aircraft operated by commercial airlines as at year end.

CARGO OPERATING FLEET

	Jet	Turboprop
Percentage of Operating Fleet in All-Cargo Use	8.4%	7.7%

Source: ch-aviation
Note: Operating Fleet includes in-service aircraft operated by commercial airlines as at year end.

The data found in Section 4 can be viewed in the IATA Reader found here. The interactive file includes data from Section 4 in tabs 4 and 5: Regional Comparison and/or Fatality Risk per Region of Operator. You can also access these tabs from the Excel home page, tab 1.

REGIONAL BREAKDOWN

	AFI	ASPAC	CIS	EUR	LATAM/ CAR	MENA	NAM	NASIA
Jet - Sector Landings (Millions)	0.35	3.01	0.91	3.75	1.54	1.08	7.40	4.88
Turboprop - Sector Landings (Millions)	0.36	0.87	0.07	0.57	0.35	0.04	0.53	0.05

AIRCRAFT ACCIDENTS

Note: Summaries of all the year's accidents are presented in Annex 3.

NUMBER OF ACCIDENTS

	Jet	Turboprop	Total
Total	13	13	26
Hull Losses	3	5	8
Substantial Damage	10	8	18
Fatal	1	6	7
Full-Loss Equivalents	1.0	4.8	5.8
Fatalities*	62	59	121
Fatalities of people not on board the aircraft	*0*	*0*	*0*

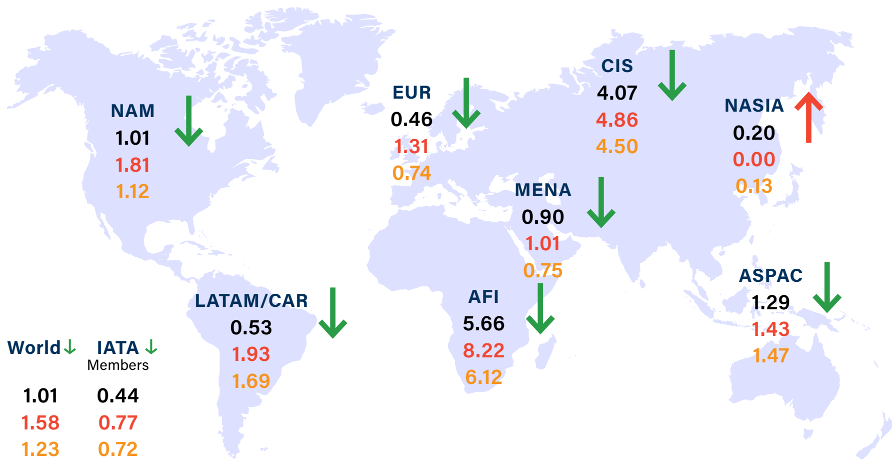
**People on board only*

ACCIDENTS PER OPERATOR REGION

	AFI	ASPAC	CIS	EUR	LATAM/ CAR	MENA	NAM	NASIA
Total	4	5	4	2	1	1	8	1
Hull Losses	2	1	3	1	0	0	1	0
Substantial Damage	2	4	1	1	1	1	7	1
Fatal	3	1	3	0	0	0	0	0
Full-Loss Equivalents	2.6	1.0	2.3	0.0	0.0	0.0	0.0	0.0
Fatalities	18	62	41	0	0	0	0	0

ALL ACCIDENT RATE

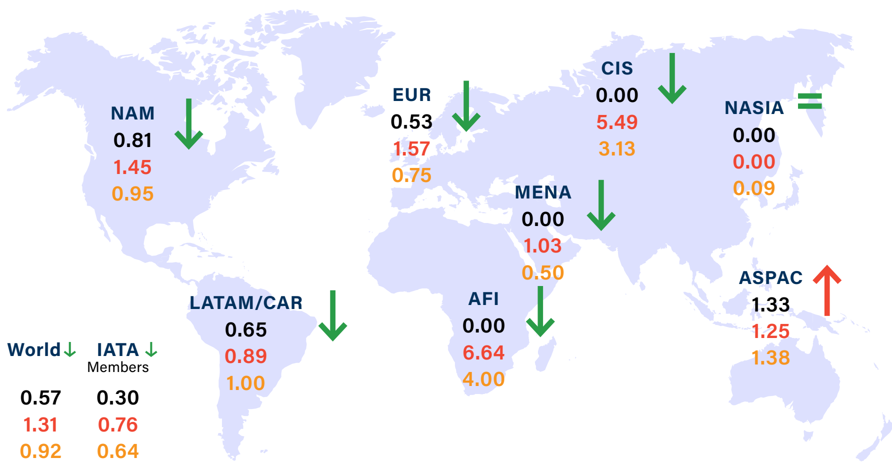
Jet & Turboprop Aircraft



2021 vs 2020 accident rate

2021
2020
'17-'21

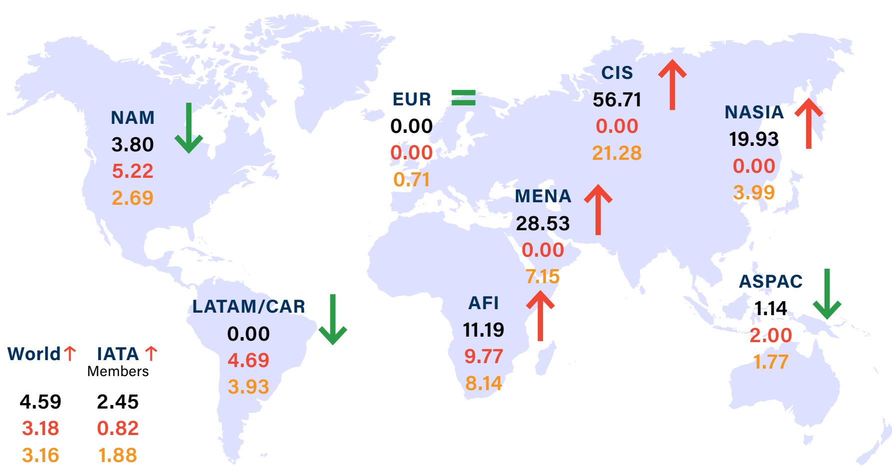
Jet Aircraft



2021 vs 2020 accident rate

2021
2020
'17-'21

Turboprop Aircraft

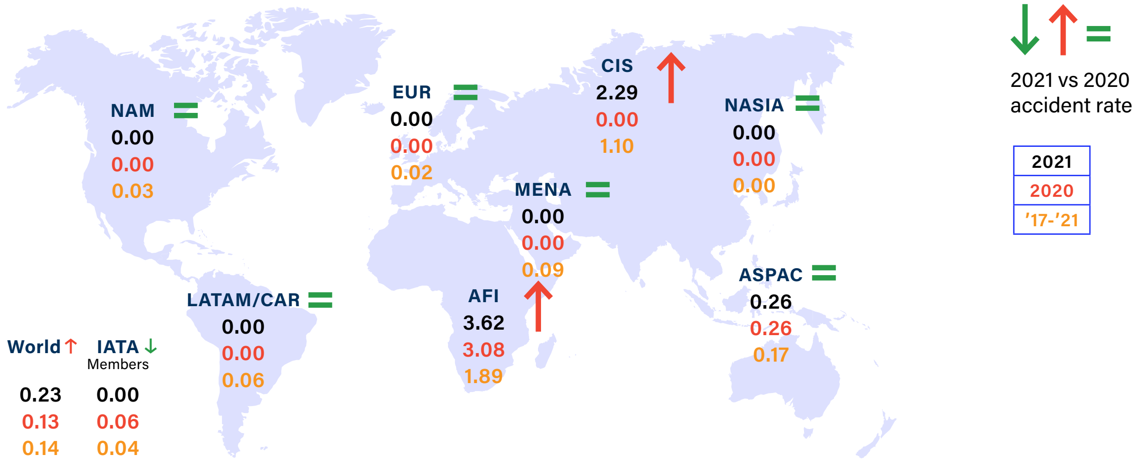


2021 vs 2020 accident rate

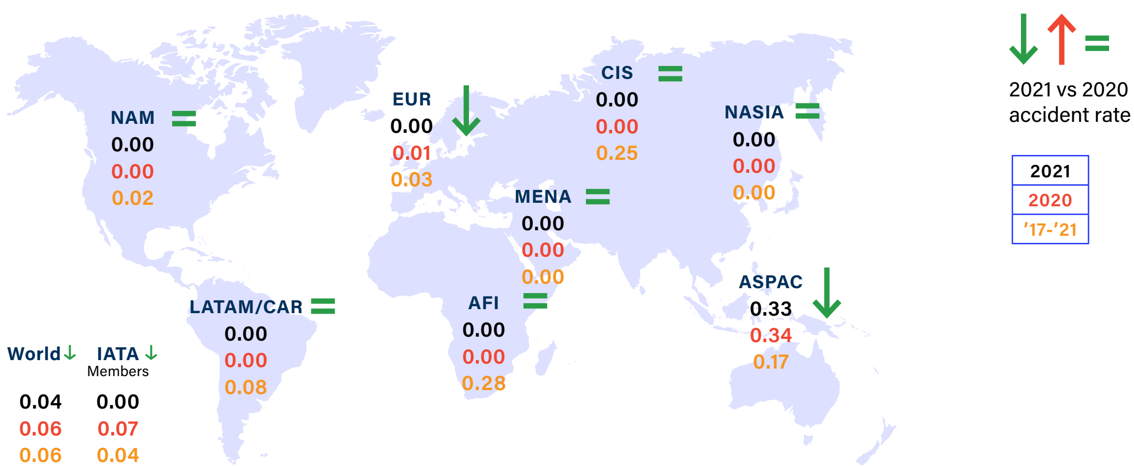
2021
2020
'17-'21

FATALITY RISK

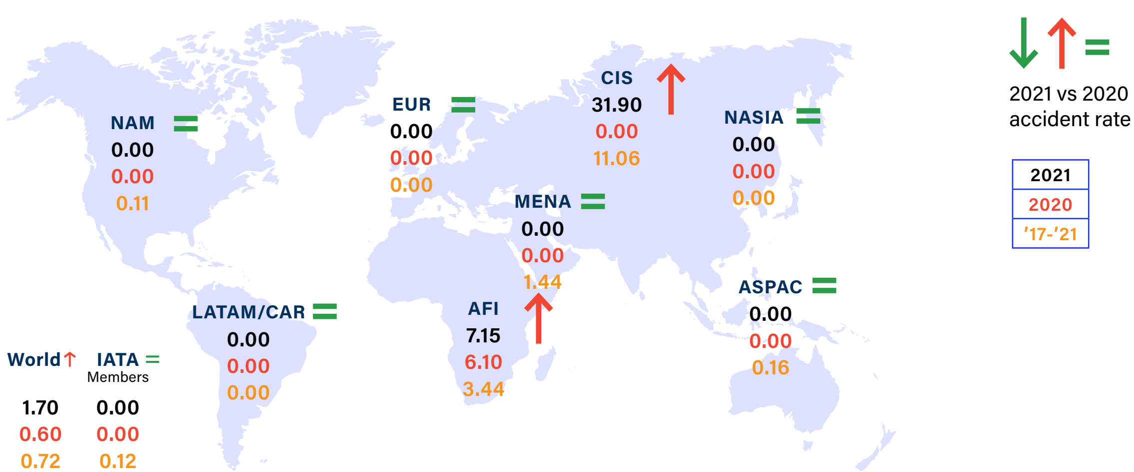
Jet & Turboprop Aircraft



Jet Aircraft

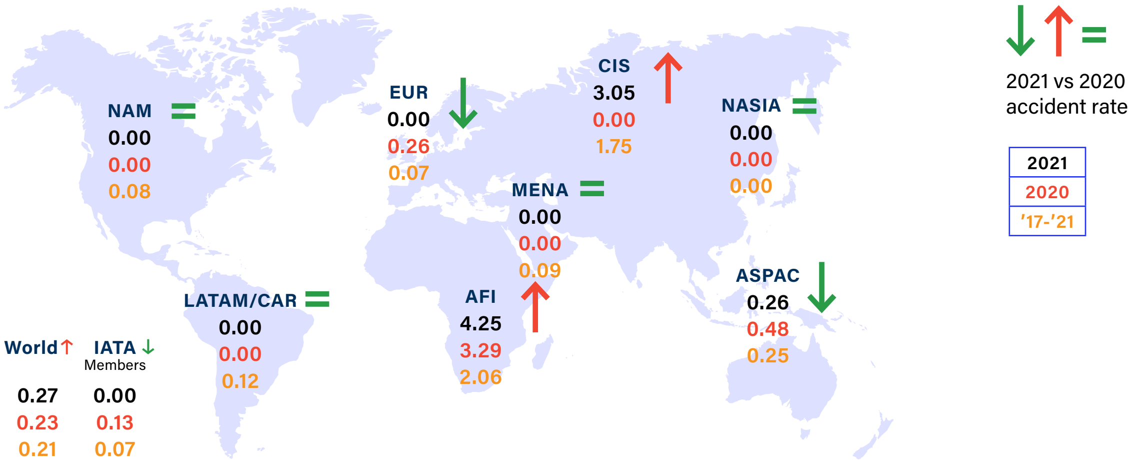


Turboprop Aircraft

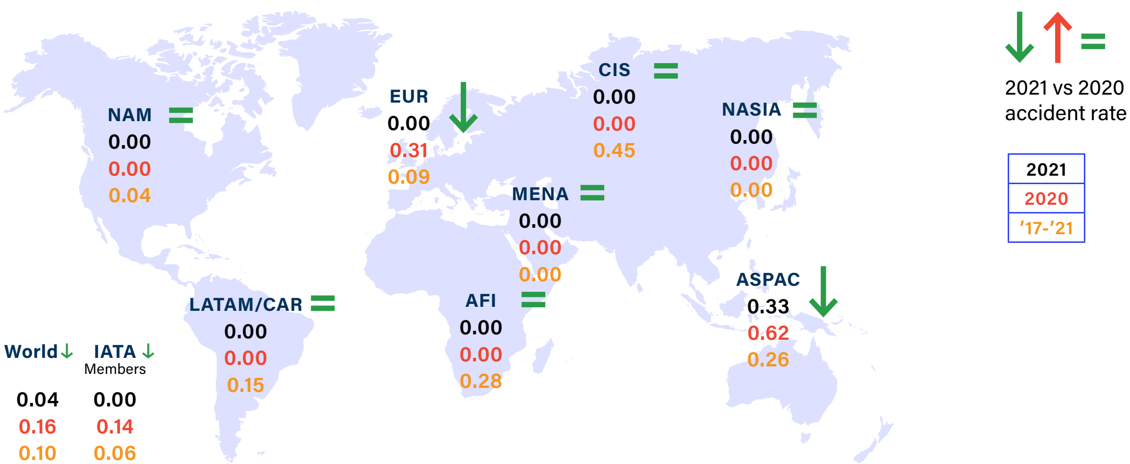


FATAL ACCIDENTS

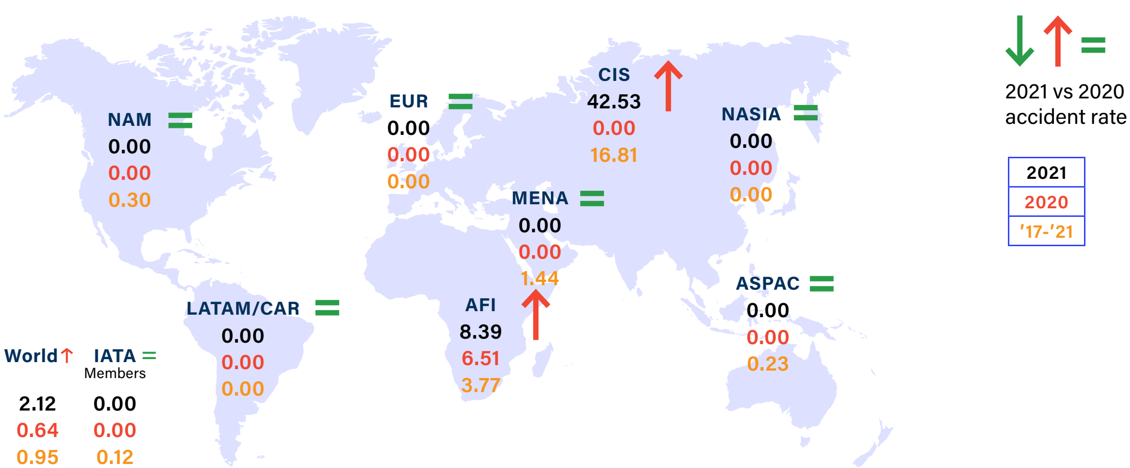
Jet & Turboprop Aircraft



Jet Aircraft

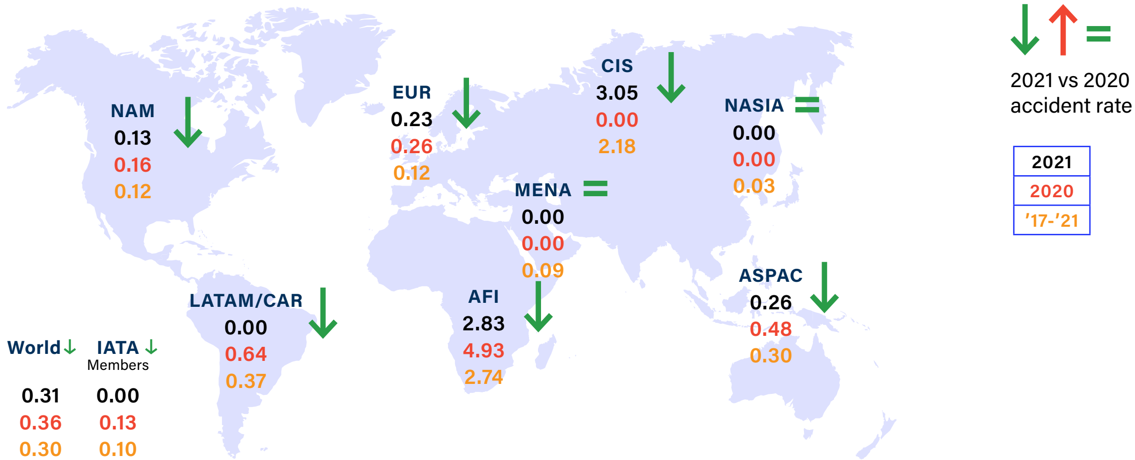


Turboprop Aircraft

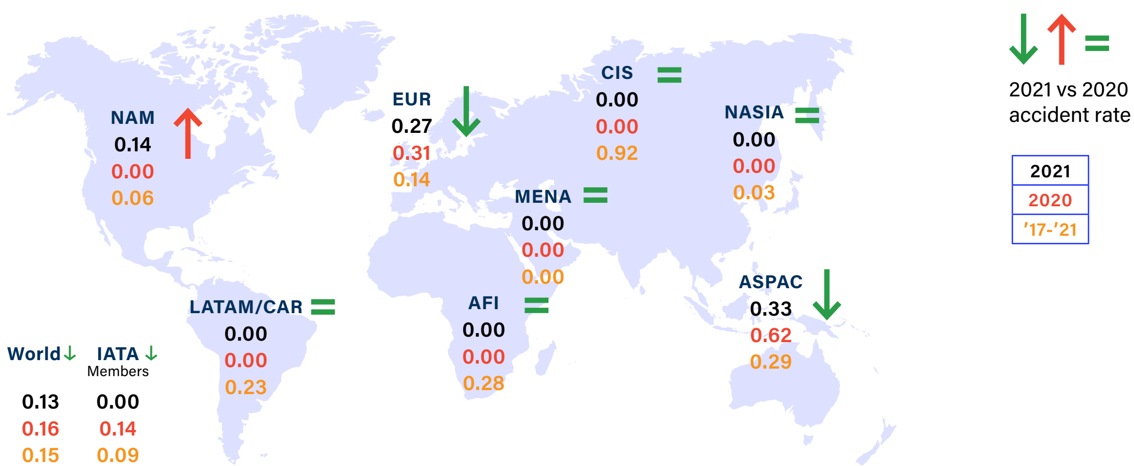


HULL LOSS

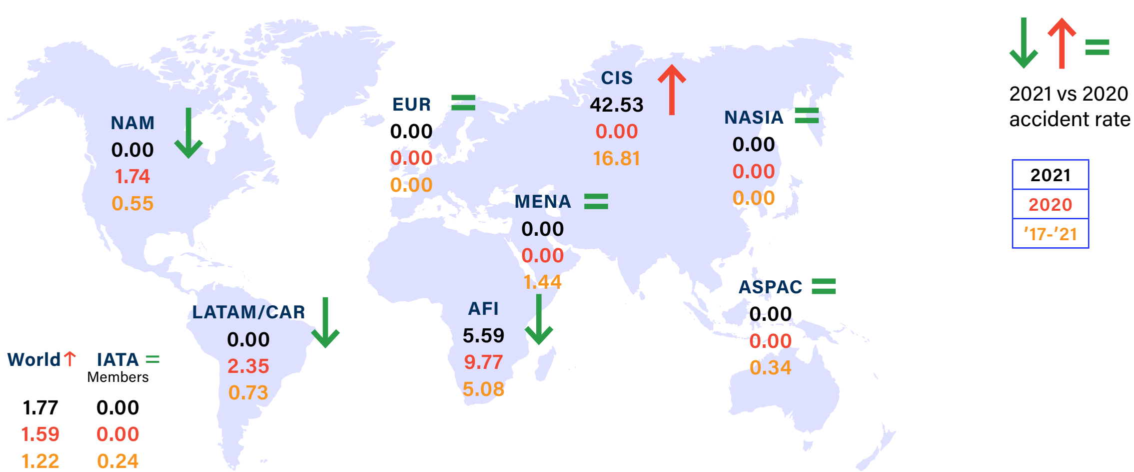
Jet & Turboprop Aircraft



Jet Aircraft



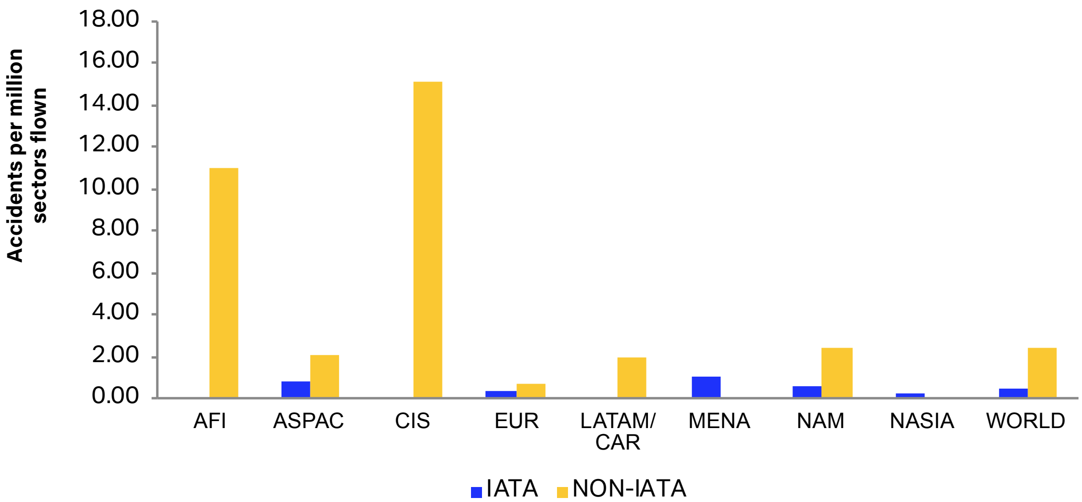
Turboprop Aircraft



IATA Member Airlines vs. Nonmembers — Total Accident Rate by Region

In an effort to better indicate the safety performance of IATA member airlines vs. nonmembers, IATA has determined the total accident rate for each, regionally and globally. IATA member airlines outperformed nonmembers in the AFI, ASPAC, CIS, EUR, LATAM/CAR and NAM regions.

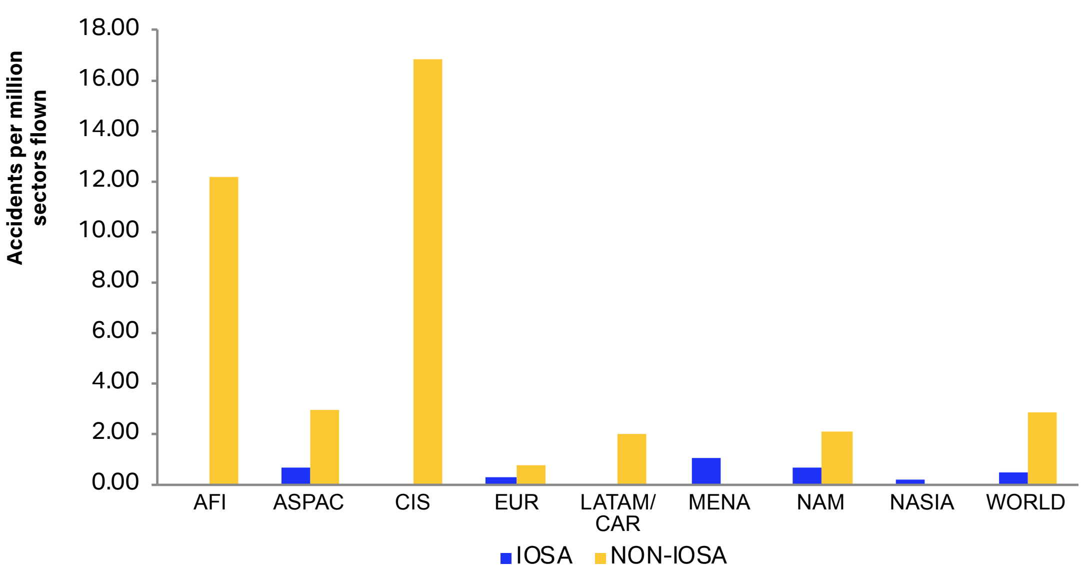
2021 Accident Rate: IATA Member Airlines vs. Nonmembers



IOSA-Registered Airlines vs. Non-IOSA —Total Accidents and Fatalities by Region

In an effort to better indicate the safety performance of IOSA-registered airlines vs. non-IOSA, IATA has determined the total accident rate for each, regionally and globally. IOSA-registered airlines outperformed non-registered airlines in the AFI, ASPAC, CIS, EUR, LATAM/CAR and NAM regions. The non-IOSA registered airline accident rate was about six times higher than that for IOSA-registered airlines in 2021.

2021 Accident Rate: IOSA-Registered vs. Non-Registered



IATA SAFETY ISSUE REVIEW MEETING

A bi-annual industry meeting for safety professionals: **air carriers; airports; manufacturers; and ground service providers.**

Date of the next **SIRM** to be announced.

Chatham House Rule means this is a protected forum for participants to openly discuss safety risks, hazards, lessons learned from accidents and incidents, and the shared results of safety studies.

Special COVID-19 Bulletins

Lessons learned from today's operational experiences and de-identified case studies.

Click here to learn more

For more information, or to contribute to the next edition of the Bulletin, please contact IATA SIRM

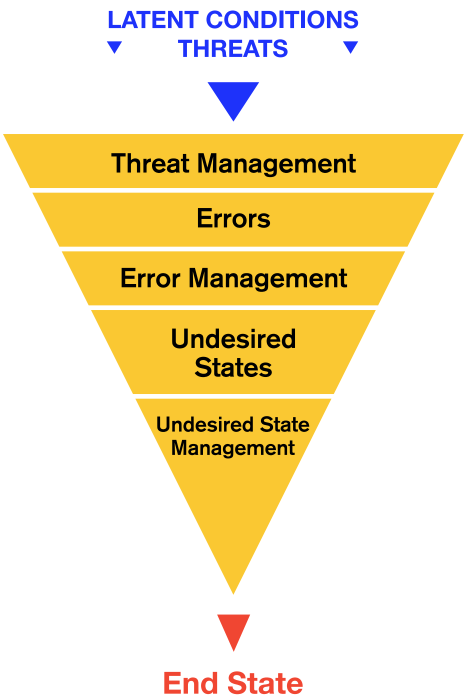
5

In-Depth Accident Analysis 2017 to 2021

INTRODUCTION TO THREAT AND ERROR MANAGEMENT

The Human Factors Research Project at the University of Texas in Austin developed Threat and Error Management (TEM) as a conceptual framework to interpret data obtained from both normal and abnormal operations. For many years, IATA has worked closely with the University of Texas Human Factors Research Team, ICAO, IATA member airlines and OEMs to apply TEM to its many safety activities.

THREAT AND ERROR MANAGEMENT FRAMEWORK



DEFINITIONS

Latent Conditions: Conditions present in the system before the accident, made evident by triggering factors. These often relate to deficiencies in organizational processes and procedures.

Threat: An event or error that occurs outside the influence of the flight crew, but which requires flight crew attention and management to properly maintain safety margins.

Flight Crew Error: An observed flight crew deviation from organizational expectations or crew intentions.

Undesired Aircraft State (UAS): A flight crew-induced aircraft state that clearly reduces safety margins; a safety compromising situation that results from ineffective TEM. An UAS is recoverable.

End State: An end state is a reportable event and unrecoverable.

Distinction between 'Undesired Aircraft State' and 'End State': UAS is recoverable (e.g., an unstable approach from which a go-around would recover the situation). An End State is unrecoverable (e.g., a runway excursion where the aircraft comes to rest off the runway).

The data found in Section 5 can be viewed in the IATA Reader Interactive Microsoft file found here. The interactive file, which includes data from Section 5, can be found in tabs 5, 6, and 7: Five-Year Accident, Accident Classification and Accident Propulsion. You can also access these tabs from the Excel home page, tab 1.

ACCIDENT CLASSIFICATION SYSTEM

At the request of member airlines, manufacturers and other organizations involved in the annual Safety Report, IATA developed an accident classification system based on the TEM framework. The purpose of the taxonomy is to:

- Acquire more meaningful data
- Extract further information/intelligence
- Formulate relevant mitigation strategies/safety recommendations

Unfortunately, some accident reports do not contain sufficient information at the time of the analysis to adequately assess contributing factors. When an event cannot be properly classified due to a lack of information, it is classified under the Insufficient Information category. Where possible, these accidents have been assigned an End State. It should also be noted that the contributing factors that have been classified do not always reflect all the factors that played a part in an accident, but rather those known at the time of the analysis.

Important note: In the in-depth analysis presented in Chapters 5 and 6, the percentages shown with regard to contributing factors (e.g., % of threats and errors noted) are based on the number of accidents in each category.

Annex 1 contains definitions and detailed information regarding the types of accidents and aircraft included in the 2021 Safety Report as well as the breakdown of IATA regions. The complete IATA TEM-based accident classification system for flight is presented in Annex 2.

ANALYSIS BY ACCIDENT CATEGORY AND REGION

This section presents an in-depth analysis of 2017 to 2021 occurrences by accident category and regional distribution. Definitions of these categories can be found in Annex 2. The countries that make up each of the IATA regions can be found in Annex 1. An in-depth regional analysis can be found in Section 6.

Referring to the accident categories helps an operator to:

- Structure safety activities and set priorities.
- Recall key risk areas (i.e., when a type of accident does not occur in a given year).
- Provide resources for well-identified prevention strategies.
- Address the categories, both systematically and continuously, within the airline's SMS.

For effective **Safety Leadership** in aviation, airline executives should set a leadership mindset that enables safety-focused behaviors to embed a positive organizational safety culture. Applied globally, this should be supported by clearly defined safety accountabilities to enable an effective safety culture to exist within each, and every, aviation service provider around the world.

IATA Safety

2021 Aircraft Accidents – Accident Count

Number of accidents: 26
Number of fatalities: 121

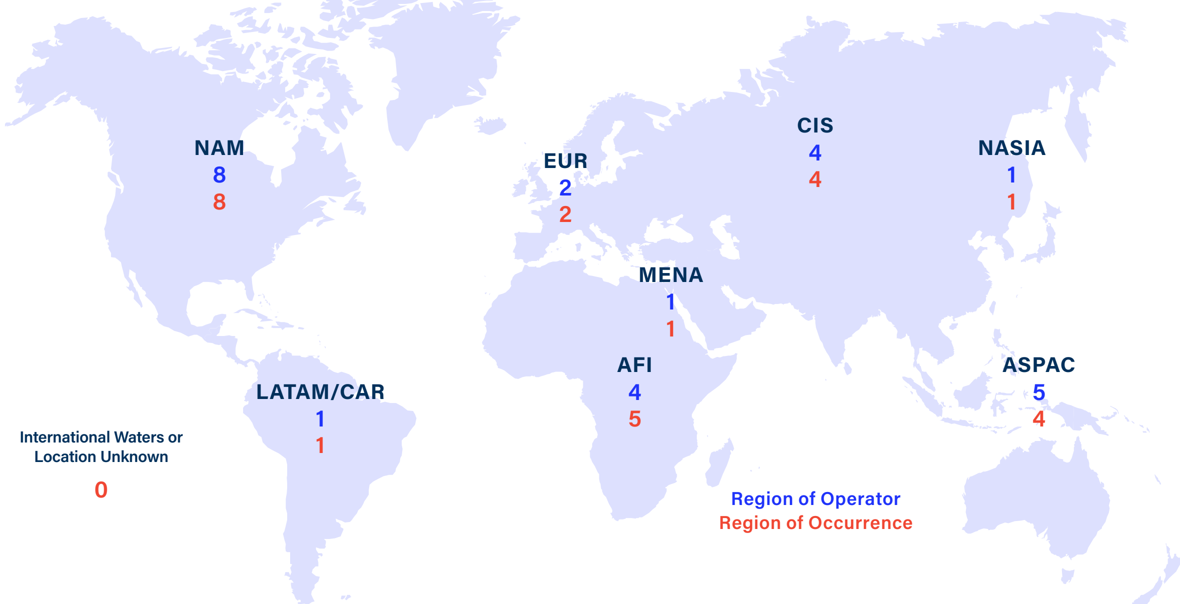
Accident Count % of Total	2021
IATA Member	31%
Full-Loss Equivalents	22%
Fatal	27%
Hull Losses	31%

Passenger	Cargo	Ferry	Jet	Turboprop
62%	38%	0%	50%	50%

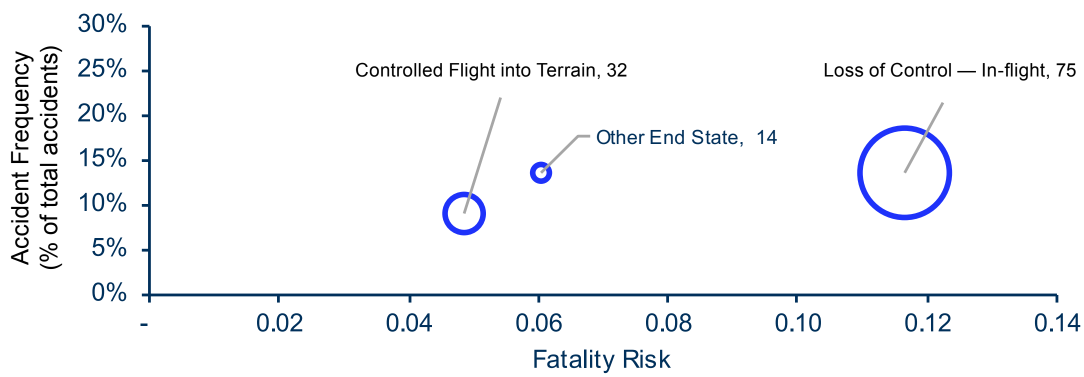
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

2021 Aircraft Accidents – Accident Rate*

Accident rate: 1.01

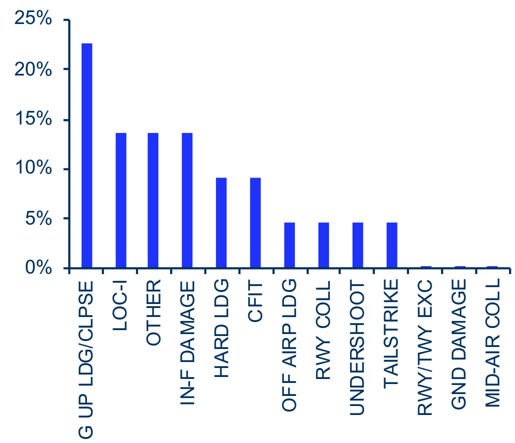
Accident Rate*	2021
IATA Member	0.44
Fatality Risk**	0.23
Fatal	0.27
Hull Losses	0.31

Jet	Turboprop	
0.57	4.59	Accident rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per 1 million flights **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2021)

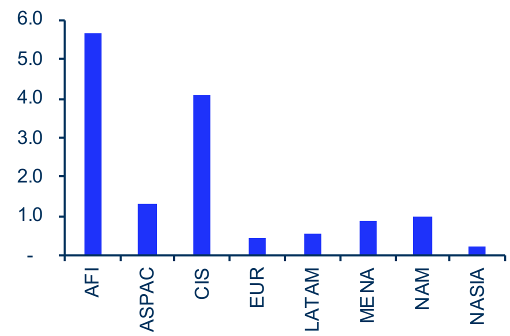
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of [Acronyms/Abbreviations section] for full names.

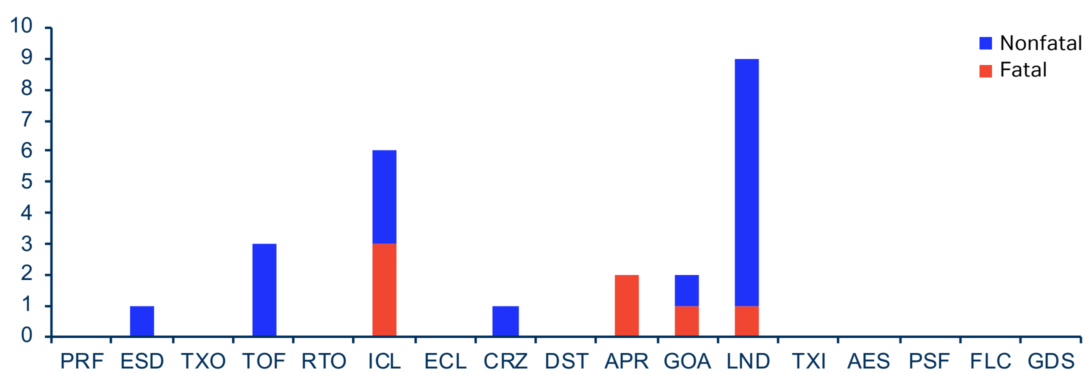
Regional Accident Rate (2021)

Accident per million sectors



Accidents per Phase of Flight (2021)

Total number of accidents (fatal vs. nonfatal)



Refer to list of [Phase of Flight definitions] for full names.

2021 Aircraft Accidents – Contributing Factors

2021 Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	46%
Safety Management	42%
Management Decisions, including Regulatory Decisions and Cost Cutting	31%
Maintenance Operations	23%
Flight Operations	15%
Selection Systems	15%
Maintenance Ops: SOPs & Checking	12%
Flight Ops: Training Systems	12%
Technology & Equipment	8%
Dispatch	4%
Ops Planning & Scheduling	4%
Flight Ops: SOPs & Checking	4%
Flight Watch/Following/Support	4%
Change Management	4%
Ground Operations	4%
Ground Ops: SOPs & Checking	4%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	38%
SOP Adherence/SOP Cross-verification	31%
Failure to GOA after Destabilization on Approach	12%
Callouts	8%
Documentation	8%
Pilot-to-Pilot Communication	4%
Incorrect or Missing Log Book Entries	4%
Automation	4%
Wrong Weight & Balance/Fuel Information	4%
Failure to GOA after Abnormal Runway Contact	4%

2021 Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	31%
Poor Visibility/IMC	19%
Maintenance Events	19%
Aircraft Malfunction	19%
Gear/Tire	12%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	12%
Airport Facilities	12%
Operational Pressure	12%
Contained Engine Failure/Powerplant Malfunction	12%
Wildlife/Birds/Foreign Object	12%
Wind/Windshear/Gusty Wind	8%
Icing Conditions	8%
Foreign Objects, FOD	8%
Lack of Visual Reference	8%
Thunderstorms	8%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	4%
Dispatch/Paperwork	4%
Nav Aids	4%
Ground-based Nav Aid Malfunction or not Available	4%
Ground Events	4%

2021 Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	19%
Unstable Approach	15%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	12%
Operation Outside Aircraft Limitations	12%
Abrupt Aircraft Control	12%
Continued Landing after Unstable Approach	12%
Unnecessary Weather Penetration	8%
Controlled Flight Towards Terrain	8%
Loss of Aircraft Control While on the Ground	8%
Flight Controls/Automation	8%
Brakes/Thrust Reversers/Ground Spoilers	8%
Systems	4%
Landing Gear	4%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	27%
Monitor/Cross-check	12%
In-flight Decision-making/Contingency Management	12%
Automation Management	8%
Leadership	8%
Taxiway/Runway Management	4%
Captain Should Show Leadership	4%

Refer to the list of Accident Classification Taxonomy.

Competency-Based Training and Assessment (CBTA) / Evidence-Based Training (EBT)

CBTA is a training methodology sustained by robust course design, instructor qualification and data collection to continuously enhance training efficiency and effectiveness.
CBTA is applicable to all spectrum of pilot training from pilot aptitude testing, pilot initial licensing training, Instructor/Evaluator training and operator training.

Why?

As experience with CBTA grows, the aviation industry realizes that CBTA is a better way to develop a competent workforce than the traditional task- or hours-based training and checking.

IATA's Role?

IATA led the development of EBT, the first CBTA recurrent training program for flight crew, and has supported its implementation across the world since its endorsement by ICAO

EBT is characterized by the development and assessment of the overall capability of a pilot across a range of competencies, rather than by measuring the performance in individual events or maneuvers.

A team of IATA CBTA/EBT experts can assist airlines, ATOs and CAAs with all aspects of CBTA and EBT implementation programs.

IATA Consulting can assist you with every aspect of CBTA/EBT implementation

Pre-Implementation

- Delivery of awareness workshops to top management and operational staff.
- Assessment of your organization's (AOC-ATO) needs.
- Proposal for options and associated implementation plan.
- Buy-in from your CAA.

Competencies for Pilots and Instructors

- Support the definition and implementation of your pilot and instructor competency grading system.
- Train and assess your CBTA instructor core group in accordance to your competency performance standards.

Program Design

- Support program design, e.g., IATA has designed a CBTA evaluator (Train the Trainer) course for a major international training organization

Program monitoring

- Propose technical solutions for training data collection and analysis.
- Adjustment and continuous improvement of the training program (based on training system feedback).

IATA CBTA Library

- This library of documents consolidates the best practices for the implementation of effective and efficient CBTA programs for flight crew training, e.g., the Instructor/ Evaluator Training Guide, which includes the IATA competency model for instructor and evaluator.

IATA CBTA Library
Please click here for more information.

IATA CBTA/EBT Consulting
Please contact us at EBT@IATA.org for more information.

IATA Consulting

2017-2021 Aircraft Accidents – Accident Count

Number of accidents: 221

Number of fatalities: 1,035

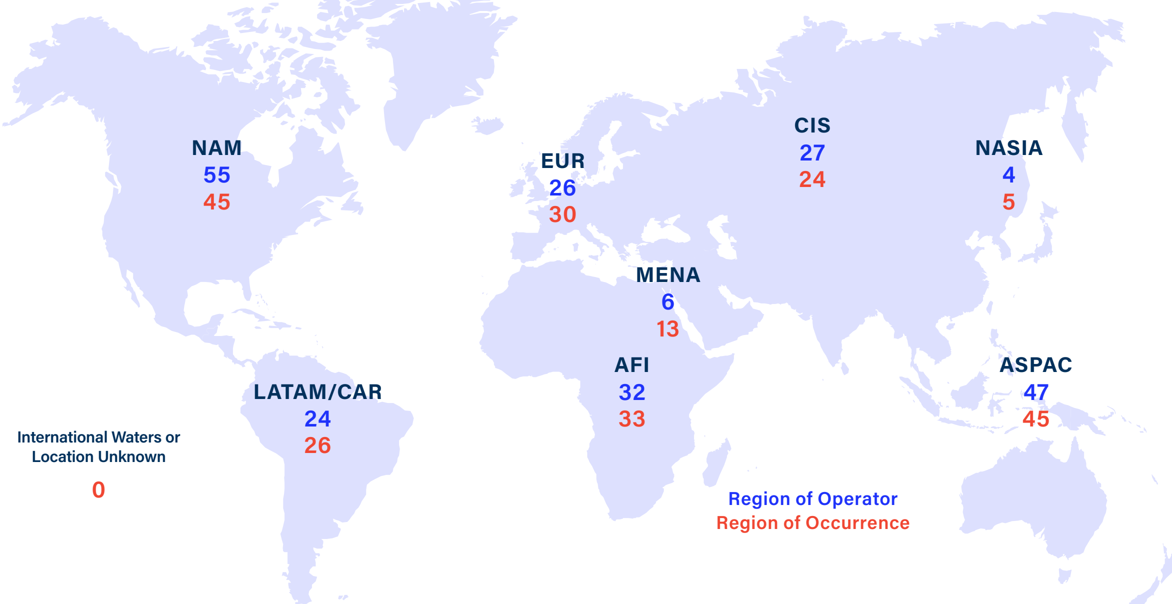
Accident Count % of Total	2017-2021
IATA Member	36%
Full-Loss Equivalents	11%
Fatal	17%
Hull Losses	24%

Passenger	Cargo	Ferry	Jet	Turboprop
78%	22%	0%	64%	36%

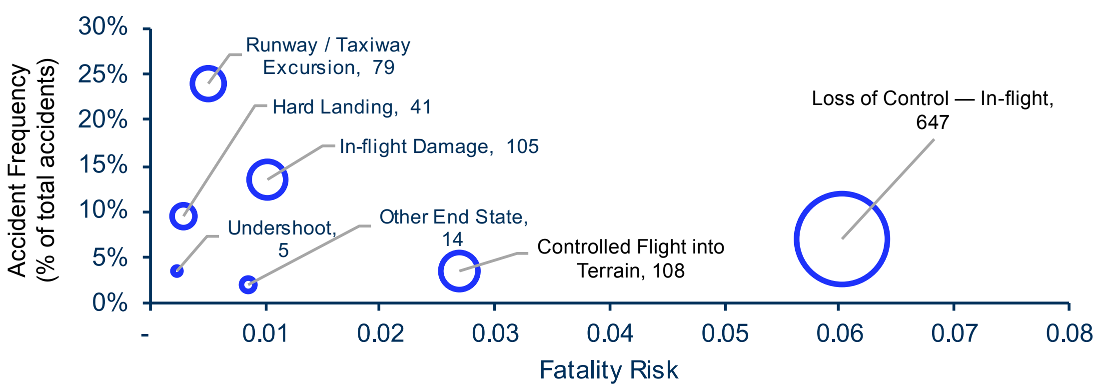
Note: the sum may not add to 100% due to rounding.

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

2017-2021 Aircraft Accidents – Accident Rate*

Accident rate: 1.21

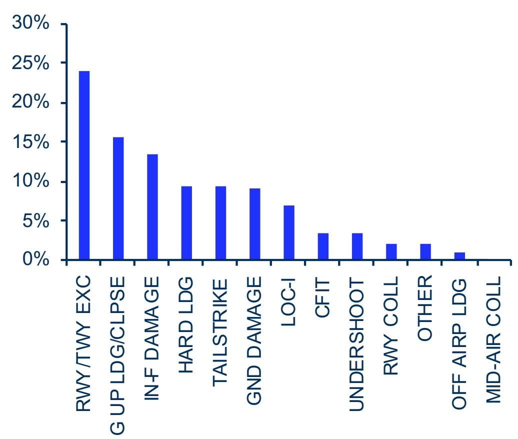
Average Accident Rate*	2017-2021
IATA Member	0.74
Fatality Risk**	0.14
Fatal	0.20
Hull Losses	0.28

Jet	Turboprop	
0.91	2.93	Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
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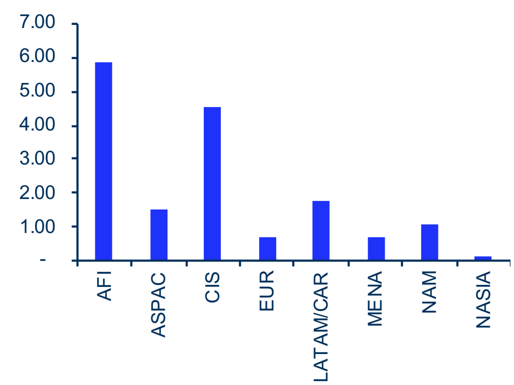
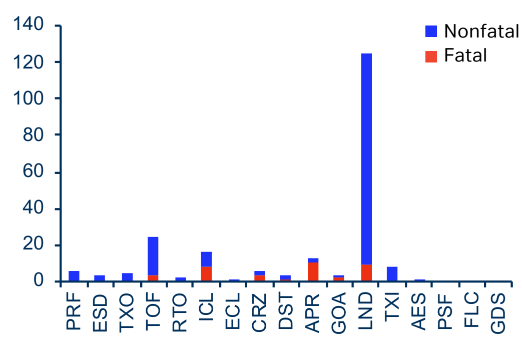
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

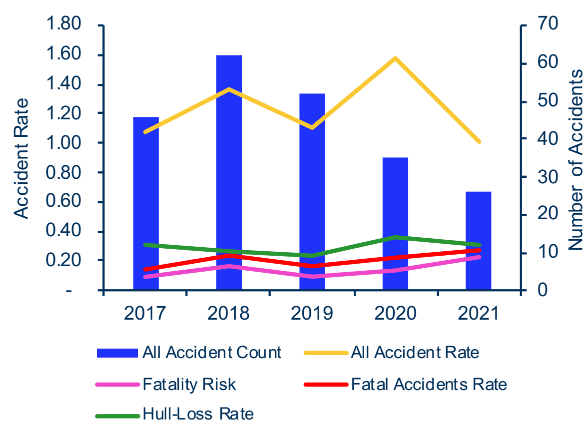
Total number of accidents (fatal vs. nonfatal)



Refer to list of [Phase of Flight definitions] for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



2017-2021 Aircraft Accidents – Contributing Factors

2017-2021 Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	34%
Safety Management	33%
Flight Operations	24%
Flight Ops: Training Systems	16%
Selection Systems	14%
Maintenance Operations	14%
Flight Ops: SOPs & Checking	13%
Management Decisions, including Regulatory Decisions and Cost Cutting	12%
Maintenance Ops: SOPs & Checking	10%
Design	5%
Ground Operations	5%
Ground Ops: SOPs & Checking	5%
Dispatch	4%
Technology & Equipment	3%
Change Management	2%
Ground Ops: Training Systems	2%
Ops Planning & Scheduling	2%
Dispatch Ops: SOPs & Checking	2%
Flight Watch/Following/Support	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	37%
SOP Adherence/SOP Cross-verification	31%
Failure to GOA after Destabilization on Approach	14%
Callouts	11%
Pilot-to-Pilot Communication	10%
Failure to GOA after Abnormal Runway Contact	9%
Crew to External Communication	4%
Normal Checklist	3%
Documentation	3%
ATC	3%
Wrong Weight & Balance/Fuel Information	3%
Briefings	3%
Abnormal Checklist	2%
Ground Navigation	2%
Automation	2%
Systems/Radios/Instruments	2%
Maintenance	1%

2017-2021 Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	35%
Aircraft Malfunction	24%
Wind/Windshear/Gusty Wind	21%
Airport Facilities	19%
Poor Visibility/IMC	15%
Thunderstorms	14%
Maintenance Events	13%
Gear/Tire	13%
Contaminated Runway/Taxiway - Poor Braking Action	9%
Operational Pressure	7%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	6%
Wildlife/Birds/Foreign Object	5%
Ground Events	5%
Nav Aids	5%
Contained Engine Failure/Powerplant Malfunction	5%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	5%
Ground-based Nav Aid Malfunction or not Available	5%
Lack of Visual Reference	5%
Optical Illusion/Visual Misperception	4%
Air Traffic Services	4%
Fatigue	4%
Icing Conditions	4%
Hydraulic System Failure	3%
Traffic	3%
Dispatch/Paperwork	3%
Terrain/Obstacles	3%
MEL Item	2%
Brakes	2%
Foreign Objects, FOD	2%
Airport Perimeter Control/Fencing/Wildlife Control	2%
Extensive/Uncontained Engine Failure	2%
Fire/Smoke (Cockpit/Cabin/Cargo)	1%
Flight Controls	1%
Spatial Disorientation/Somatogravic Illusion	1%
Electrical Power Generation Failure	1%
Crew Incapacitation	1%

2017-2021 Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	22%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	21%
Unstable Approach	17%
Abrupt Aircraft Control	16%
Continued Landing after Unstable Approach	15%
Unnecessary Weather Penetration	14%
Operation Outside Aircraft Limitations	11%
Brakes/Thrust Reversers/Ground Spoilers	6%
Controlled Flight Towards Terrain	5%
Loss of Aircraft Control While on the Ground	4%
Flight Controls/Automation	3%
Engine	2%
Landing Gear	2%
Weight & Balance	2%
Systems	1%
Ramp Movements, Including When Under Marshalling	1%
Rejected Takeoff after V_1	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	28%
Monitor/Cross-check	19%
In-flight Decision-making/Contingency Management	16%
Leadership	16%
Captain Should Show Leadership	14%
Taxiway/Runway Management	8%
FO Is Assertive When Necessary	6%
Workload Management	6%
Communication Environment	5%
Automation Management	5%
Reactive – Contingency Management	4%
Proactive – In-flight Decision-making	4%
Evaluation of Plans	3%
Inquiry	1%
SOP Briefing/Planning	1%
Plans Stated	1%

Refer to the list of Accident Classification Taxonomy.

> A continuous, systematic review of **Safety Risks** is essential during a period of change to effectively manage aviation hazards and risks through effective mitigations and safety improvement programs to meet the industry's needs.

IATA Safety

2017-2021 Fatal Aircraft Accidents – Accident Count

Number of accidents: 37
Number of fatalities: 1,035

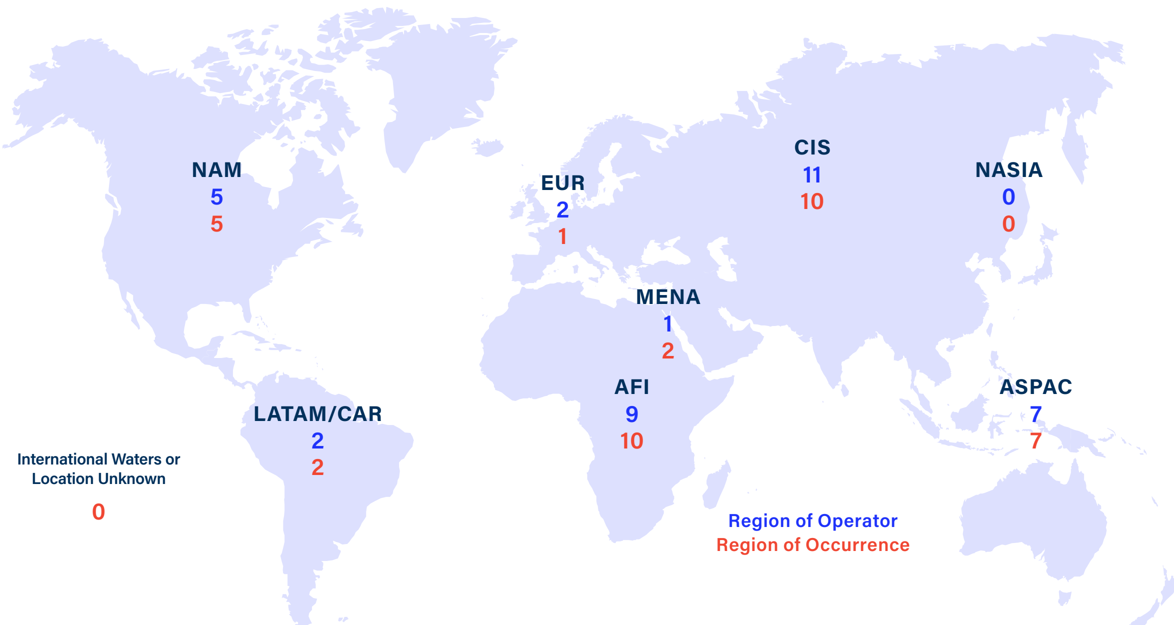
Accident Count % of Total	2017-2021
IATA Member	19%
Full-Loss Equivalents	67%
Fatal	100%
Hull Losses	89%

Passenger	Cargo	Ferry	Jet	Turboprop
68%	32%	0%	41%	59%

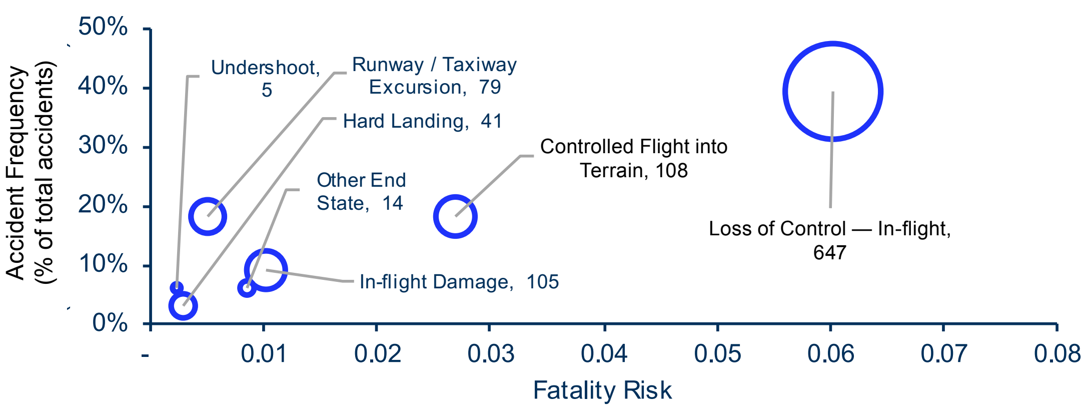
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

2017-2021 Fatal Aircraft Accidents – Accident Rate*

Accident rate: 0.20

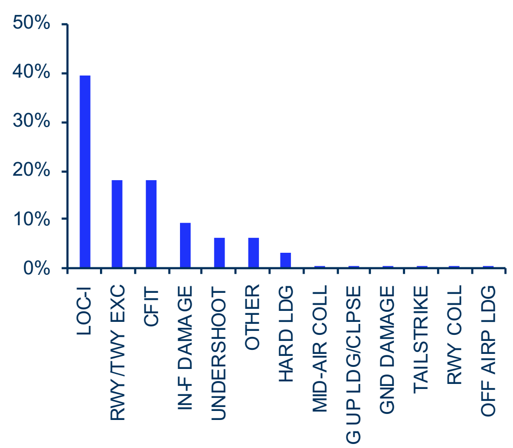
Average Accident Rate*	2017-2021
IATA Member	**0.07**
Fatality Risk**	**0.14**
Fatal	**0.20**
Hull Losses	**0.18**

Jet	Turboprop	
0.10	**0.81**	Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

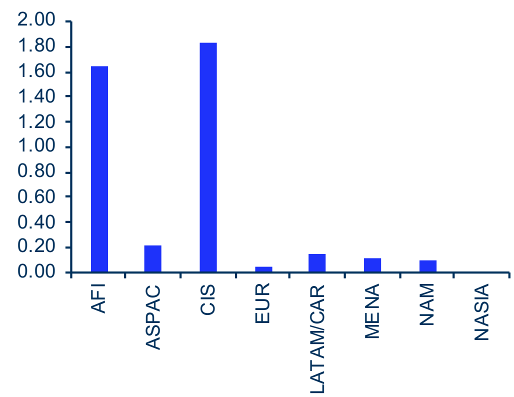
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

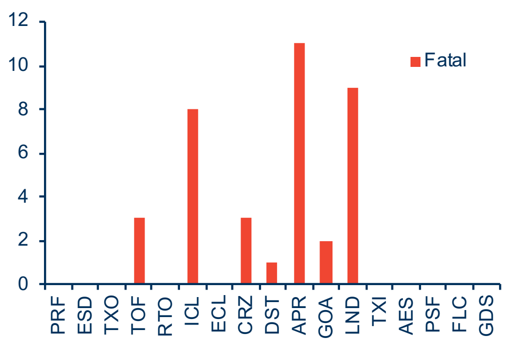
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

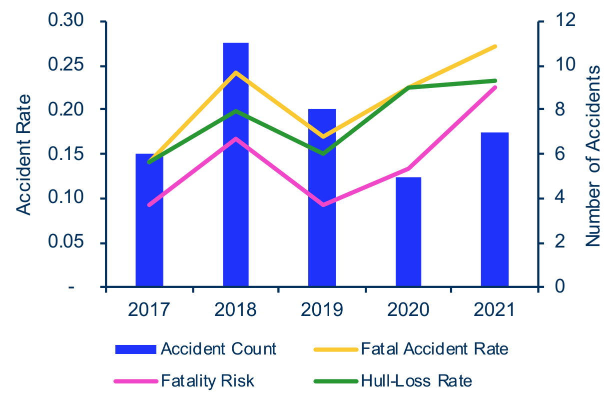
Total number of accidents (fatal)



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



2017-2021 Fatal Aircraft Accidents – Contributing Factors

2017-2021 Fatal Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	62%
Safety Management	62%
Management Decisions, including Regulatory Decisions and Cost Cutting	41%
Flight Operations	41%
Selection Systems	35%
Flight Ops: Training Systems	32%
Flight Ops: SOPs & Checking	27%
Dispatch	14%
Ground Operations	11%
Ground Ops: SOPs & Checking	11%
Maintenance Operations	11%
Design	8%
Change Management	8%
Maintenance Ops: SOPs & Checking	8%
Dispatch Ops: SOPs & Checking	8%
Flight Watch/Following/Support	8%
Technology & Equipment	5%
Ops Planning & Scheduling	3%
Ground Ops: Training Systems	3%
Maintenance Ops: Training Systems	3%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	46%
Manual Handling/Flight Controls	43%
Failure to GOA after Destabilization on Approach	24%
Pilot-to-Pilot Communication	22%
Callouts	19%
Documentation	11%
Wrong Weight & Balance/Fuel Information	11%
Crew to External Communication	11%
Briefings	8%
ATC	8%
Normal Checklist	5%
Abnormal Checklist	5%
Systems/Radios/Instruments	3%
Failure to GOA after Abnormal Runway Contact	3%
Maintenance	3%

2017-2021 Fatal Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	51%
Poor Visibility/IMC	32%
Operational Pressure	27%
Aircraft Malfunction	22%
Thunderstorms	16%
Wind/Windshear/Gusty Wind	16%
Maintenance Events	14%
Icing Conditions	11%
Lack of Visual Reference	11%
Air Traffic Services	11%
Nav Aids	11%
Ground-based Nav Aid Malfunction or not Available	11%
Terrain/Obstacles	11%
Contained Engine Failure/Powerplant Malfunction	11%
Dispatch/Paperwork	11%
Fatigue	11%
Airport Facilities	8%
Ground Events	8%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	8%
Spatial Disorientation/Somatogravic Illusion	5%
Crew Incapacitation	5%
Wildlife/Birds/Foreign Object	3%
Extensive/Uncontained Engine Failure	3%
Avionics/Flight Instruments	3%
Hydraulic System Failure	3%
MEL Item	3%
Manuals/Charts/Checklists	3%
Optical Illusion/Visual Misperception	3%

2017-2021 Fatal Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	41%
Operation Outside Aircraft Limitations	32%
Unnecessary Weather Penetration	27%
Unstable Approach	24%
Continued Landing after Unstable Approach	24%
Abrupt Aircraft Control	22%
Controlled Flight Towards Terrain	22%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	11%
Brakes/Thrust Reversers/Ground Spoilers	11%
Flight Controls/Automation	11%
Engine	5%
Weight & Balance	5%
Unauthorized Airspace Penetration	3%
Loss of Aircraft Control While on the Ground	3%
Systems	3%
Landing Gear	3%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	43%
In-flight Decision-making/Contingency Management	38%
Leadership	35%
Monitor / Cross-check	35%
Captain Should Show Leadership	32%
FO Is Assertive When Necessary	19%
Communication Environment	16%
Automation Management	14%
Reactive – Contingency Management	11%
Workload Management	11%
Taxiway / Runway Management	11%
Evaluation of Plans	8%
Proactive – In-flight Decision-making	5%
SOP Briefing/Planning	5%
Plans Stated	5%
Inquiry	3%

Refer to the list of Accident Classification Taxonomy.

2017-2021 Nonfatal Aircraft Accidents – Accident Count

Number of accidents: 184
Number of fatalities: 0

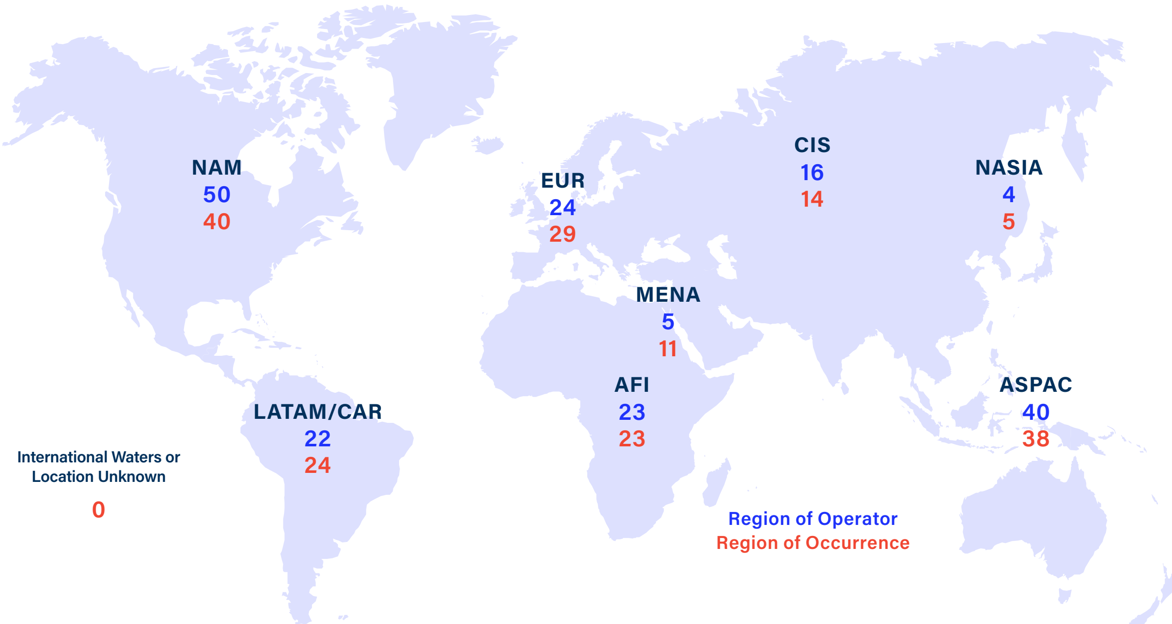
Accident Count % of Total	2017-2021
IATA Member	39%
Full-Loss Equivalents	0%
Fatal	0%
Hull Losses	10%

Passenger	Cargo	Ferry	Jet	Turboprop
80%	20%	0%	69%	31%

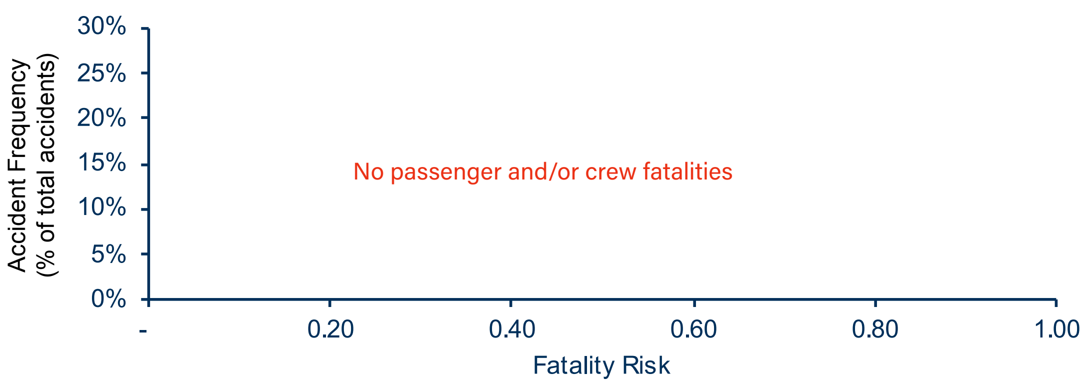
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

2017-2021 Nonfatal Aircraft Accidents – Accident Rate*

Accident rate: 1.01

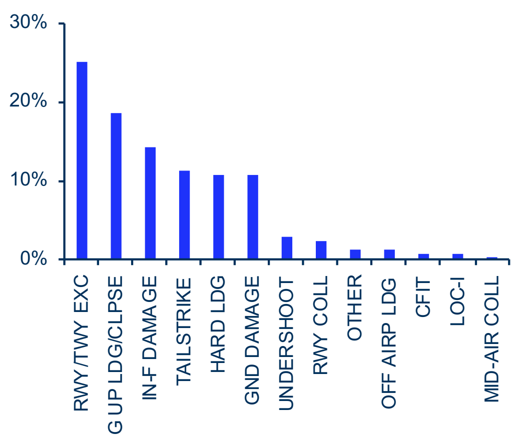
Accident Rate*	2017-2021
IATA Member	0.68
Fatality Risk**	–
Fatal	–
Hull Losses	0.10

Jet	Turboprop	
0.82	2.11	Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

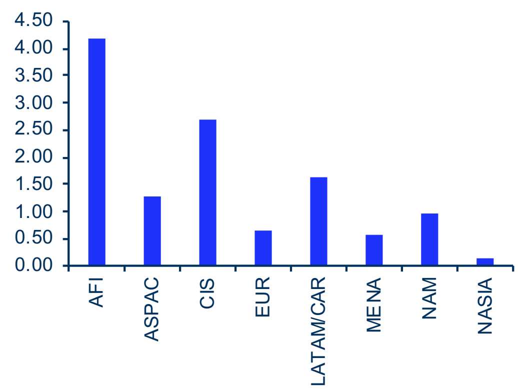
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section *for full names.*

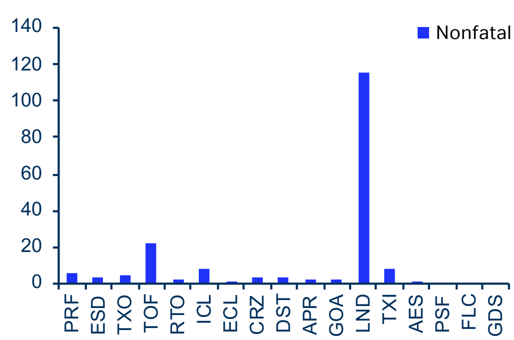
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

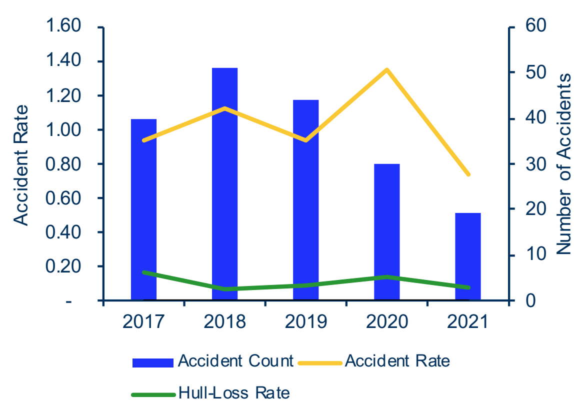
Total number of accidents (nonfatal)



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



2017-2021 Nonfatal Aircraft Accidents – Contributing Factors

2017-2021 Nonfatal Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	29%
Safety Management	28%
Flight Operations	20%
Maintenance Operations	14%
Flight Ops: Training Systems	13%
Maintenance Ops: SOPs & Checking	11%
Flight Ops: SOPs & Checking	10%
Selection Systems	10%
Management Decisions, including Regulatory Decisions and Cost Cutting	7%
Design	5%
Ground Operations	3%
Ground Ops: SOPs & Checking	3%
Technology & Equipment	3%
Dispatch	2%
Ground Ops: Training Systems	2%
Ops Planning & Scheduling	2%
Change Management	1%
Cabin Operations	1%
Dispatch Ops: SOPs & Checking	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	36%
SOP Adherence/SOP Cross-verification	28%
Failure to GOA after Destabilization on Approach	13%
Failure to GOA after Abnormal Runway Contact	10%
Callouts	10%
Pilot-to-Pilot Communication	8%
Normal Checklist	3%
Ground Navigation	3%
Automation	3%
Crew to External Communication	2%
Abnormal Checklist	2%
ATC	2%
Documentation	2%
Systems/Radios/Instruments	2%
Briefings	2%
Wrong Weight & Balance/Fuel Information	1%
Maintenance	1%
Wrong Altimeter Reference Settings (QNH, QFE)	1%
Incorrect or Missing Log Book Entries	1%

2017-2021 Nonfatal Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	32%
Aircraft Malfunction	25%
Wind/Windshear/Gusty Wind	22%
Airport Facilities	21%
Gear/Tire	15%
Thunderstorms	14%
Maintenance Events	13%
Poor Visibility/IMC	11%
Contaminated Runway/Taxiway - Poor Braking Action	11%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	6%
Wildlife/Birds/Foreign Object	6%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	6%
Ground Events	5%
Optical Illusion/Visual Misperception	4%
Nav Aids	4%
Contained Engine Failure/Powerplant Malfunction	4%
Traffic	4%
Lack of Visual Reference	3%
Hydraulic System Failure	3%
Operational Pressure	3%
Ground-based Nav Aid Malfunction or not Available	3%
Airport Perimeter Control/Fencing/Wildlife Control	2%
Air Traffic Services	2%
Icing Conditions	2%
Brakes	2%
Fatigue	2%
Foreign Objects, FOD	2%
MEL Item	2%
Fire/Smoke (Cockpit/Cabin/Cargo)	2%
Dispatch/Paperwork	2%
Extensive/Uncontained Engine Failure	2%
Flight Controls	1%
Terrain/Obstacles	1%
Electrical Power Generation Failure	1%
Structural Failure	1%
Secondary Flight Controls	1%
Dangerous Goods	1%
Primary Flight Controls	1%

2017-2021 Nonfatal Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	23%
Vertical/Lateral/Speed Deviation	18%
Unstable Approach	15%
Abrupt Aircraft Control	15%
Continued Landing after Unstable Approach	13%
Unnecessary Weather Penetration	12%
Operation Outside Aircraft Limitations	7%
Brakes/Thrust Reversers/Ground Spoilers	5%
Loss of Aircraft Control While on the Ground	4%
Landing Gear	2%
Engine	2%
Ramp Movements, Including When Under Marshalling	2%
Flight Controls/Automation	2%
Rejected Takeoff after V_1	1%
Controlled Flight Towards Terrain	1%
Weight & Balance	1%
Systems	1%
Runway/Taxiway Incursion	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	24%
Monitor/Cross-check	16%
In-flight Decision-making/Contingency Management	12%
Leadership	12%
Captain Should Show Leadership	10%
Taxiway/Runway Management	7%
Workload Management	5%
Proactive – In-flight Decision-making	4%
Communication Environment	3%
FO Is Assertive When Necessary	3%
Automation Management	3%
Reactive – Contingency Management	3%
Evaluation of Plans	2%
Inquiry	1%

Refer to the list of Accident Classification Taxonomy.

2017-2021 IOSA Aircraft Accidents – Accident Count

Number of accidents: 105
Number of fatalities: 582

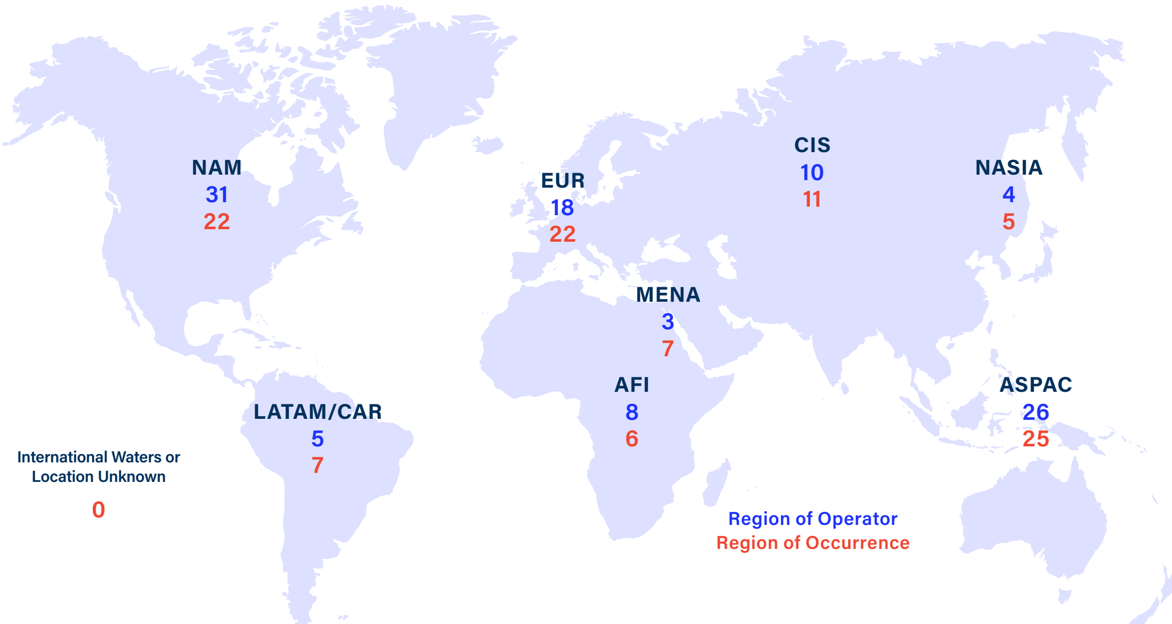
Accident Count % of Total	2017-2021
IATA Member	75%
Full-Loss Equivalents	6%
Fatal	10%
Hull Losses	13%

Passenger	Cargo	Ferry	Jet	Turboprop
91%	9%	0%	84%	16%

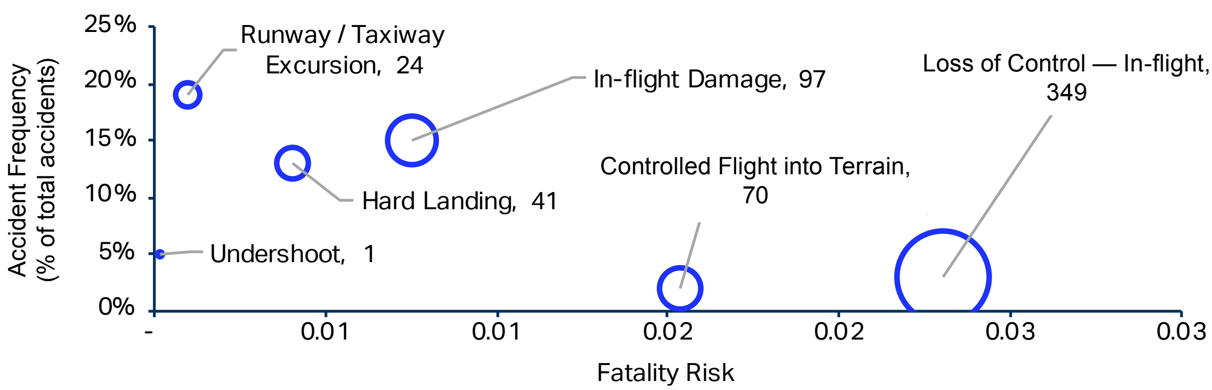
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

2017-2021 IOSA Aircraft Accidents – Accident Rate*

Accident rate: 0.81

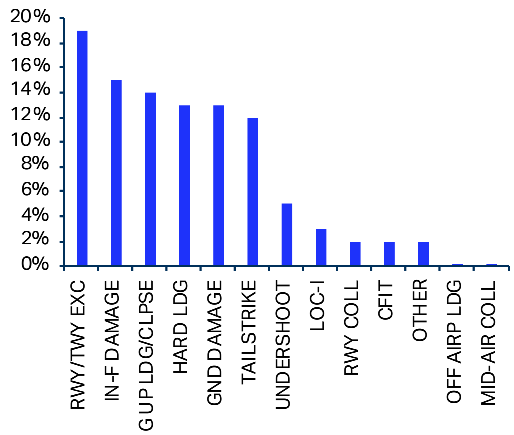
Accident Rate*	2017-2021
IATA Member	0.75
Fatality Risk**	0.05
Fatal	0.08
Hull Losses	0.11

Jet	Turboprop	
0.73	1.68	Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

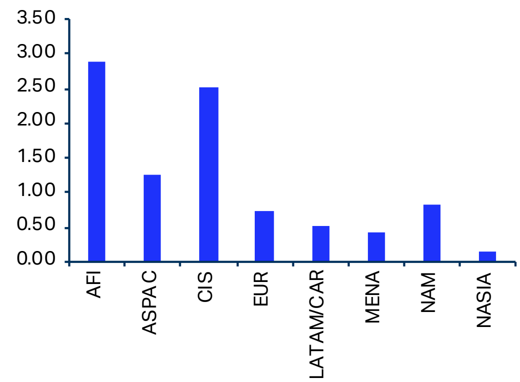
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

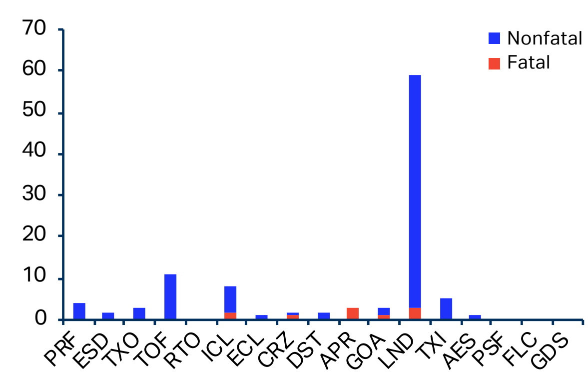
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

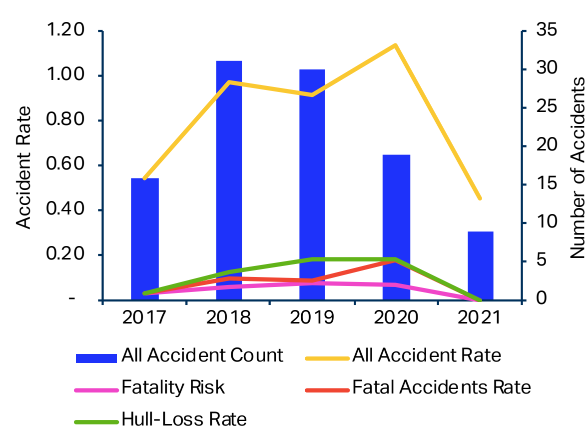
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



2017-2021 IOSA Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	30%
Flight Operations	26%
Safety Management	26%
Flight Ops: Training Systems	19%
Flight Ops: SOPs & Checking	17%
Maintenance Operations	13%
Selection Systems	12%
Maintenance Ops: SOPs & Checking	11%
Management Decisions, including Regulatory Decisions and Cost Cutting	7%
Design	6%
Change Management	3%
Ground Ops: SOPs & Checking	3%
Ground Operations	3%
Technology & Equipment	3%
Flight Watch/Following/Support	1%
Maintenance Ops: Training Systems	1%
Cabin Operations	1%
Ground Ops: Training Systems	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	48%
SOP Adherence/SOP Cross-verification	37%
Failure to GOA after Destabilization on Approach	20%
Pilot-to-Pilot Communication	15%
Callouts	13%
Failure to GOA after Abnormal Runway Contact	12%
Ground Navigation	4%
Normal Checklist	4%
Automation	4%
Crew to External Communication	4%
Abnormal Checklist	3%
ATC	3%
Briefings	3%
Systems/Radios/Instruments	3%
Documentation	2%
Maintenance	1%
Wrong Altimeter Reference Settings (QNH, QFE)	1%
Wrong Weight & Balance/Fuel Information	1%
Incorrect or Missing Log Book Entries	1%

2017-2021 IOSA Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	38%
Wind/Windshear/Gusty Wind	27%
Aircraft Malfunction	22%
Thunderstorms	18%
Airport Facilities	18%
Poor Visibility/IMC	17%
Gear/Tire	13%
Maintenance Events	11%
Contaminated Runway/Taxiway - Poor Braking Action	10%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	7%
Traffic	6%
Ground Events	6%
Optical Illusion/Visual Misperception	6%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	5%
Operational Pressure	5%
Fatigue	5%
Lack of Visual Reference	5%
Wildlife/Birds/Foreign Object	5%
Air Traffic Services	4%
Contained Engine Failure/Powerplant Malfunction	3%
Ground-based Nav Aid Malfunction or not Available	3%
Hydraulic System Failure	3%
Fire/Smoke (Cockpit/Cabin/Cargo)	3%
Nav Aids	3%
Extensive/Uncontained Engine Failure	2%
Dispatch/Paperwork	2%
Terrain/Obstacles	2%
Icing Conditions	2%
Foreign Objects, FOD	2%
Dangerous Goods	1%
Avionics/Flight Instruments	1%
Airport Perimeter Control/Fencing/Wildlife Control	1%
Spatial Disorientation/Somatogravic Illusion	1%
MEL Item	1%
Manuals/Charts/Checklists	1%
Electrical Power Generation Failure	1%
Crew Incapacitation	1%

2017-2021 IOSA Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	32%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	29%
Unstable Approach	22%
Continued Landing after Unstable Approach	21%
Abrupt Aircraft Control	21%
Unnecessary Weather Penetration	17%
Operation Outside Aircraft Limitations	10%
Brakes/Thrust Reversers/Ground Spoilers	9%
Flight Controls/Automation	6%
Controlled Flight Towards Terrain	5%
Ramp Movements, Including When Under Marshalling	3%
Engine	3%
Weight & Balance	1%
Loss of Aircraft Control While on the Ground	1%
Landing Gear	1%
Systems	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	35%
Leadership	23%
Monitor/Cross-check	21%
Captain Should Show Leadership	19%
In-flight Decision-making/Contingency Management	18%
FO Is Assertive When Necessary	9%
Workload Management	9%
Communication Environment	9%
Automation Management	8%
Proactive – In-flight Decision-making	7%
Taxiway/Runway Management	7%
Reactive – Contingency Management	5%
Evaluation of Plans	3%
Plans Stated	2%
SOP Briefing/Planning	1%
Inquiry	1%

Refer to the list of Accident Classification Taxonomy.

Safety Connect
supports the delivery of a connected IATA community where IATA safety improvement programs actively support IATA members, and the wider industry, to continually reduce the likelihood of aviation incidents and accidents.

IATA Safety

2017-2021 Non-IOSA Aircraft Accidents – Accident Count

Number of accidents: 116
Number of fatalities: 453

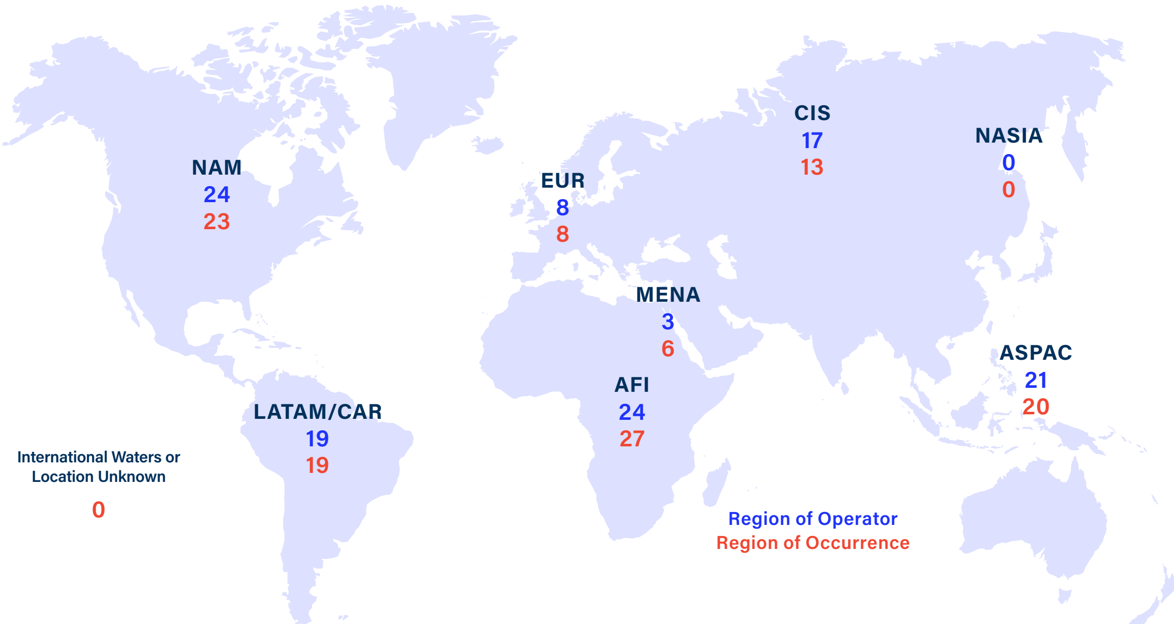
Accident Count % of Total	2017-2021
IATA Member	0%
Full-Loss Equivalents	16%
Fatal	23%
Hull Losses	33%

Passenger	Cargo	Ferry	Jet	Turboprop
66%	34%	0%	47%	53%

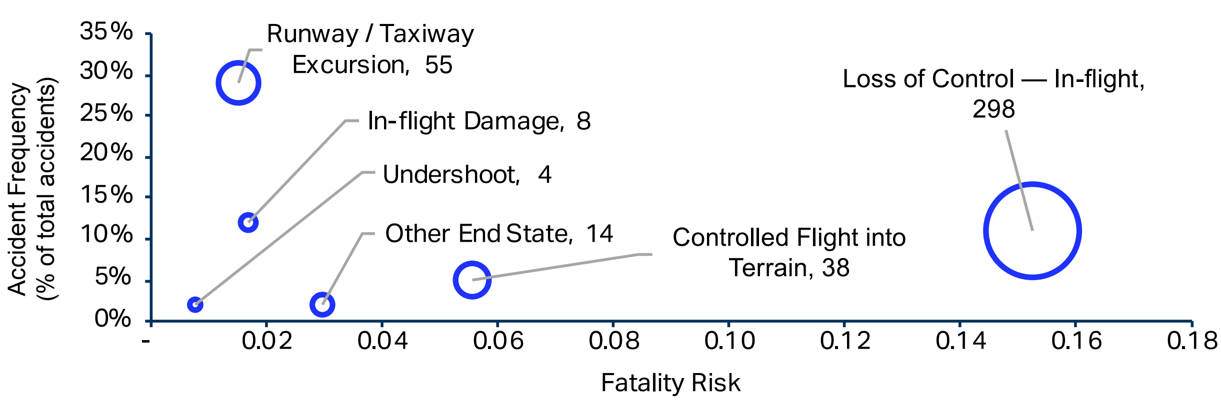
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

2017-2021 Non-IOSA Aircraft Accidents – Accident Rate*

Accident rate: 2.21

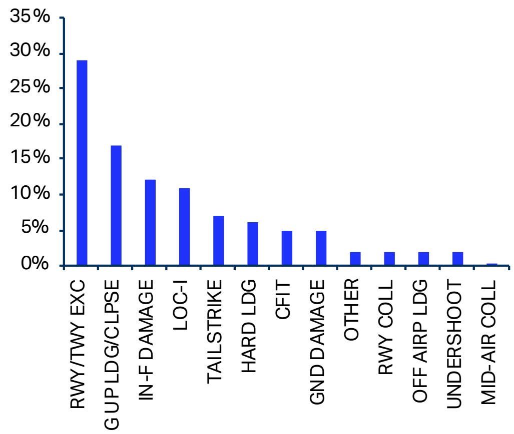
Accident Rate*	2017-2021
IATA Member	–
Fatality Risk**	0.34
Fatal	0.51
Hull Losses	0.72

Jet	Turboprop	
1.52	3.67	Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

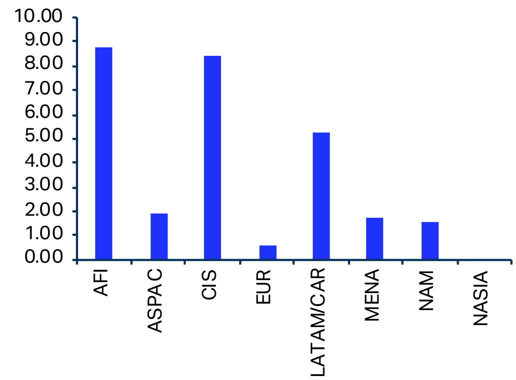
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

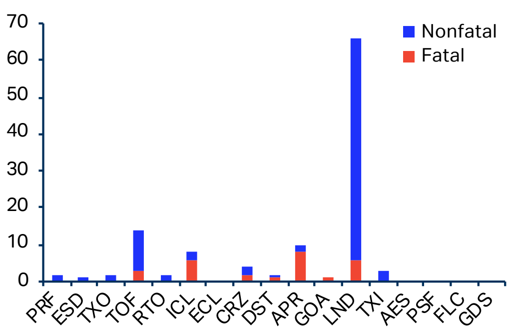
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

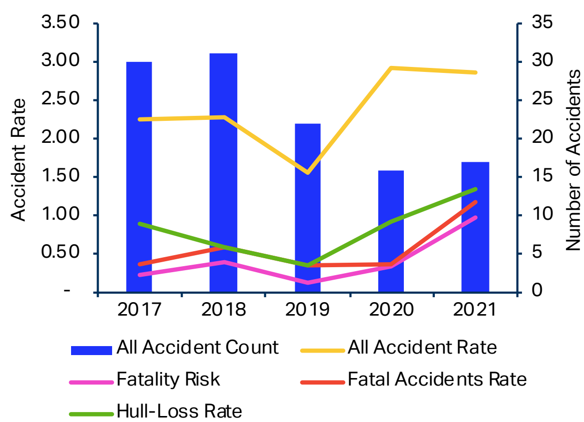
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



2017-2021 Non-IOSA Aircraft Accidents – Contributing Factors

2017-2021 Non-IOSA Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Safety Management	41%
Regulatory Oversight	39%
Flight Operations	22%
Management Decisions, including Regulatory Decisions and Cost Cutting	17%
Selection Systems	16%
Maintenance Operations	14%
Flight Ops: Training Systems	13%
Flight Ops: SOPs & Checking	9%
Maintenance Ops: SOPs & Checking	9%
Dispatch	7%
Ground Operations	6%
Ground Ops: SOPs & Checking	6%
Design	5%
Ops Planning & Scheduling	3%
Technology & Equipment	3%
Dispatch Ops: SOPs & Checking	3%
Ground Ops: Training Systems	3%
Change Management	2%
Flight Watch/Following/Support	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	28%
SOP Adherence/SOP Cross-verification	25%
Callouts	9%
Failure to GOA after Destabilization on Approach	9%
Failure to GOA after Abnormal Runway Contact	6%
Pilot-to-Pilot Communication	5%
Wrong Weight & Balance/Fuel Information	4%
Documentation	4%
Crew to External Communication	3%
Briefings	3%
ATC	3%
Normal Checklist	3%
Abnormal Checklist	2%
Maintenance	1%
Ground Navigation	1%
Automation	1%
Systems/Radios/Instruments	1%

2017-2021 Non-IOSA Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	32%
Aircraft Malfunction	27%
Airport Facilities	19%
Wind/Windshear/Gusty Wind	16%
Maintenance Events	15%
Poor Visibility/IMC	13%
Gear/Tire	12%
Thunderstorms	11%
Operational Pressure	9%
Contaminated Runway/Taxiway - Poor Braking Action	9%
Contained Engine Failure/Powerplant Malfunction	7%
Nav Aids	7%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	6%
Ground-based Nav Aid Malfunction or not Available	6%
Wildlife/Birds/Foreign Object	6%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	5%
Ground Events	5%
Icing Conditions	5%
Dispatch/Paperwork	4%
Lack of Visual Reference	4%
Brakes	3%
Terrain/Obstacles	3%
Air Traffic Services	3%
Hydraulic System Failure	3%
MEL Item	3%
Fatigue	3%
Optical Illusion/Visual Misperception	3%
Airport Perimeter Control/Fencing/Wildlife Control	3%
Foreign Objects, FOD	2%
Flight Controls	2%
Extensive/Uncontained Engine Failure	2%
Electrical Power Generation Failure	1%
Spatial Disorientation/Somatogravic Illusion	1%
Secondary Flight Controls	1%
Crew Incapacitation	1%
Structural Failure	1%
Traffic	1%
Primary Flight Controls	1%

2017-2021 Non-IOSA Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	15%
Operation Outside Aircraft Limitations	13%
Unstable Approach	12%
Unnecessary Weather Penetration	12%
Vertical/Lateral/Speed Deviation	12%
Abrupt Aircraft Control	11%
Continued Landing after Unstable Approach	9%
Loss of Aircraft Control While on the Ground	6%
Controlled Flight Towards Terrain	4%
Brakes/Thrust Reversers/Ground Spoilers	3%
Weight & Balance	3%
Landing Gear	3%
Systems	2%
Rejected Takeoff after V_1	2%
Engine	2%
Runway/Taxiway Incursion	1%
Unauthorized Airspace Penetration	1%
Flight Controls/Automation	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	21%
Monitor/Cross-check	18%
In-flight Decision-making/Contingency Management	15%
Captain Should Show Leadership	9%
Leadership	9%
Taxiway/Runway Management	9%
Reactive – Contingency Management	3%
Workload Management	3%
FO Is Assertive When Necessary	3%
Automation Management	3%
Communication Environment	3%
Evaluation of Plans	3%
Proactive – In-flight Decision-making	2%
Inquiry	1%
SOP Briefing/Planning	1%

Refer to the list of Accident Classification Taxonomy.

A Big Step Forward for Operators with Small Aircraft

Safety

- Globally recognized safety standards unique for the commercial aviation industry
- Enables implementation of Safety Management System (SMS)

Operations

- Measures operator's conformity with relevant ICAO requirements (Annex 6 and others)
- Streamlines training standards and enables improvements
- Reduction of redundant audits and associated costs

Commercial

- Code sharing and other types of commercial agreements
- Reduction in insurance premiums
- Improved marketability

For more information, visit us at
iata.org/ISSA or contact **issa@iata.org**

IATA ISSA

Loss of Control — In-flight – Accident Count

2021	Number of accidents:	3	Number of fatalities:	75
2017-2021	Number of accidents:	14	Number of fatalities:	647

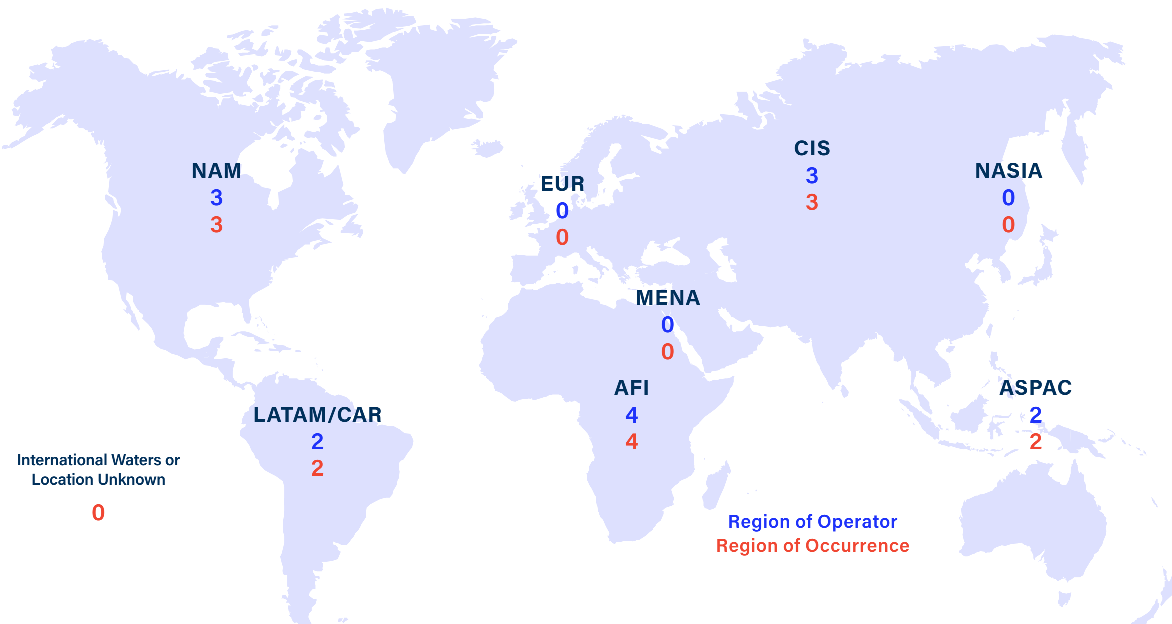
Accident Count % of Total	2021	'17-'21
IATA Member	0%	14%
Full-Loss Equivalents	100%	79%
Fatal	100%	93%
Hull Losses	100%	100%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	67%	33%	0%	33%	67%
2017-2021	79%	21%	0%	57%	43%

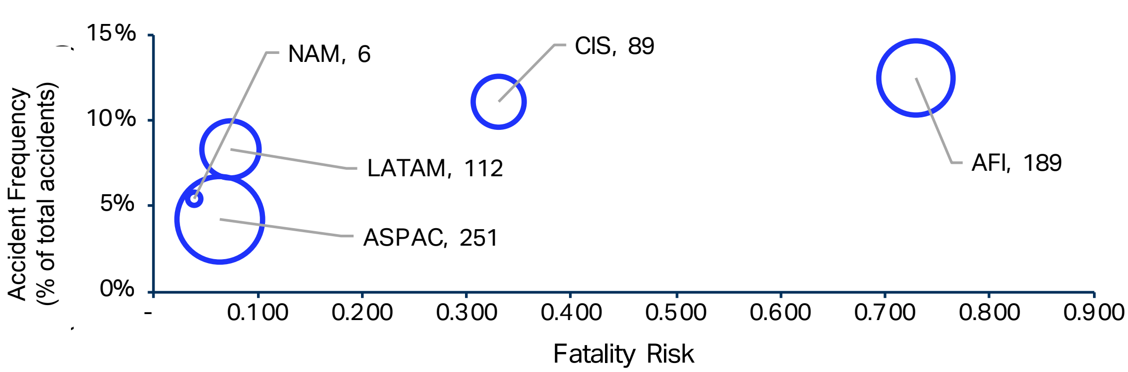
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Loss of Control — In-flight – Accident Rate*

2021 Accident rate: 0.12
2017-2021 Accident rate: 0.08

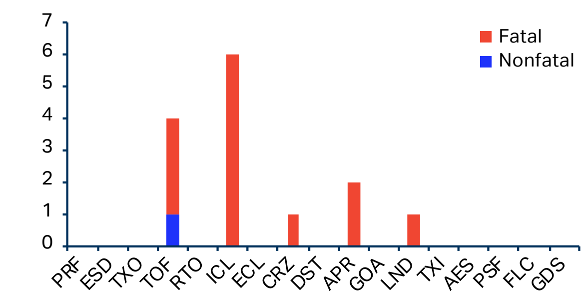
Accident Rate*	2021	'17-'21
IATA Member	–	0.02
Fatality Risk**	0.12	0.06
Fatal	0.12	0.07
Hull Losses	0.12	0.08

	Jet	Turboprop	
2021	0.04	0.71	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	0.05	0.22	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

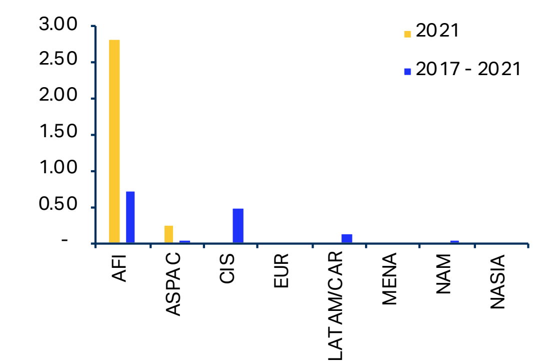
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

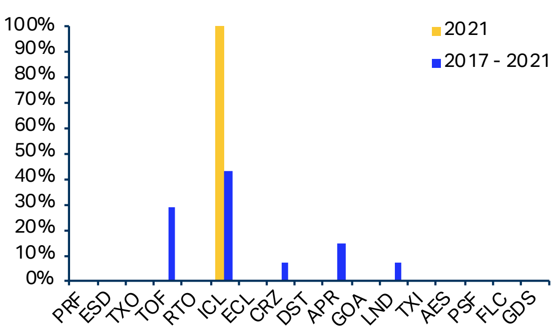
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

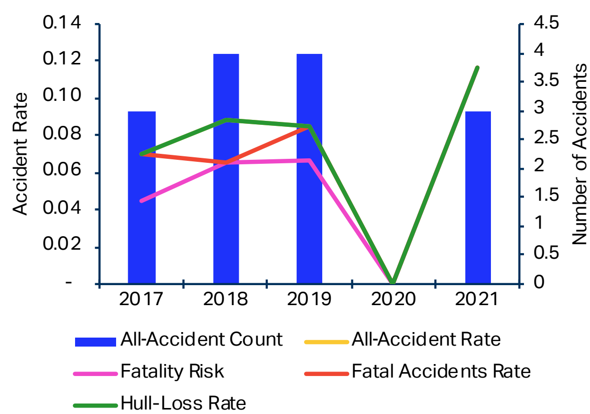
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



Note: The all-accident rate and hull loss rate share the same value.

Loss of Control — In-flight

LATENT CONDITIONS

	Percentage Contribution
Safety Management	86%
Regulatory Oversight	79%
Management Decisions, including Regulatory Decisions and Cost Cutting	64%
Selection Systems	57%
Flight Operations	57%
Flight Ops: Training Systems	50%
Flight Ops: SOPs & Checking	43%
Ground Ops: SOPs & Checking	29%
Ground Operations	29%
Dispatch	21%
Dispatch Ops: SOPs & Checking	14%
Maintenance Operations	14%
Change Management	14%
Design	14%
Ground Ops: Training Systems	7%
Maintenance Ops: Training Systems	7%
Maintenance Ops: SOPs & Checking	7%

THREATS

	Percentage Contribution
Meteorology	50%
Maintenance Events	29%
Icing Conditions	21%
Ground Events	21%
Aircraft Malfunction	21%
Dispatch/Paperwork	21%
Operational Pressure	21%
Spatial Disorientation/Somatogravic Illusion	14%
Poor Visibility/IMC	14%
Contained Engine Failure/Powerplant Malfunction	14%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	7%
Wildlife/Birds/Foreign Object	7%
Thunderstorms	7%
Fatigue	7%
Lack of Visual Reference	7%
MEL Item	7%
Manuals/Charts/Checklists	7%
Airport Facilities	7%
Wind/Windshear/Gusty Wind	7%
Avionics/Flight Instruments	7%

Loss of Control — In-flight

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	50%
SOP Adherence/SOP Cross-verification	50%
Pilot-to-Pilot Communication	21%
Documentation	21%
Wrong Weight & Balance/Fuel Information	21%
Abnormal Checklist	7%
Normal Checklist	7%
Systems/Radios/Instruments	7%
Callouts	7%
Crew to External Communication	7%
Failure to GOA after Destabilization on Approach	7%
Maintenance	7%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	43%
Operation Outside Aircraft Limitations	36%
Abrupt Aircraft Control	21%
Flight Controls/Automation	21%
Unnecessary Weather Penetration	14%
Weight & Balance	7%
Unstable Approach	7%
Continued Landing after Unstable Approach	7%
Systems	7%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	50%
Leadership	43%
Captain Should Show Leadership	36%
In-flight Decision-making/Contingency Management	36%
Monitor/Cross-check	36%
Workload Management	21%
Automation Management	21%
FO Is Assertive When Necessary	14%
Communication Environment	7%
Reactive – Contingency Management	7%
Evaluation of Plans	7%
SOP Briefing/Planning	7%
Proactive – In-flight Decision-making	7%
Taxiway/Runway Management	7%

Refer to the list of Accident Classification Taxonomy.

See overview of LOC-I and related ACTF recommendations

Controlled Flight into Terrain – Accident Count

2021	Number of accidents: 2	Number of fatalities: 32
2017-2021	Number of accidents: 7	Number of fatalities: 108

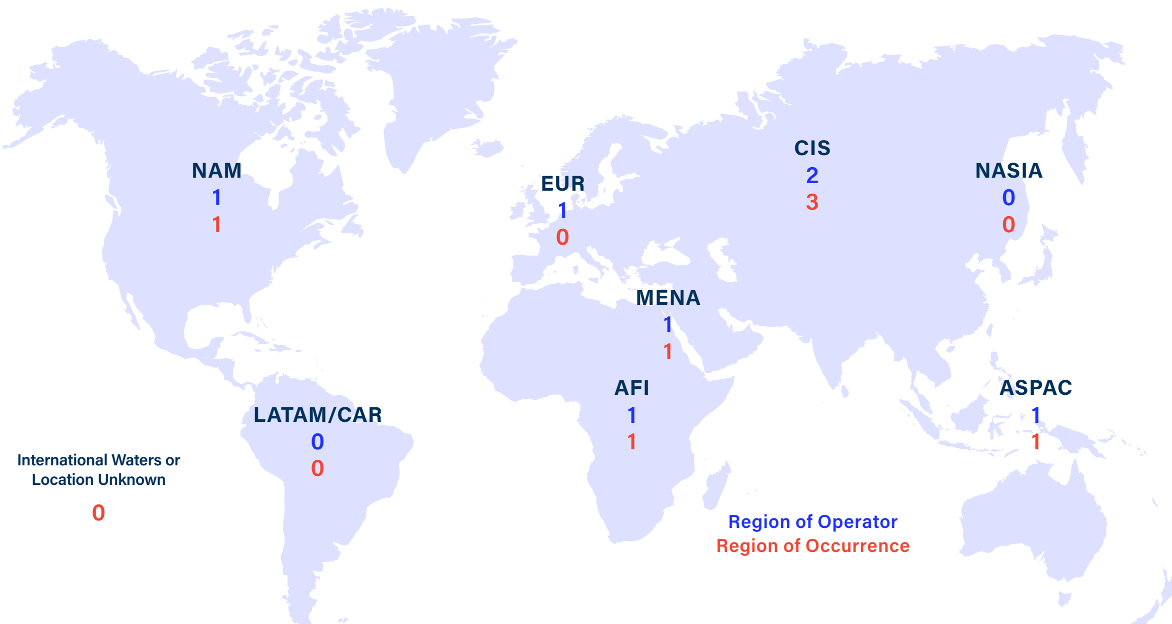
Accident Count % of Total	2021	'17-'21
IATA Member	0%	14%
Full-Loss Equivalents	63%	70%
Fatal	100%	86%
Hull Losses	100%	86%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	100%	0%	0%	0%	100%
2017-2021	43%	57%	0%	14%	86%

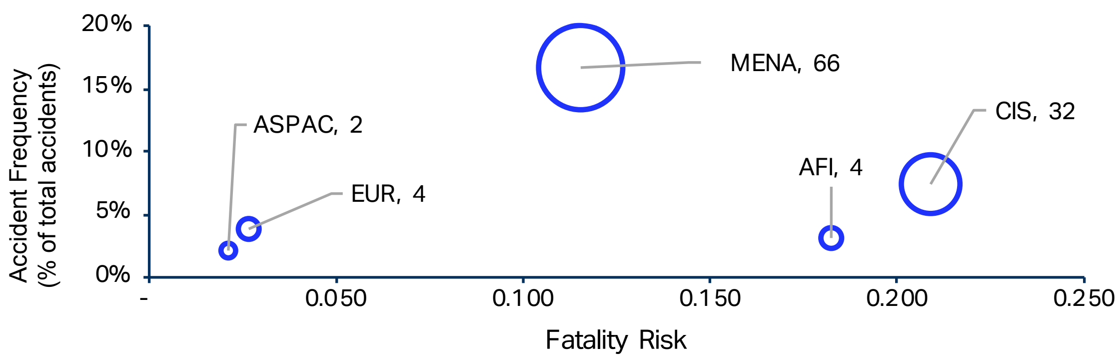
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Controlled Flight into Terrain – Accident Rate*

2021 Accident rate: 0.08
2017-2021 Accident rate: 0.04

Accident Rate*	2021	'17-'21
IATA Member	–	0.01
Fatality Risk**	0.05	0.03
Fatal	0.08	0.03
Hull Losses	0.08	0.03

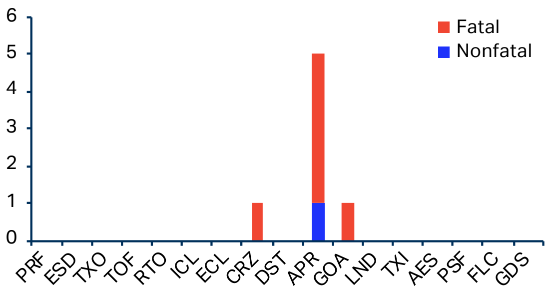
	Jet	Turboprop
2021	–	0.71
2017-2021	0.01	0.22

Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

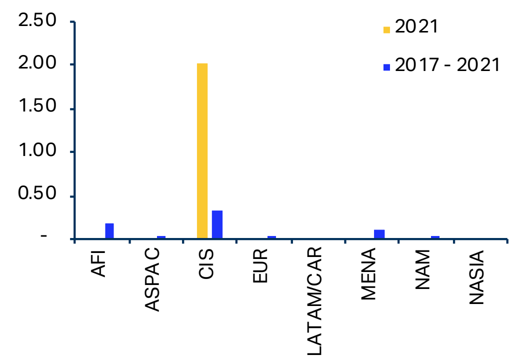
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

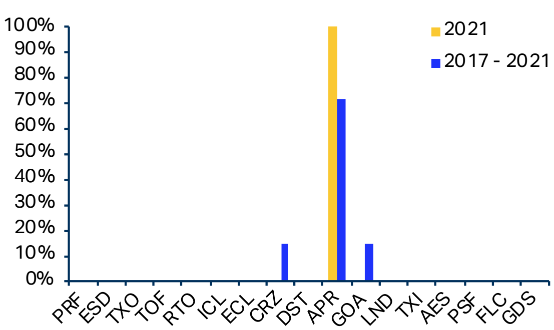
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

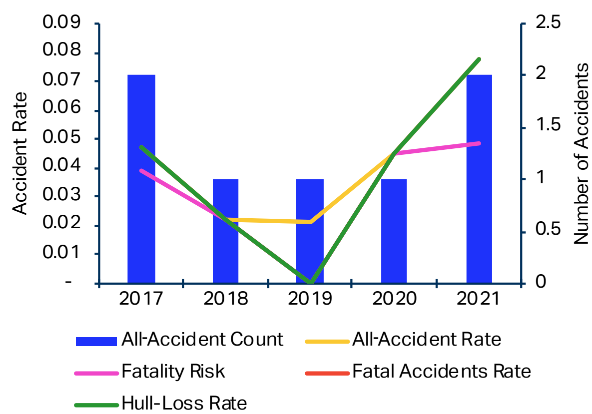
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



Note: The hull loss rate and fatal accident rate share the same value.

Controlled Flight into Terrain – Contributing Factors

Controlled Flight into Terrain

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	71%
Safety Management	57%
Flight Operations	57%
Management Decisions, including Regulatory Decisions and Cost Cutting	43%
Selection Systems	43%
Flight Ops: SOPs & Checking	43%
Technology & Equipment	29%
Flight Watch/Following/Support	29%
Flight Ops: Training Systems	29%
Dispatch	14%

THREATS

	Percentage Contribution
Meteorology	86%
Poor Visibility/IMC	86%
Nav Aids	43%
Ground-based Nav Aid Malfunction or not Available	43%
Operational Pressure	43%
Terrain/Obstacles	43%
Lack of Visual Reference	29%
Air Traffic Services	29%
Aircraft Malfunction	14%
Wind/Windshear/Gusty Wind	14%
Fatigue	14%

Controlled Flight into Terrain

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	57%
Manual Handling/Flight Controls	43%
Callouts	43%
Failure to GOA after Destabilization on Approach	14%
Pilot-to-Pilot Communication	14%
Briefings	14%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Unnecessary Weather Penetration	57%
Vertical/Lateral/Speed Deviation	43%
Abrupt Aircraft Control	29%
Engine	29%
Operation Outside Aircraft Limitations	29%
Unstable Approach	29%
Continued Landing after Unstable Approach	14%
Flight Controls/Automation	14%

COUNTERMEASURES

	Percentage Contribution
In-flight Decision-making/Contingency Management	71%
Monitor/Cross-check	57%
Overall Crew Performance	57%
Captain Should Show Leadership	43%
FO Is Assertive When Necessary	43%
Leadership	43%
Automation Management	14%
Communication Environment	14%
Reactive – Contingency Management	14%

Refer to the list of Accident Classification Taxonomy.

See overview of CFIT and related ACTF recommendations

Mid-Air Collision – Accident Count

2021	Number of accidents: 0	Number of fatalities: 0
2017-2021	Number of accidents: 0	Number of fatalities: 0

Accident Count % of Total	2021	'17-'21
IATA Member	0%	0%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	0%

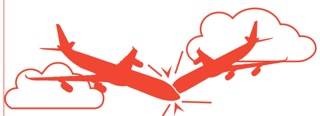
	Passenger	Cargo	Ferry	Jet	Turboprop
2021	0%	0%	0%	0%	0%
2017-2021	0%	0%	0%	0%	0%

Note: the sum may not add to 100% due to rounding

There were no accidents during the reporting period.

Mid-Air Collision – Accident Rate*

2021 Accident rate: –
2017-2021 Accident rate: –



Accident Rate*	2021	'17-'21
IATA Member	–	0%
Fatality Risk**	–	0%
Fatal	–	0%
Hull Losses	–	0%

	Jet	Turboprop	
2021	–	–	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	–	–	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

There were no accidents during the reporting period.

Mid-Air Collision – Contributing Factors

At least three accidents are required before the accident classification is provided.

See overview of Mid-Air Collision and related ACTF recommendations

Runway/Taxiway Excursion – Accident Count

2021	Number of accidents: 0	Number of fatalities: 0
2017-2021	Number of accidents: 58	Number of fatalities: 79

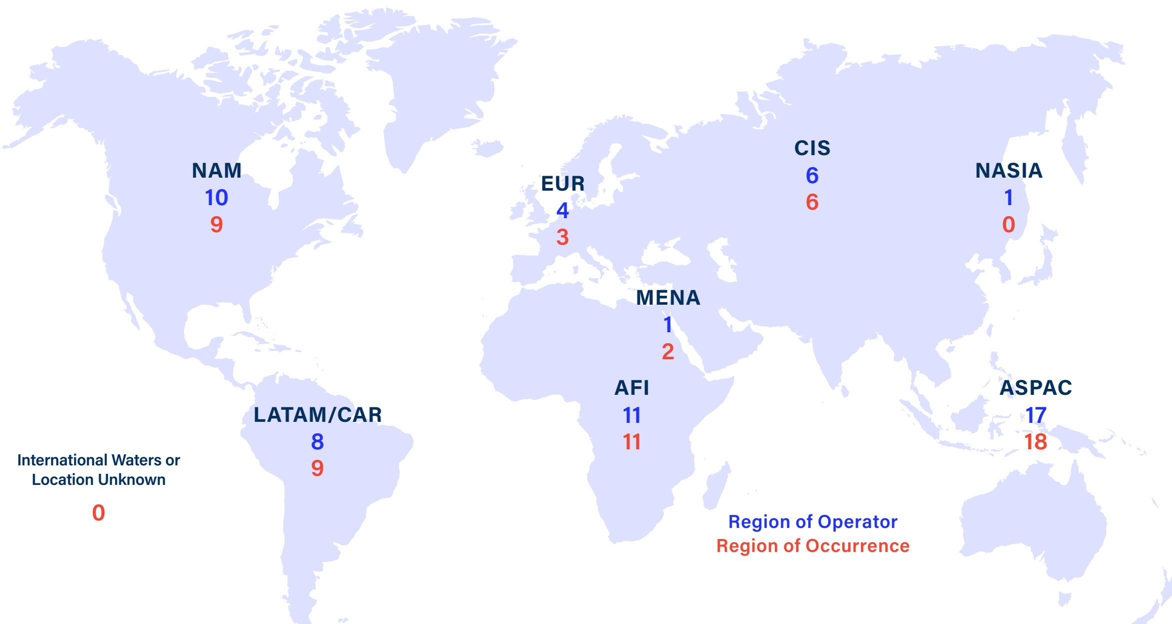
Accident Count % of Total	2021	'17-'21
IATA Member	0%	22%
Full-Loss Equivalents	0%	2%
Fatal	0%	10%
Hull Losses	0%	28%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	0%	0%	0%	0%	0%
2017-2021	83%	17%	0%	53%	47%

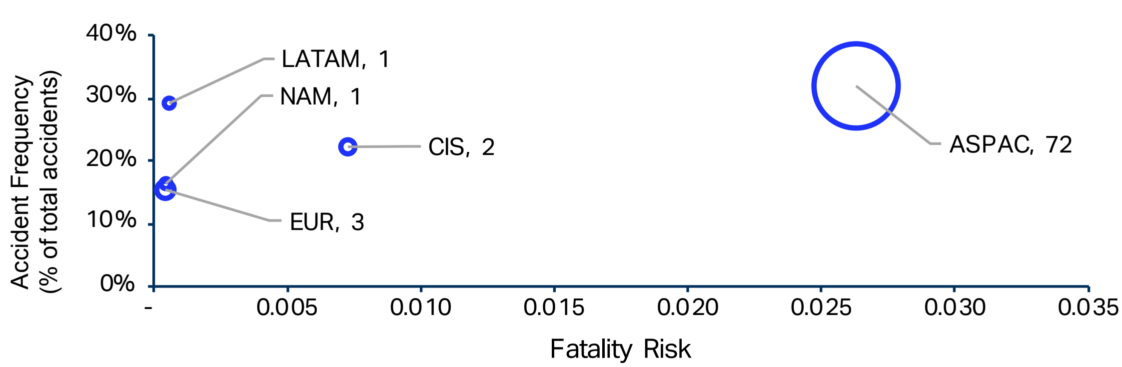
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Runway/Taxiway Excursion – Accident Rate*

2021	Accident rate: –
2017-2021	Accident rate: 0.32

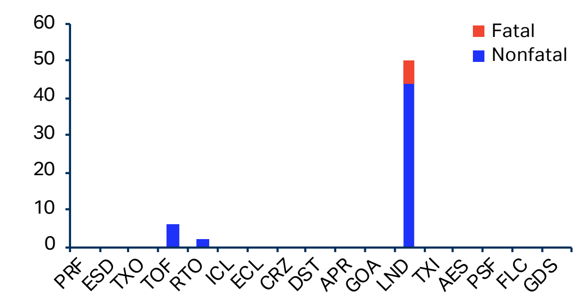
Accident Rate*	2021	'17-'21
IATA Member	–	0.12
Fatality Risk**	–	0.01
Fatal	–	0.03
Hull Losses	–	0.09

	Jet	Turboprop	
2021	–	–	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	0.20	1.00	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

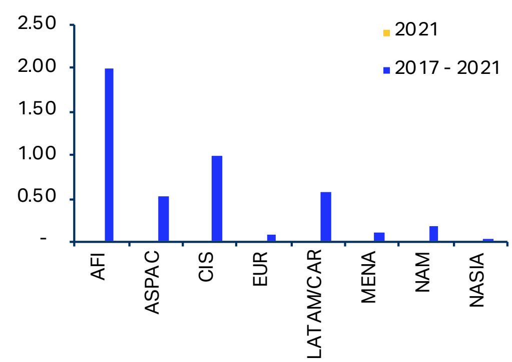
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

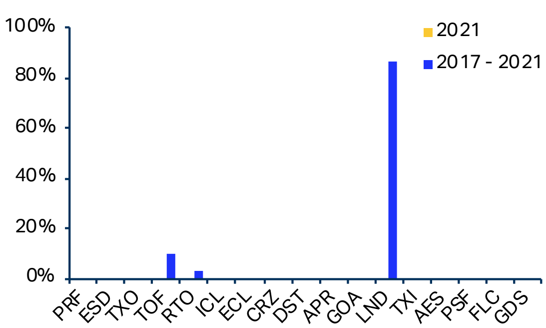
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

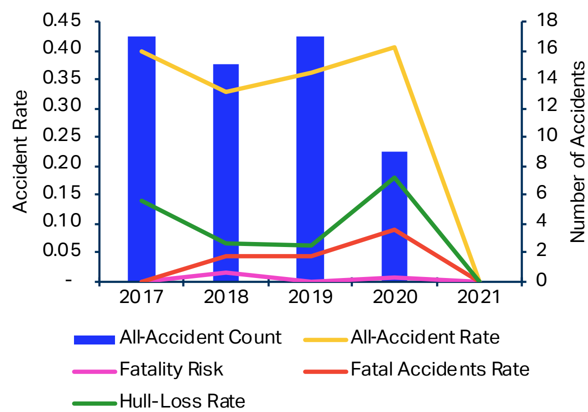
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



Runway/Taxiway Excursion

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	36%
Safety Management	34%
Flight Operations	28%
Selection Systems	17%
Flight Ops: Training Systems	16%
Flight Ops: SOPs & Checking	12%
Management Decisions, including Regulatory Decisions and Cost Cutting	9%
Maintenance Operations	9%
Maintenance Ops: SOPs & Checking	7%
Technology & Equipment	5%
Design	3%
Change Management	2%
Flight Watch/Following/Support	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	41%
SOP Adherence/SOP Cross-verification	31%
Failure to GOA after Destabilization on Approach	24%
Callouts	17%
Pilot-to-Pilot Communication	12%
Failure to GOA after Abnormal Runway Contact	10%
Crew to External Communication	5%
Normal Checklist	5%
Briefings	5%
ATC	5%
Abnormal Checklist	3%
Automation	3%
Ground Navigation	2%

Runway/Taxiway Excursion

THREATS

	Percentage Contribution
Meteorology	48%
Airport Facilities	43%
Wind/Windshear/Gusty Wind	33%
Contaminated Runway/Taxiway - Poor Braking Action	28%
Thunderstorms	28%
Aircraft Malfunction	19%
Poor Visibility/IMC	17%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	14%
Operational Pressure	10%
Optical Illusion/Visual Misperception	9%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	7%
Air Traffic Services	5%
Fatigue	5%
Contained Engine Failure/Powerplant Malfunction	5%
Maintenance Events	5%
Icing Conditions	5%
MEL Item	5%
Ground-based Nav Aid Malfunction or not Available	3%
Terrain/Obstacles	3%
Wildlife/Birds/Foreign Object	3%
Nav Aids	3%
Brakes	3%
Airport Perimeter Control/Fencing/Wildlife Control	3%
Crew Incapacitation	3%
Gear/Tire	3%
Hydraulic System Failure	3%
Flight Controls	2%
Fire/Smoke (Cockpit/Cabin/Cargo)	2%
Primary Flight Controls	2%
Lack of Visual Reference	2%

Runway/Taxiway Excursion

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	31%
Unstable Approach	22%
Unnecessary Weather Penetration	22%
Continued Landing after Unstable Approach	22%
Vertical/Lateral/Speed Deviation	21%
Brakes/Thrust Reversers/Ground Spoilers	14%
Operation Outside Aircraft Limitations	12%
Abrupt Aircraft Control	10%
Loss of Aircraft Control While on the Ground	7%
Flight Controls/Automation	3%
Rejected Takeoff after V_1	3%
Unauthorized Airspace Penetration	2%
Engine	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	31%
In-flight Decision-making/Contingency Management	21%
Taxiway/Runway Management	21%
Leadership	19%
Monitor/Cross-check	17%
Captain Should Show Leadership	17%
Workload Management	10%
Communication Environment	7%
Reactive – Contingency Management	5%
Automation Management	3%
Evaluation of Plans	3%
FO Is Assertive When Necessary	3%
Proactive – In-flight Decision-making	3%
Plans Stated	2%

Refer to the list of Accident Classification Taxonomy.

See overview of Runway/Taxiway Excursion and related ACTF recommendations

In-flight Damage – Accident Count

2021 Number of accidents: 3 Number of fatalities: 0

2017-2021 Number of accidents: 27 Number of fatalities: 105

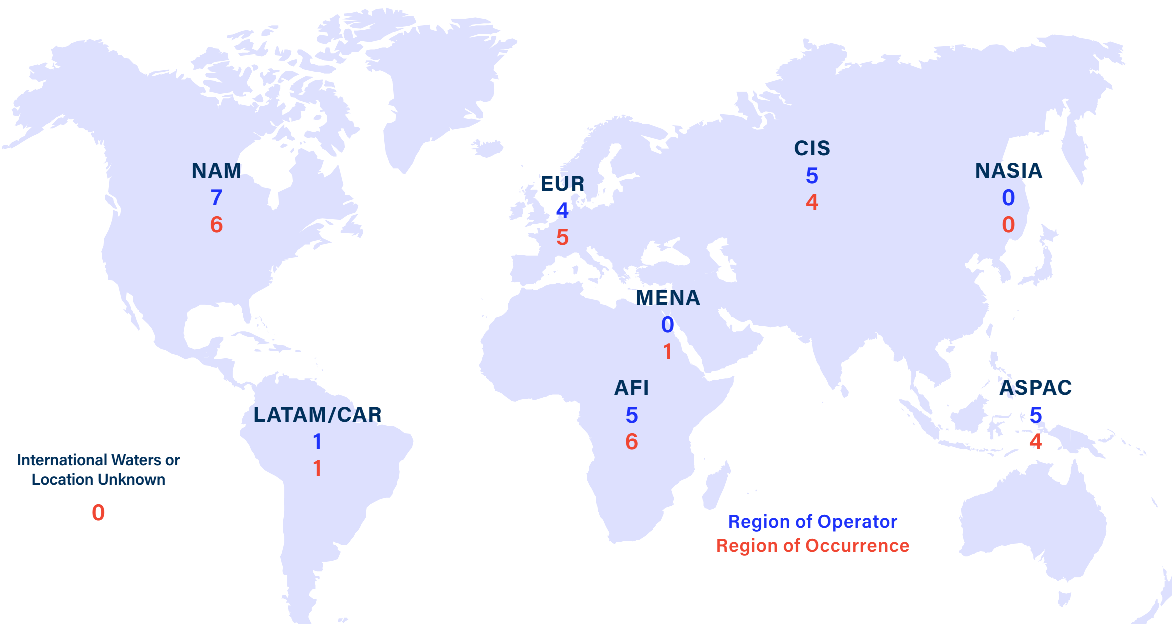
Accident Count % of Total	2021	'17-'21
IATA Member	0%	44%
Full-Loss Equivalents	0%	7%
Fatal	0%	11%
Hull Losses	0%	11%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	33%	67%	0%	67%	33%
2017-2021	78%	22%	0%	78%	22%

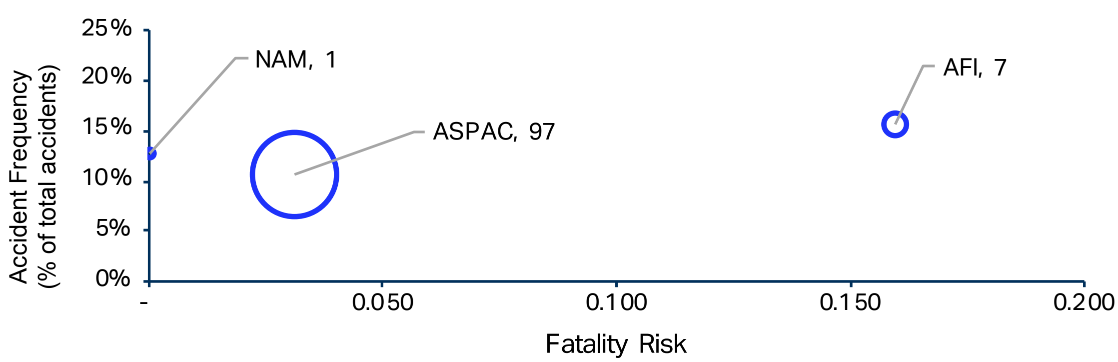
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



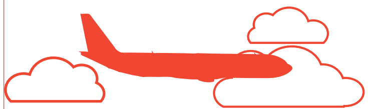
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

In-flight Damage – Accident Rate*

2021 Accident rate: 0.12
2017-2021 Accident rate: 0.15



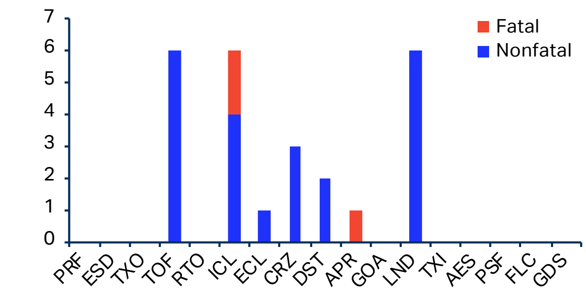
Accident Rate*	2021	'17-'21
IATA Member	-	0.11
Fatality Risk**	-	0.01
Fatal	-	0.02
Hull Losses	-	0.02

	Jet	Turboprop	
2021	0.09	0.35	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	0.13	0.22	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

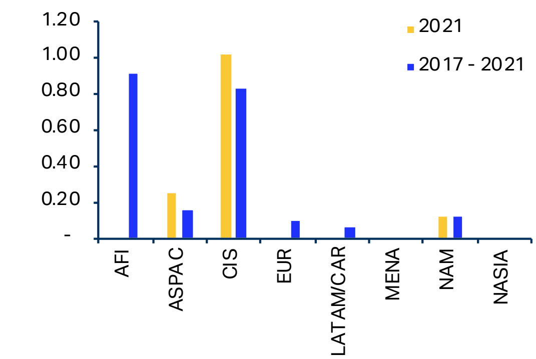
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

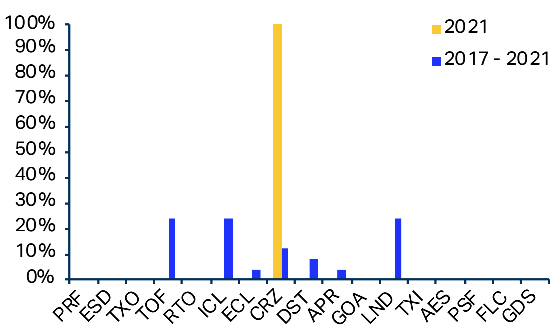
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

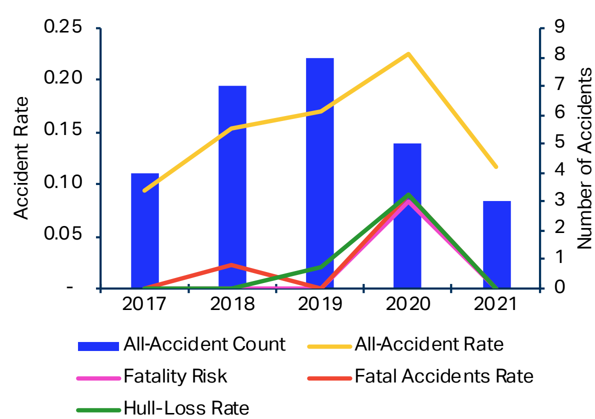
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

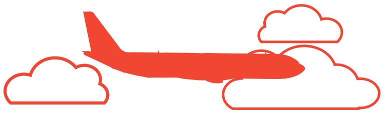
Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



In-flight Damage – Contributing Factors

In-flight Damage



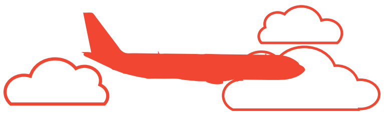
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	41%
Safety Management	30%
Maintenance Operations	19%
Maintenance Ops: SOPs & Checking	15%
Design	11%
Management Decisions, including Regulatory Decisions and Cost Cutting	11%
Change Management	4%
Ground Operations	4%
Ground Ops: Training Systems	4%
Flight Ops: Training Systems	4%
Selection Systems	4%
Ground Ops: SOPs & Checking	4%
Dispatch Ops: SOPs & Checking	4%
Dispatch	4%
Flight Operations	4%
Flight Ops: SOPs & Checking	4%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	11%
SOP Adherence/SOP Cross-verification	7%
Wrong Weight & Balance/Fuel Information	4%
Crew to External Communication	4%
Callouts	4%
Failure to GOA after Destabilization on Approach	4%
Failure to GOA after Abnormal Runway Contact	4%
ATC	4%
Normal Checklist	4%
Briefings	4%
Documentation	4%
Pilot-to-Pilot Communication	4%

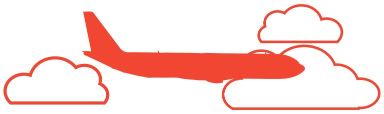
In-flight Damage



THREATS

	Percentage Contribution
Aircraft Malfunction	41%
Wildlife/Birds/Foreign Object	26%
Maintenance Events	19%
Meteorology	19%
Airport Facilities	19%
Extensive/Uncontained Engine Failure	15%
Contained Engine Failure/Powerplant Malfunction	11%
Thunderstorms	11%
Gear/Tire	11%
Foreign Objects, FOD	11%
Brakes	7%
Hydraulic System Failure	7%
Contaminated Runway/Taxiway - Poor Braking Action	7%
Wind/Windshear/Gusty Wind	7%
Poor Visibility/IMC	7%
Airport Perimeter Control/Fencing/Wildlife Control	7%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	4%
Secondary Flight Controls	4%
Flight Controls	4%
Fire/Smoke (Cockpit/Cabin/Cargo)	4%
Ground Events	4%
Electrical Power Generation Failure	4%
Dispatch/Paperwork	4%
Icing Conditions	4%
Structural Failure	4%

In-flight Damage



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Unnecessary Weather Penetration	19%
Abrupt Aircraft Control	11%
Operation Outside Aircraft Limitations	7%
Vertical/Lateral/Speed Deviation	7%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	4%
Continued Landing after Unstable Approach	4%
Systems	4%
Landing Gear	4%
Weight & Balance	4%
Unstable Approach	4%

COUNTERMEASURES

	Percentage Contribution
Leadership	4%
Communication Environment	4%
FO Is Assertive When Necessary	4%
Inquiry	4%
Monitor/Cross-check	4%
In-flight Decision-making/Contingency Management	4%
Workload Management	4%
Reactive – Contingency Management	4%
Plans Stated	4%
Evaluation of Plans	4%
Captain Should Show Leadership	4%
SOP Briefing/Planning	4%
Overall Crew Performance	4%

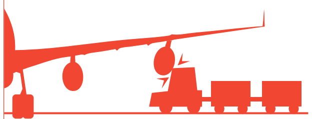
Refer to the list of Accident Classification Taxonomy.

Safety is not a sometime thing. Safety is an every time thing.

Martin Plumleigh,
SMS Manager,
Boeing Digital Aviation Solutions

Ground Damage – Accident Count

2021	Number of accidents: 0	Number of fatalities: 0
2017-2021	Number of accidents: 18	Number of fatalities: 0



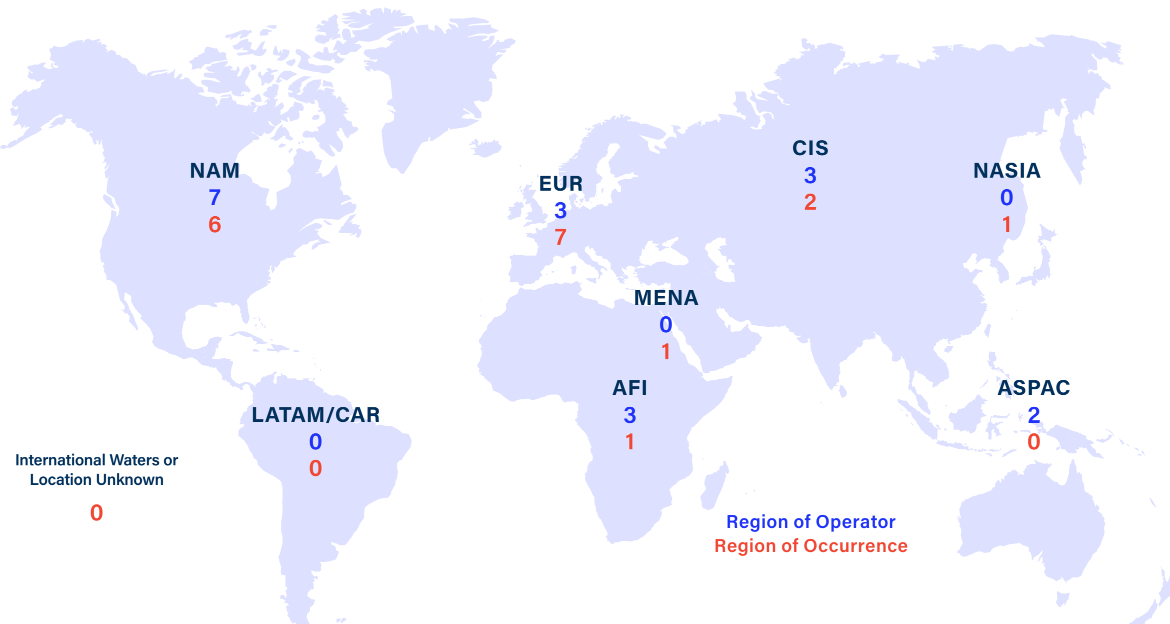
Accident Count % of Total	2021	'17-'21
IATA Member	0%	61%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	0%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	0%	0%	0%	0%	0%
2017-2021	83%	17%	0%	89%	11%

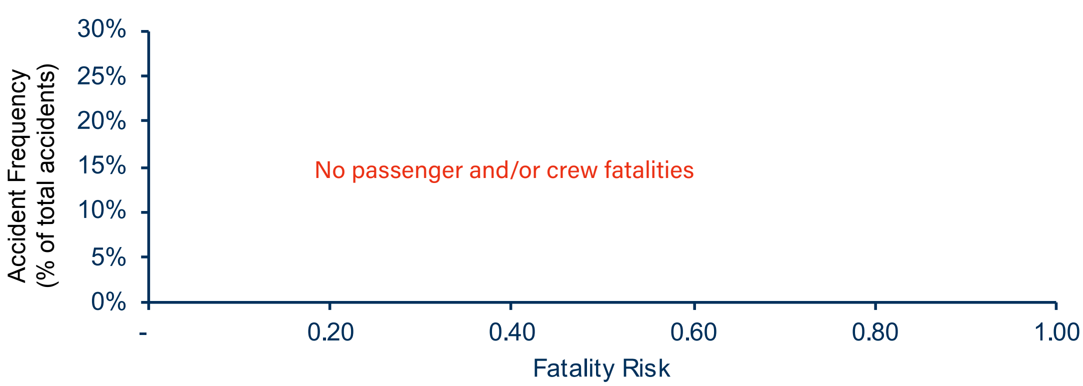
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)

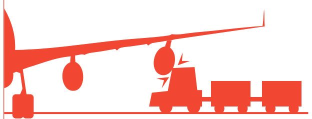


The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Ground Damage – Accident Rate*

2021 Accident rate: –

2017-2021 Accident rate: 0.10



Accident Rate*	2021	'17-'21
IATA Member	–	0.10
Fatality Risk**	–	–
Fatal	–	–
Hull Losses	–	–

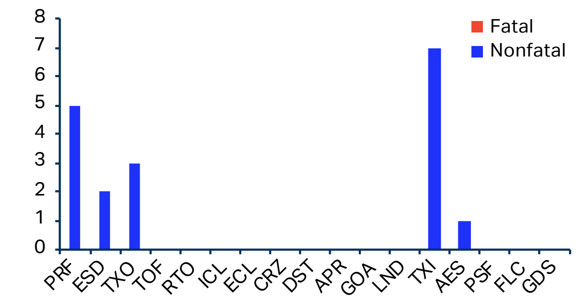
	Jet	Turboprop	
2021	–	–	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	0.10	0.07	

*Total number of accidents calculated per 1 million flights

**Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

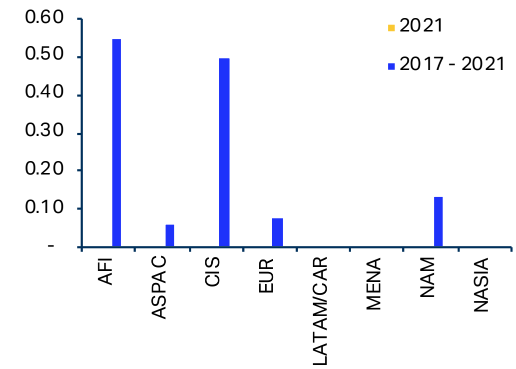
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

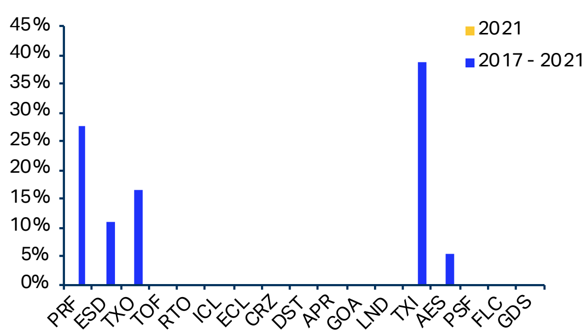
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

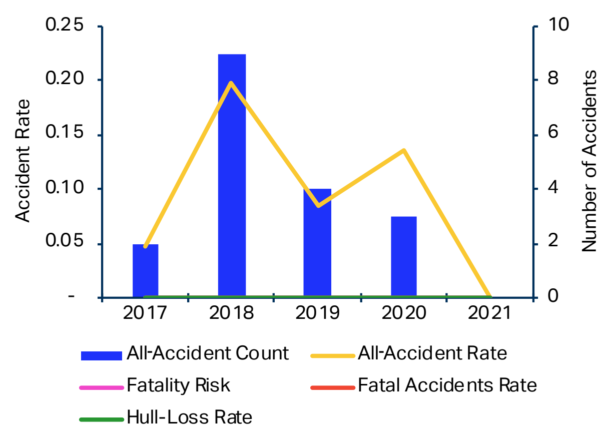
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

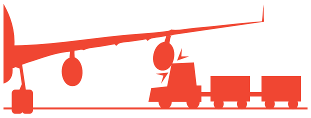
See Annex 1 for the definitions of metrics used



Note: The fatal accident rate, fatality risk, and hull loss rate share the same value.

Ground Damage – Contributing Factors

Ground Damage



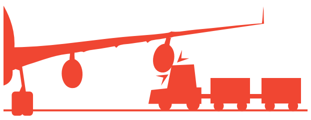
LATENT CONDITIONS

	Percentage Contribution
Ground Ops: SOPs & Checking	28%
Ground Operations	28%
Safety Management	22%
Ground Ops: Training Systems	11%
Regulatory Oversight	11%
Flight Operations	6%
Maintenance Operations	6%
Flight Ops: SOPs & Checking	6%
Flight Ops: Training Systems	6%

THREATS

	Percentage Contribution
Ground Events	33%
Traffic	33%
Airport Facilities	11%
Meteorology	11%
Operational Pressure	6%
Aircraft Malfunction	6%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	6%
Wind/Windshear/Gusty Wind	6%
Dangerous Goods	6%
Maintenance Events	6%
Air Traffic Services	6%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	6%
Poor Visibility/IMC	6%
Hydraulic System Failure	6%

Ground Damage



FLIGHT CREW ERRORS

	Percentage Contribution
Ground Navigation	17%
SOP Adherence/SOP Cross-verification	6%
Callouts	6%
Manual Handling/Flight Controls	6%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Ramp Movements, Including When Under Marshalling	17%
Loss of Aircraft Control While on the Ground	11%
Operation Outside Aircraft Limitations	6%

COUNTERMEASURES

	Percentage Contribution
Taxiway/Runway Management	11%
Overall Crew Performance	11%
Captain Should Show Leadership	6%
Leadership	6%

Refer to the list of Accident Classification Taxonomy.

See overview of Ground Damage and related ACTF recommendations

Undershoot – Accident Count

2021	Number of accidents: 1	Number of fatalities: 0
2017-2021	Number of accidents: 8	Number of fatalities: 5

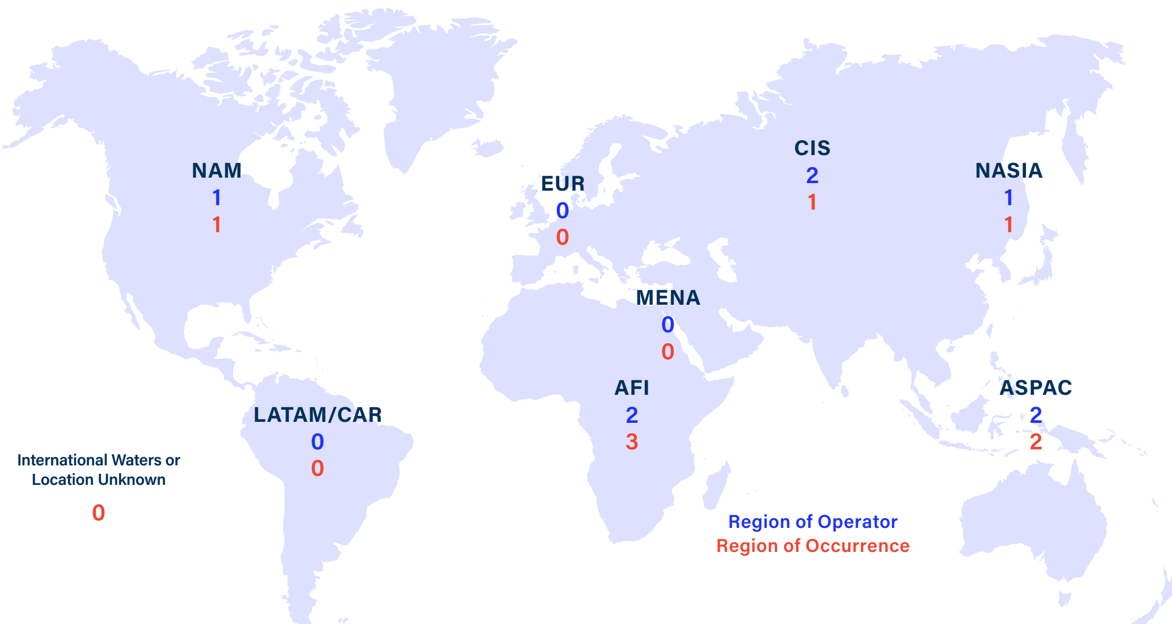
Accident Count % of Total	2021	'17-'21
IATA Member	100%	50%
Full-Loss Equivalents	0%	5%
Fatal	0%	25%
Hull Losses	0%	25%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	100%	0%	0%	0%	100%
2017-2021	75%	25%	0%	63%	38%

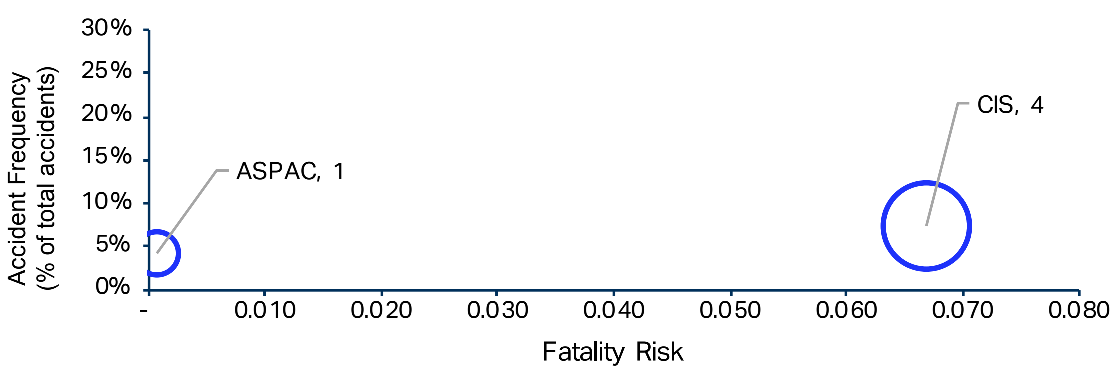
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Undershoot – Accident Rate*

2021 Accident rate: 0.04
2017-2021 Accident rate: 0.04

Accident Rate*	2021	'17-'21
IATA Member	0.06	0.04
Fatality Risk**	–	0.00
Fatal	–	0.01
Hull Losses	–	0.01

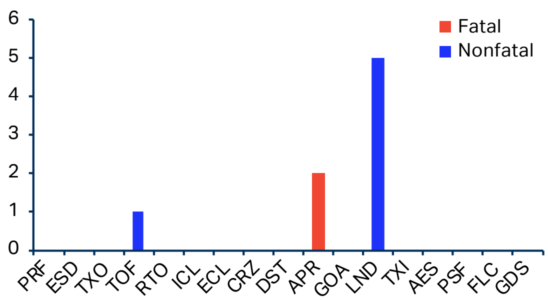
	Jet	Turboprop
2021	–	0.35
2017-2021	0.03	0.11

Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

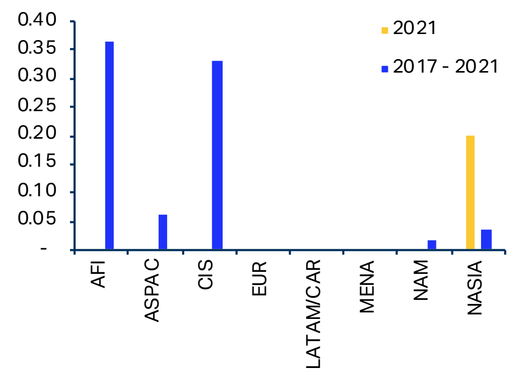
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

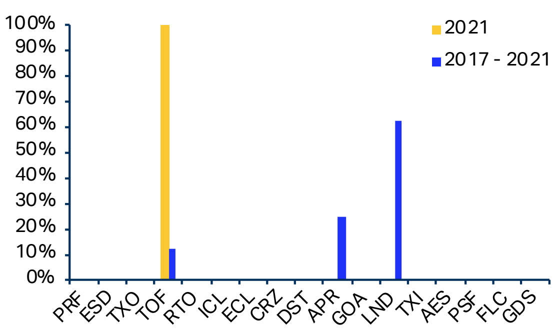
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

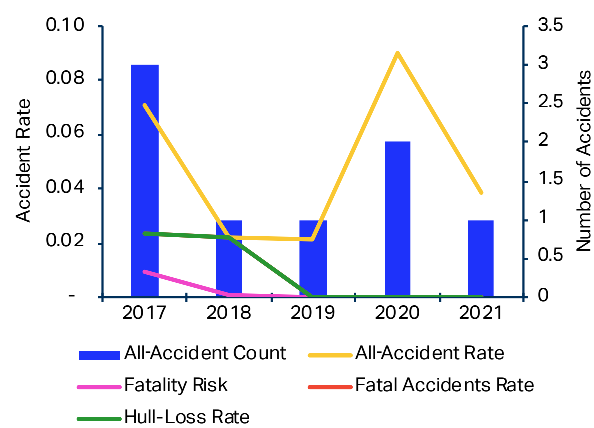
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

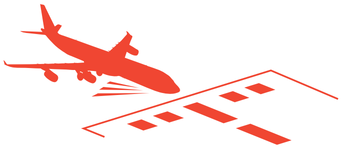
Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



Note: The fatal accident rate and hull loss rate share the same value.

Undershoot



LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	63%
Safety Management	63%
Flight Ops: SOPs & Checking	38%
Flight Operations	38%
Selection Systems	25%
Flight Ops: Training Systems	25%
Technology & Equipment	13%

THREATS

	Percentage Contribution
Meteorology	63%
Nav Aids	50%
Lack of Visual Reference	38%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	38%
Ground-based Nav Aid Malfunction or not Available	38%
Poor Visibility/IMC	38%
Wind/Windshear/Gusty Wind	38%
Airport Facilities	38%
Optical Illusion/Visual Misperception	25%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	25%
Thunderstorms	25%
Operational Pressure	13%
Contaminated Runway/Taxiway - Poor Braking Action	13%

Undershoot

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	50%
Failure to GOA after Destabilization on Approach	38%
Pilot-to-Pilot Communication	38%
Manual Handling/Flight Controls	25%
Automation	13%
Systems/Radios/Instruments	13%
Wrong Altimeter Reference Settings (QNH, QFE)	13%
Callouts	13%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	50%
Unstable Approach	50%
Continued Landing after Unstable Approach	50%
Unnecessary Weather Penetration	25%
Operation Outside Aircraft Limitations	13%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	13%

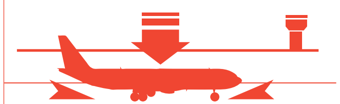
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	50%
Monitor/Cross-check	38%
Communication Environment	25%
Leadership	25%
Automation Management	25%
FO Is Assertive When Necessary	25%
Proactive – In-flight Decision-making	13%
Captain Should Show Leadership	13%
In-flight Decision-making/Contingency Management	13%

Refer to the list of Accident Classification Taxonomy.

Hard Landing – Accident Count

2021	Number of accidents: 2	Number of fatalities: 0
2017-2021	Number of accidents: 19	Number of fatalities: 41



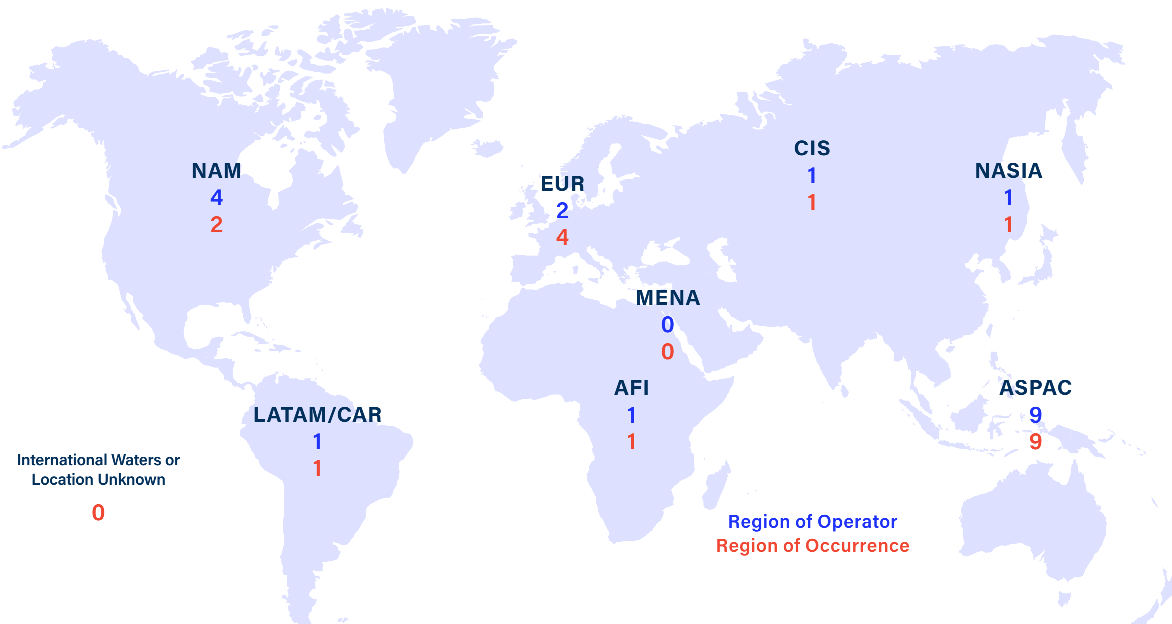
Accident Count % of Total	2021	'17-'21
IATA Member	50%	58%
Full-Loss Equivalents	0%	3%
Fatal	0%	5%
Hull Losses	50%	11%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	50%	50%	0%	50%	50%
2017-2021	95%	5%	0%	79%	21%

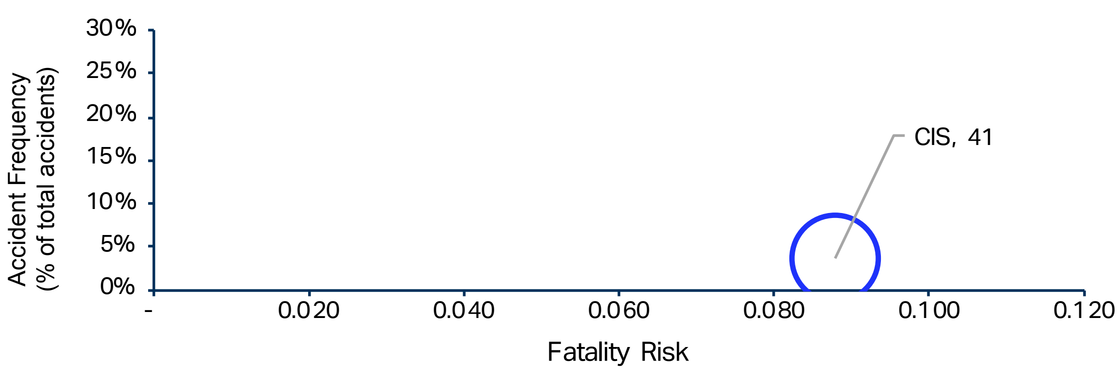
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



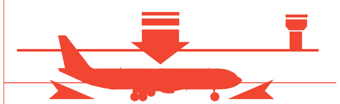
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Hard Landing – Accident Rate*

2021 Accident rate: 0.08
2017-2021 Accident rate: 0.10



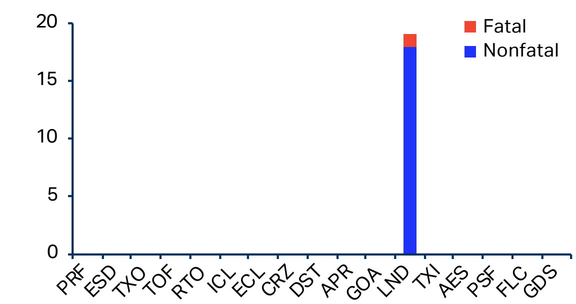
Accident Rate*	2021	'17-'21
IATA Member	0.06	0.10
Fatality Risk**	–	0.00
Fatal	–	0.01
Hull Losses	0.04	0.01

	Jet	Turboprop	
2021	0.04	0.35	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	0.10	0.15	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

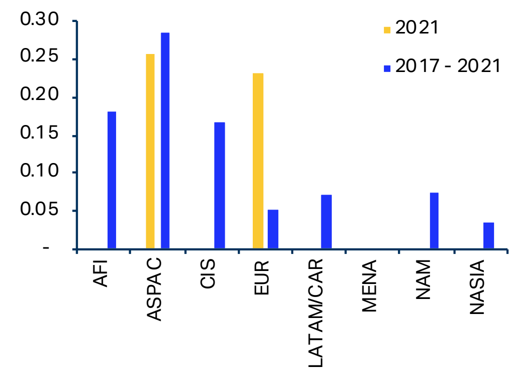
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

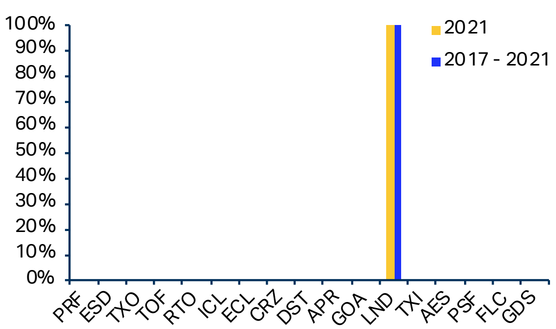
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

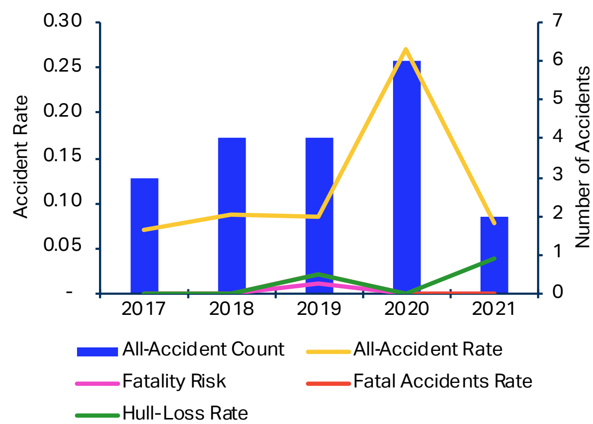
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

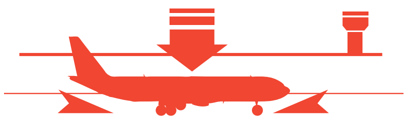
Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



Hard Landing – Contributing Factors

Hard Landing



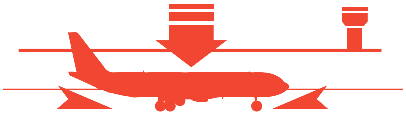
LATENT CONDITIONS

	Percentage Contribution
Flight Operations	37%
Flight Ops: Training Systems	32%
Safety Management	21%
Flight Ops: SOPs & Checking	16%
Management Decisions, including Regulatory Decisions and Cost Cutting	11%
Regulatory Oversight	11%
Selection Systems	11%

THREATS

	Percentage Contribution
Meteorology	63%
Wind/Windshear/Gusty Wind	58%
Thunderstorms	32%
Poor Visibility/IMC	26%
Lack of Visual Reference	11%
Fatigue	5%
Optical Illusion/Visual Misperception	5%
Aircraft Malfunction	5%
Nav Aids	5%
Ground-based Nav Aid Malfunction or not Available	5%

Hard Landing



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	89%
SOP Adherence/SOP Cross-verification	53%
Failure to GOA after Destabilization on Approach	47%
Failure to GOA after Abnormal Runway Contact	37%
Crew to External Communication	11%
Automation	11%
Callouts	11%
ATC	5%
Maintenance	5%
Pilot-to-Pilot Communication	5%
Normal Checklist	5%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	68%
Vertical/Lateral/Speed Deviation	68%
Abrupt Aircraft Control	63%
Unstable Approach	53%
Continued Landing after Unstable Approach	47%
Unnecessary Weather Penetration	21%
Operation Outside Aircraft Limitations	16%
Engine	5%
Flight Controls/Automation	5%
Brakes/Thrust Reversers/Ground Spoilers	5%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	47%
In-flight Decision-making/Contingency Management	32%
Monitor/Cross-check	32%
Proactive – In-flight Decision-making	21%
Captain Should Show Leadership	16%
Leadership	16%
Reactive – Contingency Management	11%
Automation Management	11%

Refer to the list of Accident Classification Taxonomy.

Gear-up Landing/Gear Collapse – Accident Count

2021	Number of accidents:	5	Number of fatalities:	0
2017-2021	Number of accidents:	31	Number of fatalities:	0

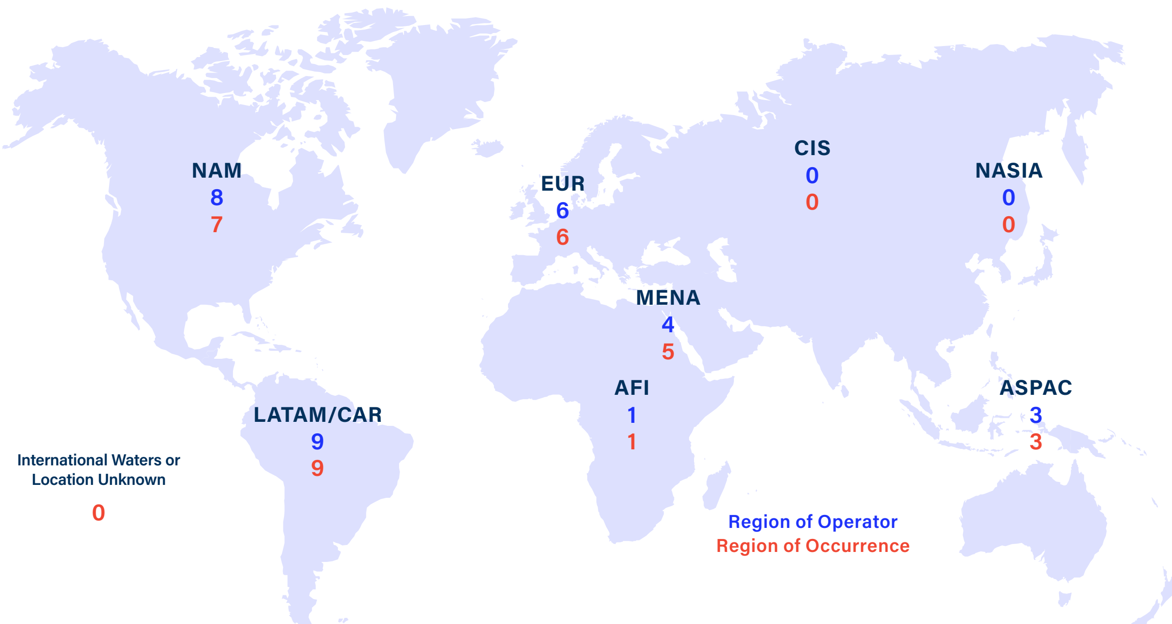
Accident Count % of Total	2021	'17-'21
IATA Member	20%	32%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	6%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	60%	40%	0%	40%	60%
2017-2021	68%	32%	0%	58%	42%

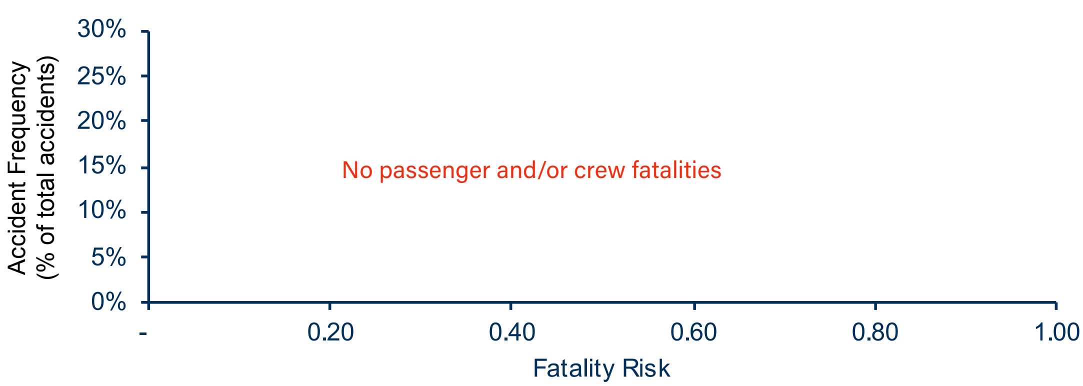
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Gear-up Landing/Gear Collapse – Accident Rate*

2021 Accident rate: 0.19
2017-2021 Accident rate: 0.17

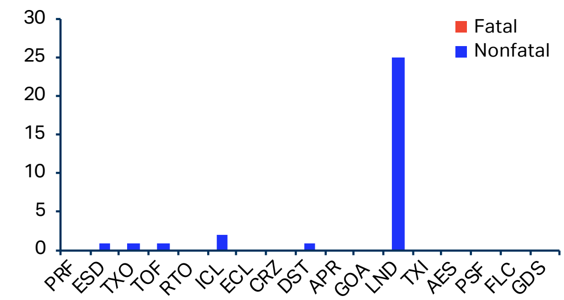
Accident Rate*	2021	'17-'21
IATA Member	0.06	0.09
Fatality Risk**	–	–
Fatal	–	–
Hull Losses	–	0.01

	Jet	Turboprop	
2021	0.09	1.06	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	0.12	0.48	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

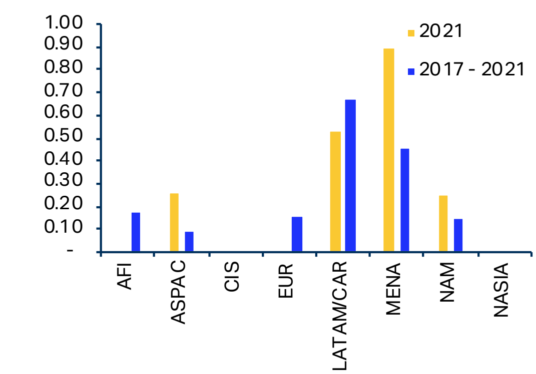
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

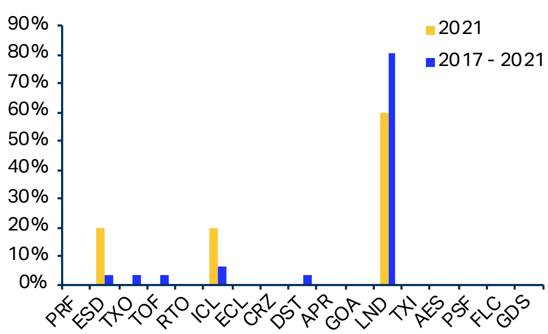
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

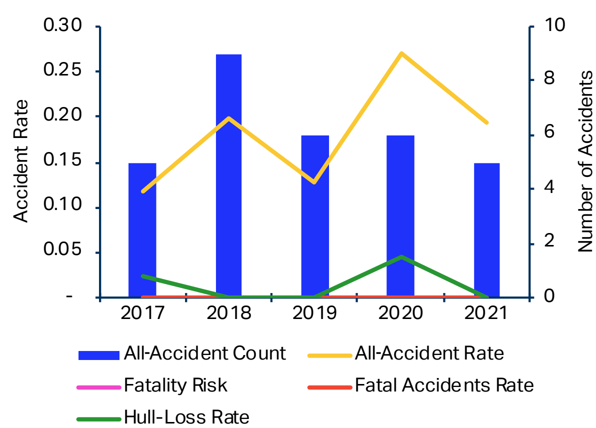
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



Note: The fatal accident rate and fatality risk share the same value.

Gear-up Landing/Gear Collapse – Contributing Factors

Gear-up Landing/Gear Collapse

LATENT CONDITIONS

	Percentage Contribution
Maintenance Operations	45%
Maintenance Ops: SOPs & Checking	39%
Regulatory Oversight	39%
Safety Management	29%
Design	16%
Flight Operations	10%
Selection Systems	10%
Flight Ops: Training Systems	6%
Flight Ops: SOPs & Checking	6%
Management Decisions, including Regulatory Decisions and Cost Cutting	6%
Technology & Equipment	3%
Ops Planning & Scheduling	3%
Cabin Operations	3%
Dispatch Ops: SOPs & Checking	3%
Dispatch	3%

THREATS

	Percentage Contribution
Gear/Tire	74%
Aircraft Malfunction	74%
Maintenance Events	45%
Hydraulic System Failure	6%
Nav Aids	3%
Operational Pressure	3%
Dispatch/Paperwork	3%
Thunderstorms	3%
Wind/Windshear/Gusty Wind	3%
Airport Facilities	3%
Electrical Power Generation Failure	3%
Meteorology	3%
Poor Visibility/IMC	3%
Contained Engine Failure/Powerplant Malfunction	3%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	3%
Ground-based Nav Aid Malfunction or not Available	3%

Gear-up Landing/Gear Collapse

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	13%
Abnormal Checklist	6%
Failure to GOA after Destabilization on Approach	3%
Systems/Radios/Instruments	3%
Manual Handling/Flight Controls	3%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Landing Gear	10%
Unstable Approach	6%
Operation Outside Aircraft Limitations	3%
Continued Landing after Unstable Approach	3%
Unnecessary Weather Penetration	3%
Systems	3%

COUNTERMEASURES

	Percentage Contribution
Monitor/Cross-check	6%
Overall Crew Performance	6%
In-flight Decision-making/Contingency Management	6%
Leadership	3%
Captain Should Show Leadership	3%
Proactive – In-flight Decision-making	3%
Evaluation of Plans	3%
FO Is Assertive When Necessary	3%
Communication Environment	3%
Workload Management	3%

Refer to the list of Accident Classification Taxonomy.

Tail Strike – Accident Count

2021	Number of accidents: 4	Number of fatalities: 0
2017-2021	Number of accidents: 23	Number of fatalities: 0

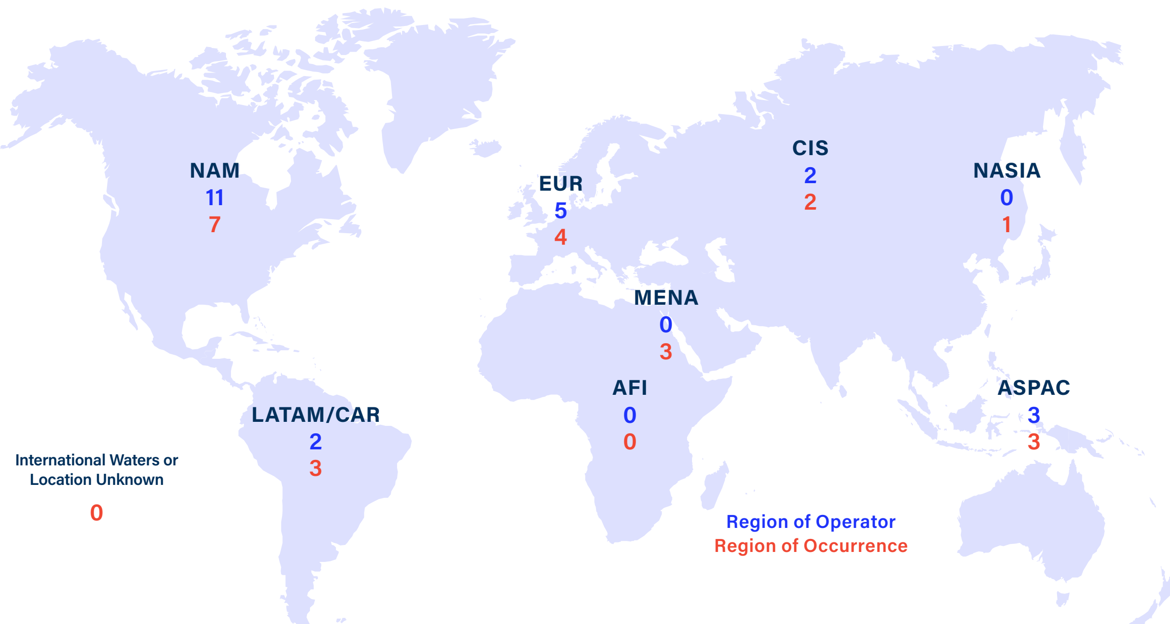
Accident Count % of Total	2021	'17-'21
IATA Member	100%	57%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	0%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	50%	50%	0%	100%	0%
2017-2021	87%	13%	0%	87%	13%

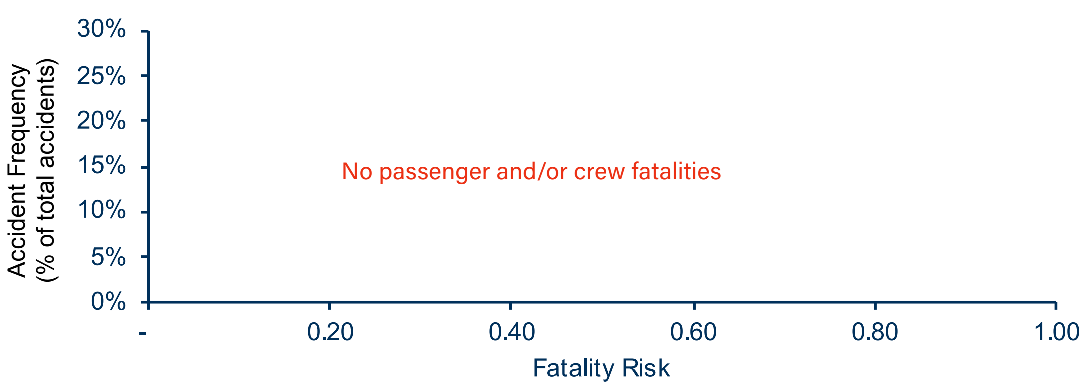
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



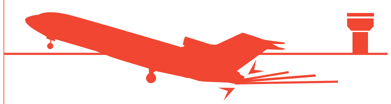
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Tail Strike – Accident Rate*

2021 Accident rate: 0.16
2017-2021 Accident rate: 0.13



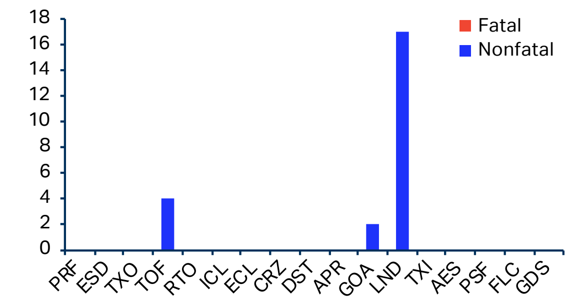
Accident Rate*	2021	'17-'21
IATA Member	0.22	0.12
Fatality Risk**	–	–
Fatal	–	–
Hull Losses	–	–

	Jet	Turboprop	
2021	0.17	–	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	0.13	0.11	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

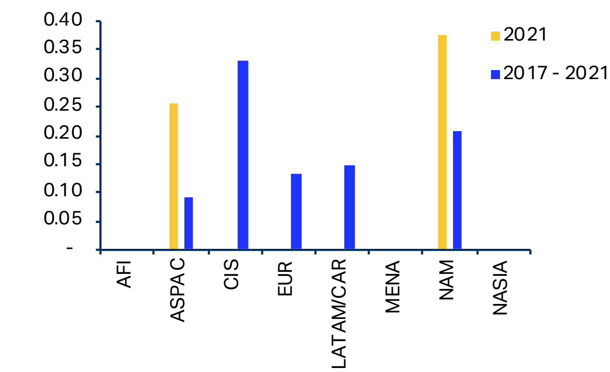
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

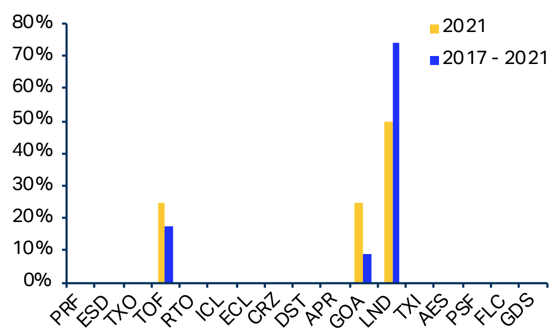
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

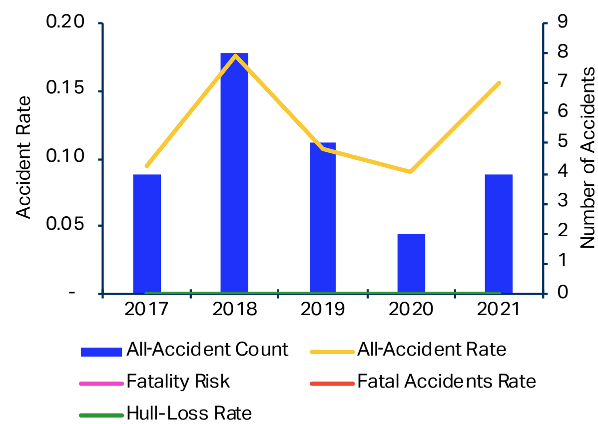
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



Note: The fatal accident rate, fatality risk, and hull loss rate share the same value.

Tail Strike – Contributing Factors

Tail Strike

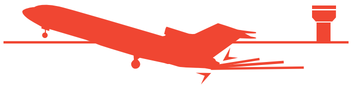
LATENT CONDITIONS

	Percentage Contribution
Flight Operations	22%
Safety Management	13%
Flight Ops: SOPs & Checking	9%
Flight Ops: Training Systems	9%
Selection Systems	4%
Ops Planning & Scheduling	4%
Dispatch	4%
Regulatory Oversight	4%

THREATS

	Percentage Contribution
Meteorology	30%
Wind/Windshear/Gusty Wind	26%
Dispatch/Paperwork	9%
Poor Visibility/IMC	9%
Optical Illusion/Visual Misperception	4%
Terrain/Obstacles	4%
Thunderstorms	4%
Fatigue	4%
Ground Events	4%

Tail Strike



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	70%
SOP Adherence/SOP Cross-verification	57%
Failure to GOA after Abnormal Runway Contact	26%
Pilot-to-Pilot Communication	17%
Callouts	9%
Wrong Weight & Balance/Fuel Information	9%
Failure to GOA after Destabilization on Approach	9%
Documentation	9%
Normal Checklist	4%
Systems/Radios/Instruments	4%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	57%
Abrupt Aircraft Control	35%
Vertical/Lateral/Speed Deviation	26%
Unstable Approach	17%
Continued Landing after Unstable Approach	13%
Weight & Balance	9%
Operation Outside Aircraft Limitations	9%
Unnecessary Weather Penetration	4%
Brakes/Thrust Reversers/Ground Spoilers	4%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	35%
Monitor/Cross-check	35%
Captain Should Show Leadership	17%
Leadership	17%
In-flight Decision-making/Contingency Management	13%
Workload Management	9%
Communication Environment	9%
FO Is Assertive When Necessary	4%
Automation Management	4%
Evaluation of Plans	4%
Reactive – Contingency Management	4%

Refer to the list of Accident Classification Taxonomy.

See overview of Tail Strike and related ACTF recommendations

Off-Airport Landing/Ditching – Accident Count

2021 Number of accidents: 1 Number of fatalities: 0
2017-2021 Number of accidents: 2 Number of fatalities: 0

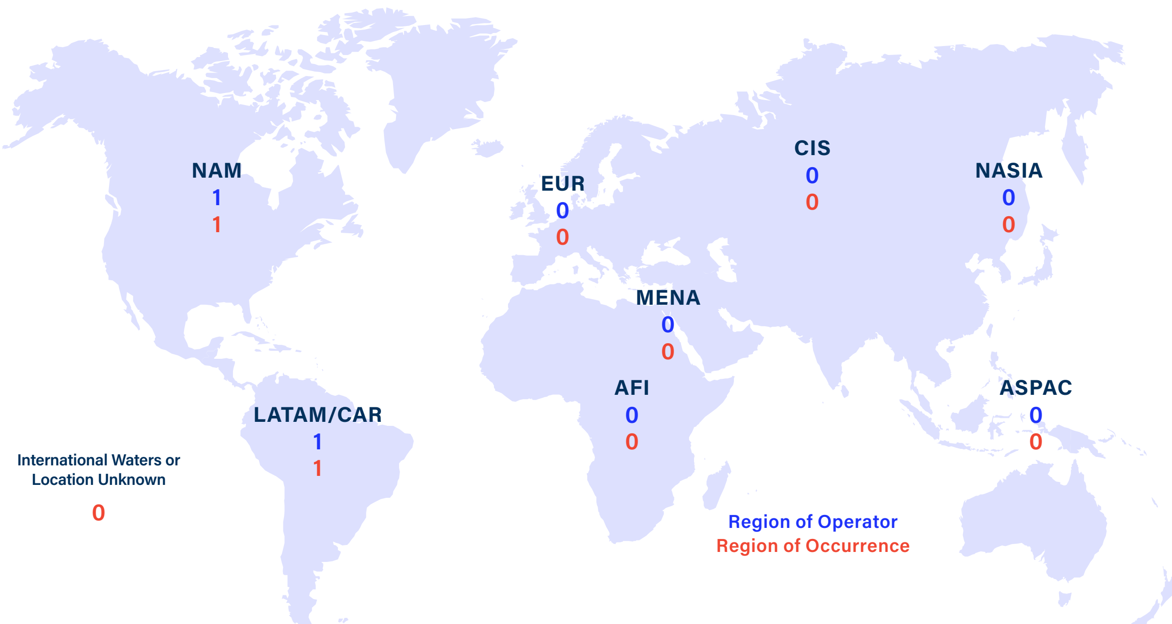
Accident Count % of Total	2021	'17-'21
IATA Member	0%	0%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	100%	50%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	0%	100%	0%	100%	0%
2017-2021	0%	100%	0%	50%	50%

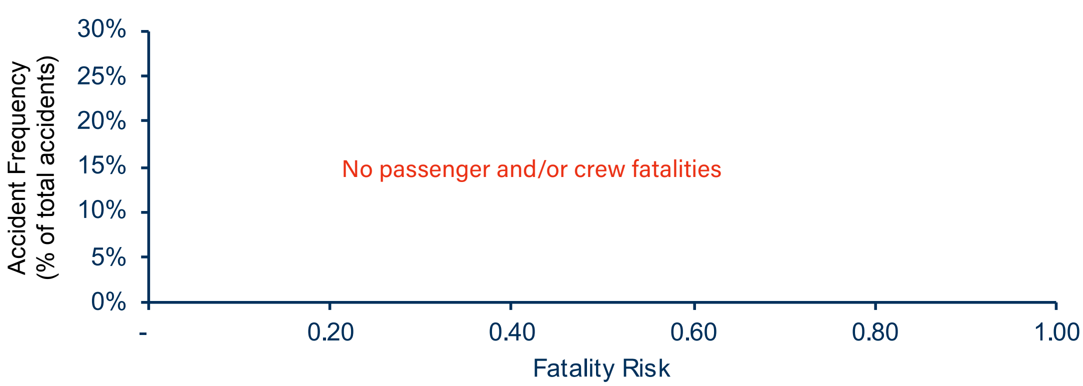
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



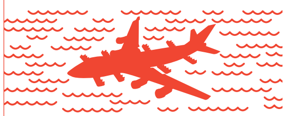
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Off-Airport Landing/Ditching – Accident Rate*

2021 Accident rate: 0.04
2017-2021 Accident rate: 0.01



Accident Rate*	2021	'17-'21
IATA Member	–	–
Fatality Risk**	–	–
Fatal	–	–
Hull Losses	0.04	0.01

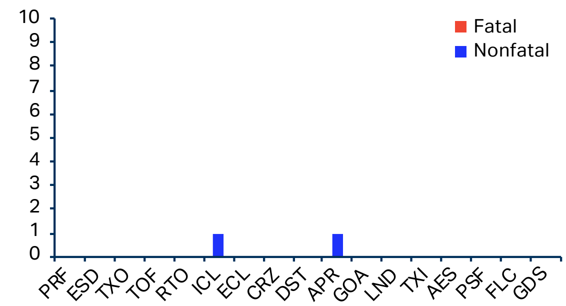
	Jet	Turboprop
2021	**0.04**	**–**
2017-2021	**0.01**	**0.04**

Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

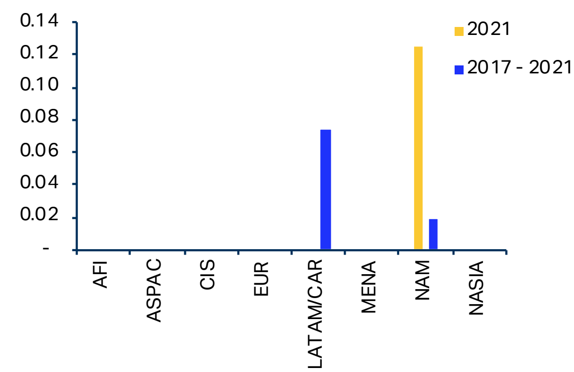
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

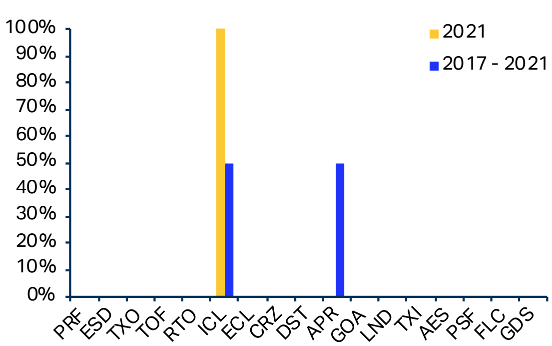
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

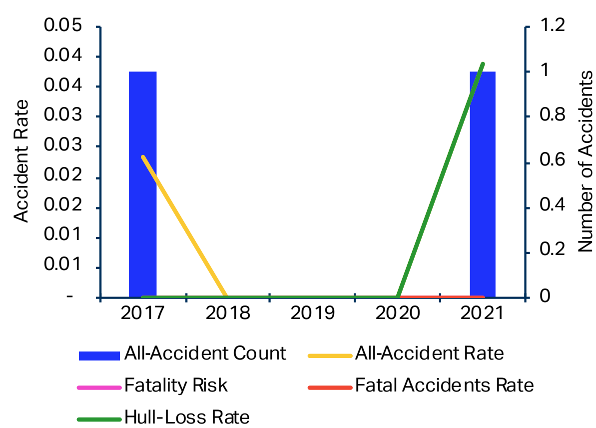
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

Five-Year Trend (2017-2021)

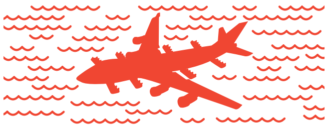
See Annex 1 for the definitions of metrics used



Note: The fatal accident rate and fatality risk share the same value.

Off-Airport Landing/Ditching – Contributing Factors

Off-Airport Landing/Ditching



LATENT CONDITIONS

	Percentage Contribution
Management Decisions, including Regulatory Decisions and Cost Cutting	100%
Regulatory Oversight	100%
Safety Management	100%
Dispatch	50%
Selection Systems	50%
Flight Operations	50%
Maintenance Operations	50%

THREATS

	Percentage Contribution
Maintenance Events	50%
Contained Engine Failure/Powerplant Malfunction	50%

FLIGHT CREW ERRORS

	Percentage Contribution
—	—

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
—	—

COUNTERMEASURES

	Percentage Contribution
In-flight Decision-making/Contingency Management	50%

Refer to the list of Accident Classification Taxonomy.

Runway Collision – Accident Count

2021	Number of accidents: 2	Number of fatalities: 0
2017-2021	Number of accidents: 5	Number of fatalities: 0

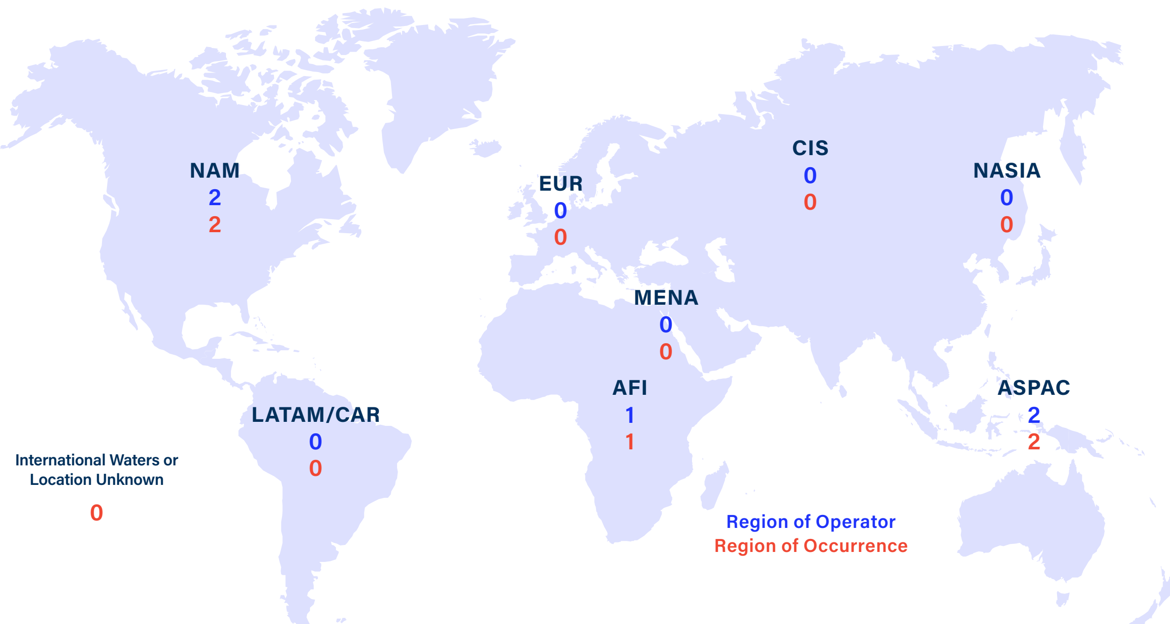
Accident Count % of Total	2021	'17-'21
IATA Member	0%	0%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	0%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	100%	0%	0%	50%	50%
2017-2021	80%	20%	0%	60%	40%

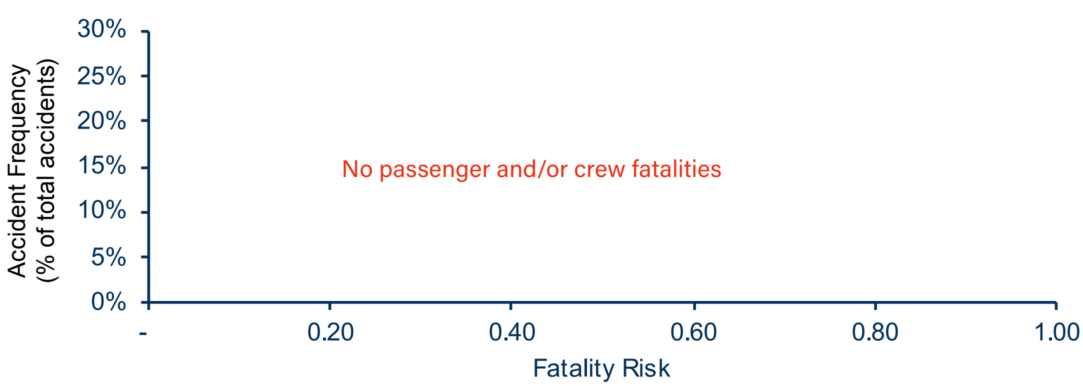
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Runway Collision – Accident Rate*

2021	Accident rate: 0.08
2017-2021	Accident rate: 0.03

Accident Rate*	2021	'17-'21
IATA Member	-	-
Fatality Risk**	-	-
Fatal	-	-
Hull Losses	-	-

	Jet	Turboprop
2021	0.04	0.35
2017-2021	0.02	0.07

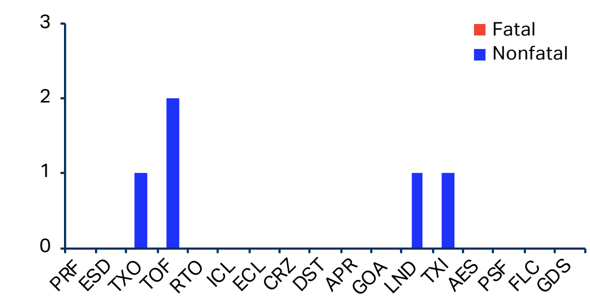
Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights

**Number of full-loss equivalents per 1 million flights

Accidents per Phase of Flight (2017-2021)

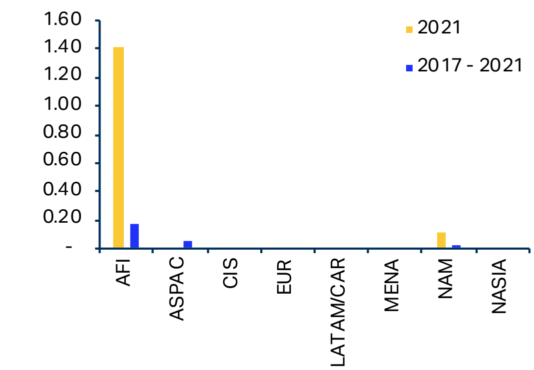
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

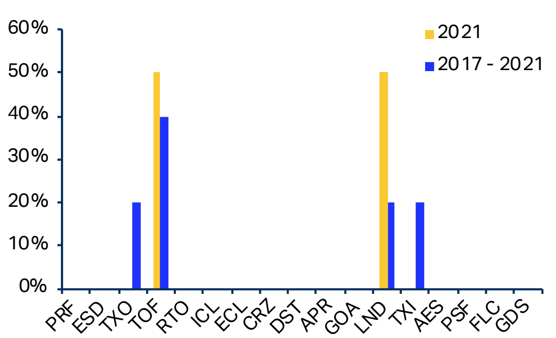
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

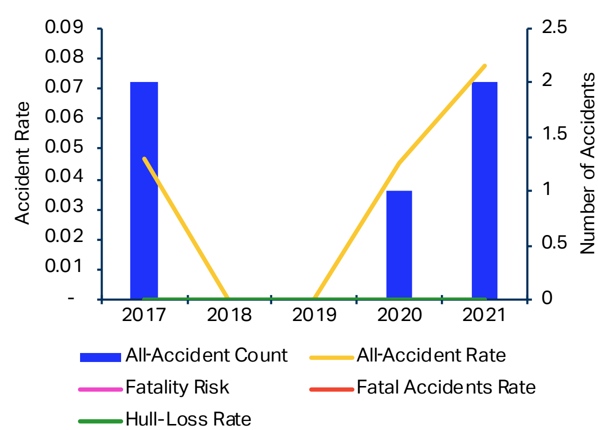
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

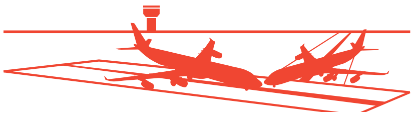
Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



Note: The fatal accident rate, fatality risk and hull loss rate share the same value.

Runway Collision



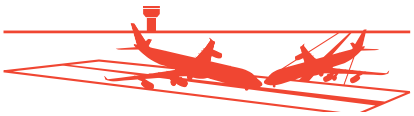
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	60%
Safety Management	40%
Management Decisions, including Regulatory Decisions and Cost Cutting	20%
Flight Operations	20%
Flight Ops: Training Systems	20%
Change Management	20%
Ops Planning & Scheduling	20%

THREATS

	Percentage Contribution
Air Traffic Services	40%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	20%
Airport Facilities	20%
Wildlife/Birds/Foreign Object	20%
Foreign Objects, FOD	20%
Operational Pressure	20%
Traffic	20%

Runway Collision



FLIGHT CREW ERRORS

	Percentage Contribution
Callouts	20%
Ground Navigation	20%
Crew to External Communication	20%
Briefings	20%
SOP Adherence/SOP Cross-verification	20%
Manual Handling/Flight Controls	20%
ATC	20%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Runway/Taxiway Incursion	20%
Loss of Aircraft Control While on the Ground	20%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	40%
Inquiry	20%
Leadership	20%
Taxiway/Runway Management	20%
Monitor/Cross-check	20%
Captain Should Show Leadership	20%

Refer to the list of Accident Classification Taxonomy.

Jet Aircraft Accidents – Accident Count

2021	Number of accidents:	13	Number of fatalities:	62
2017-2021	Number of accidents:	142	Number of fatalities:	775

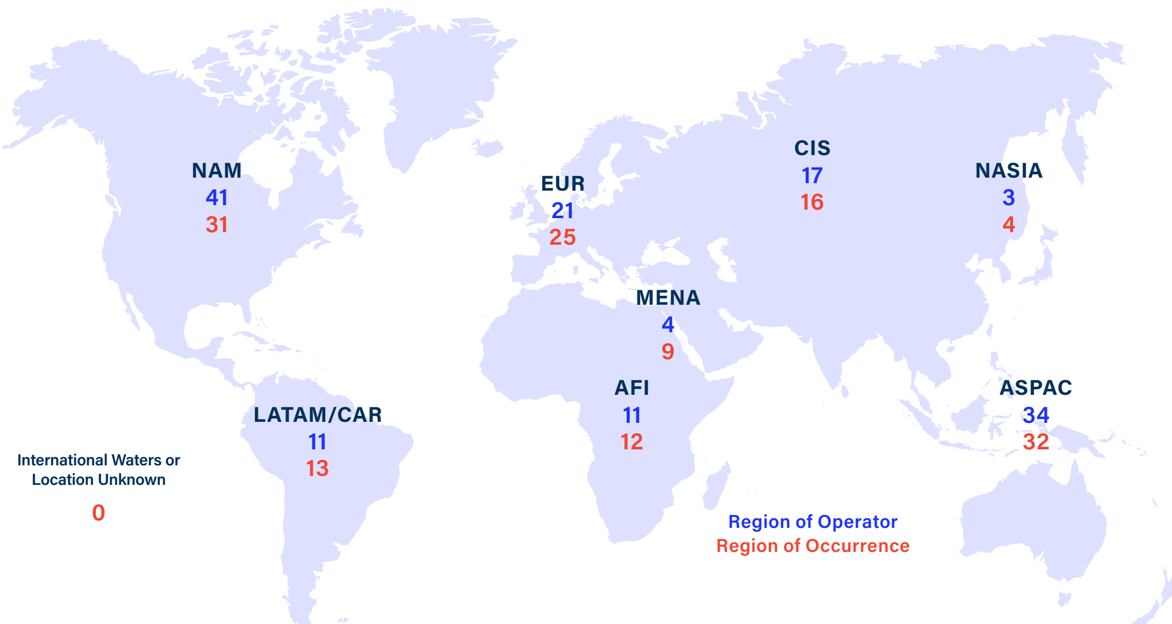
Accident Count % of Total	2021	'17-'21
IATA Member	38%	46%
Full-Loss Equivalents	0%	2%
Fatal	8%	11%
Hull Losses	23%	16%

	Passenger	Cargo	Ferry
2021	46%	54%	0%
2017-2021	83%	17%	0%

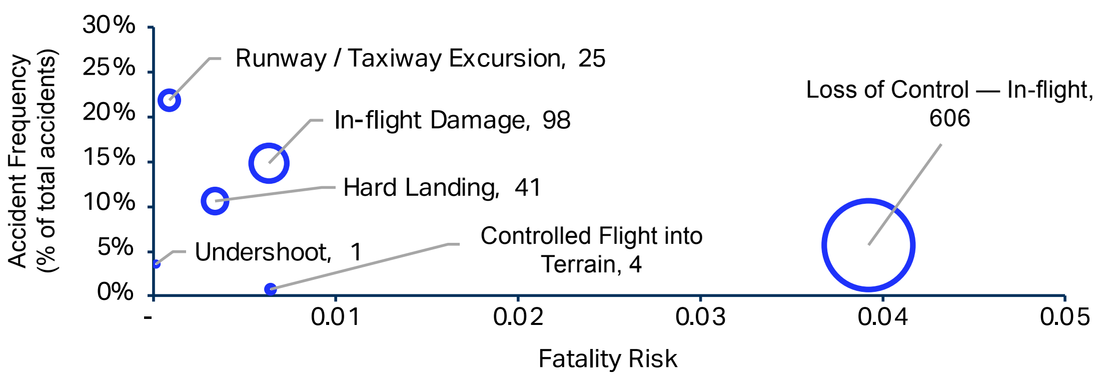
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Jet Aircraft Accidents – Accident Rate*

2021 Accident rate: 0.57
2017-2021 Accident rate: 0.91

Accident Rate*	2021	'17-'21
IATA Member	0.30	0.66
Fatality Risk**	–	0.02
Fatal	0.04	0.10
Hull Losses	0.13	0.15

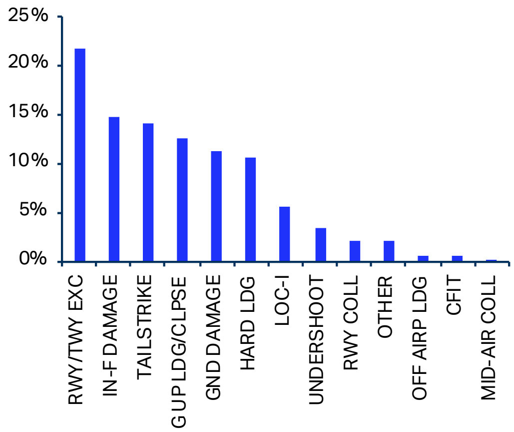
Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights

**Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

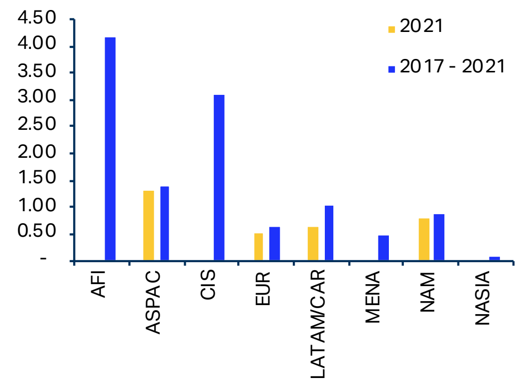
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of [Acronyms/Abbreviations section](#) for full names.

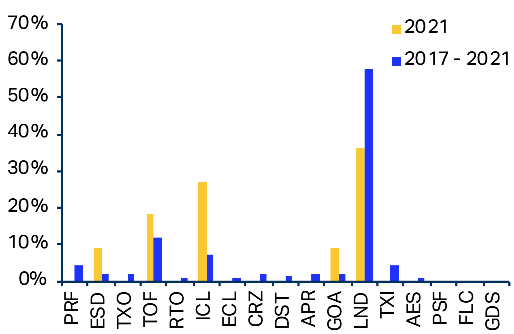
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

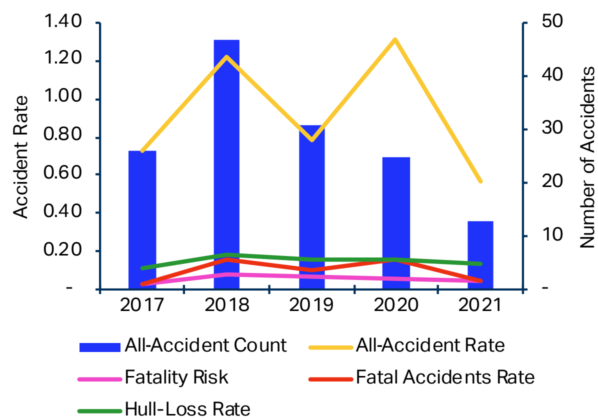
Distribution of accidents as percentage of total



Refer to list of [Phase of Flight definitions](#) for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



Jet Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	35%
Safety Management	34%
Flight Operations	23%
Flight Ops: Training Systems	18%
Maintenance Operations	16%
Flight Ops: SOPs & Checking	15%
Selection Systems	12%
Maintenance Ops: SOPs & Checking	12%
Management Decisions, including Regulatory Decisions and Cost Cutting	8%
Design	7%
Ground Operations	4%
Ground Ops: SOPs & Checking	4%
Technology & Equipment	4%
Dispatch	3%
Change Management	2%
Dispatch Ops: SOPs & Checking	2%
Ground Ops: Training Systems	1%
Flight Watch/Following/Support	1%
Ops Planning & Scheduling	1%
Maintenance Ops: Training Systems	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	42%
SOP Adherence/SOP Cross-verification	34%
Failure to GOA after Destabilization on Approach	17%
Pilot-to-Pilot Communication	13%
Callouts	11%
Failure to GOA after Abnormal Runway Contact	11%
Crew to External Communication	4%
Normal Checklist	4%
Documentation	3%
Automation	3%
Ground Navigation	3%
ATC	3%
Wrong Weight & Balance/Fuel Information	2%
Briefings	2%
Systems/Radios/Instruments	2%
Abnormal Checklist	1%
Maintenance	1%
Incorrect or Missing Log Book Entries	1%
Wrong Altimeter Reference Settings (QNH, QFE)	1%

Jet Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	36%
Wind/Windshear/Gusty Wind	24%
Aircraft Malfunction	23%
Airport Facilities	20%
Maintenance Events	17%
Thunderstorms	16%
Gear/Tire	13%
Poor Visibility/IMC	12%
Contaminated Runway/Taxiway - Poor Braking Action	11%
Operational Pressure	7%
Wildlife/Birds/Foreign Object	6%
Ground Events	6%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	6%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	6%
Optical Illusion/Visual Misperception	5%
Nav Aids	5%
Hydraulic System Failure	4%
Traffic	4%
Ground-based Nav Aid Malfunction or not Available	4%
Fatigue	4%
Lack of Visual Reference	4%
Air Traffic Services	4%
Icing Conditions	4%
Contained Engine Failure/Powerplant Malfunction	4%
Extensive/Uncontained Engine Failure	3%
Dispatch/Paperwork	3%
MEL Item	3%
Foreign Objects, FOD	2%
Brakes	2%
Spatial Disorientation/Somatogravic Illusion	1%
Flight Controls	1%
Airport Perimeter Control/Fencing/Wildlife Control	1%
Fire/Smoke (Cockpit/Cabin/Cargo)	1%
Primary Flight Controls	1%
Structural Failure	1%
Electrical Power Generation Failure	1%
Avionics/Flight Instruments	1%
Secondary Flight Controls	1%
Dangerous Goods	1%
Manuals/Charts/Checklists	1%
Crew Incapacitation	1%

Jet Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	25%
Vertical/Lateral/Speed Deviation	24%
Unstable Approach	20%
Continued Landing after Unstable Approach	18%
Abrupt Aircraft Control	15%
Unnecessary Weather Penetration	13%
Operation Outside Aircraft Limitations	12%
Brakes/Thrust Reversers/Ground Spoilers	7%
Flight Controls/Automation	3%
Weight & Balance	2%
Controlled Flight Towards Terrain	2%
Ramp Movements, Including When Under Marshalling	2%
Loss of Aircraft Control While on the Ground	1%
Engine	1%
Rejected Takeoff after V_1	1%
Systems	1%
Landing Gear	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	30%
Monitor/Cross-check	20%
Leadership	18%
In-flight Decision-making/Contingency Management	17%
Captain Should Show Leadership	15%
Taxiway/Runway Management	10%
Automation Management	7%
Workload Management	7%
Communication Environment	6%
FO Is Assertive When Necessary	6%
Reactive – Contingency Management	5%
Proactive – In-flight Decision-making	4%
Evaluation of Plans	3%
Plans Stated	1%
SOP Briefing/Planning	1%
Inquiry	1%

Refer to the list of Accident Classification Taxonomy.

I-ASC SURVEY
IATA AVIATION SAFETY CULTURE

BECAUSE IT'S SAFER TO KNOW

IMPROVE YOUR SAFETY CULTURE WITH MEASUREABLE, ACTIONABLE AND COMPARABLE RESULTS

Improving your organization's safety culture

Is your safety culture improving? Do you have reliable KPIs to identify gaps and measure progress? How does your safety culture compare with the rest of the industry?

The first industry-wide solution specifically designed to measure safety culture

I-ASC was developed to address the industry's need to measure and demonstrate continuous improvement of safety culture, using a standardized methodology and performance indicators. The electronic survey facilitates an effective SMS and contributes to achieving improved safety performance, by enabling participants to measure and benchmark their safety culture against their peers across the industry using comparable KPIs.

Find out more on how your organization can benefit:
www.iata.org/i-asc

IATA I-ASC

Turboprop Aircraft Accidents – Accident Count

2021	Number of accidents: 13	Number of fatalities: 59
2017-2021	Number of accidents: 79	Number of fatalities: 260

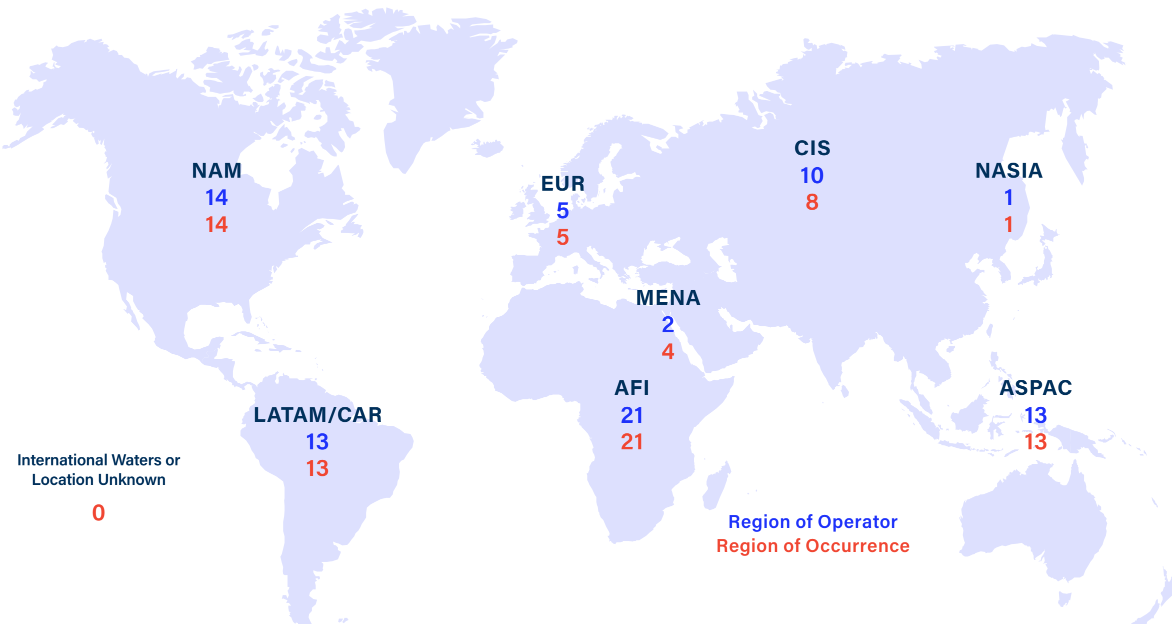
Accident Count % of Total	2021	'17-'21
IATA Member	23%	18%
Full-Loss Equivalents	0%	1%
Fatal	46%	28%
Hull Losses	38%	37%

	Passenger	Cargo	Ferry
2021	77%	23%	0%
2017-2021	68%	32%	0%

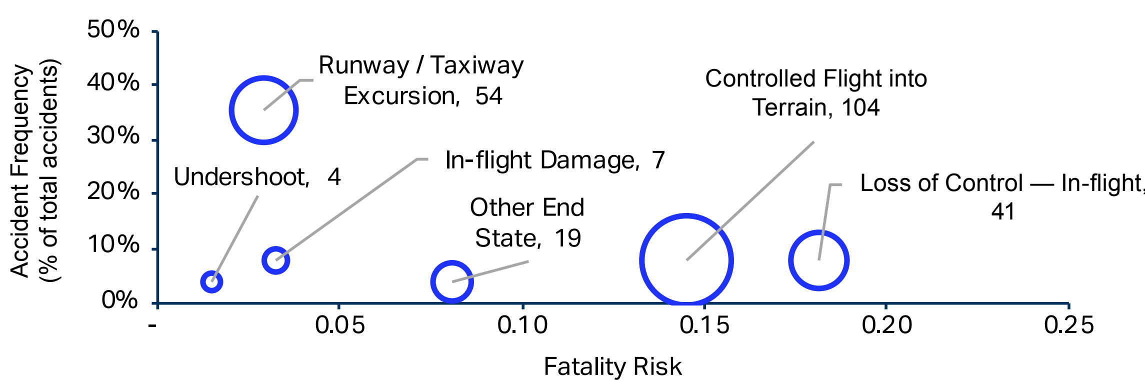
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Turboprop Aircraft Accidents – Accident Rate*

2021	Accident rate: 4.59
2017-2021	Accident rate: 2.93

Accident Rate*	2021	'17-'21
IATA Member	2.45	1.91
Fatality Risk**	–	0.04
Fatal	2.12	0.81
Hull Losses	1.77	1.07

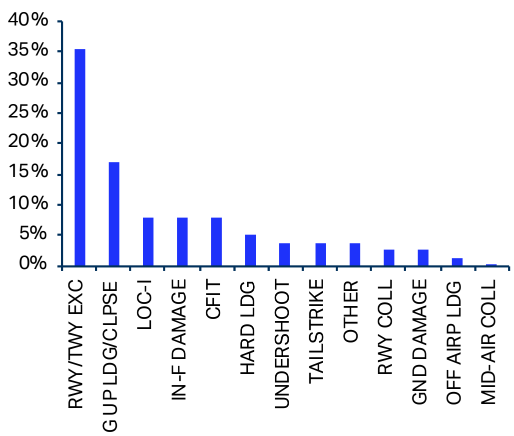
Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights

**Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

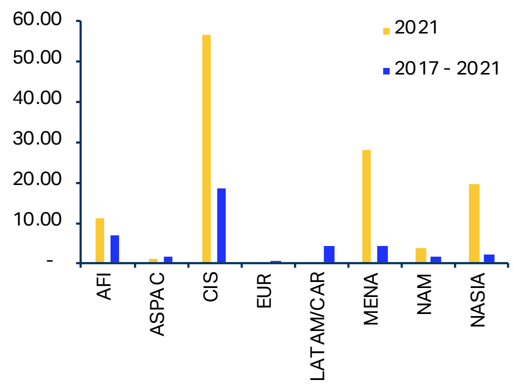
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of [Acronyms/Abbreviations section](#) for full names.

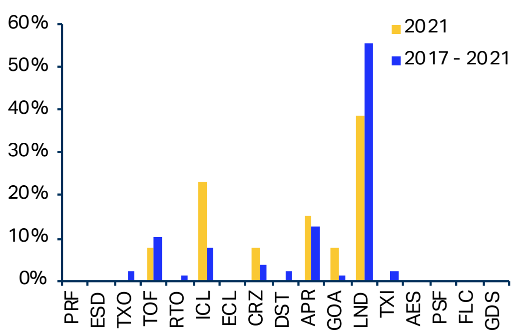
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

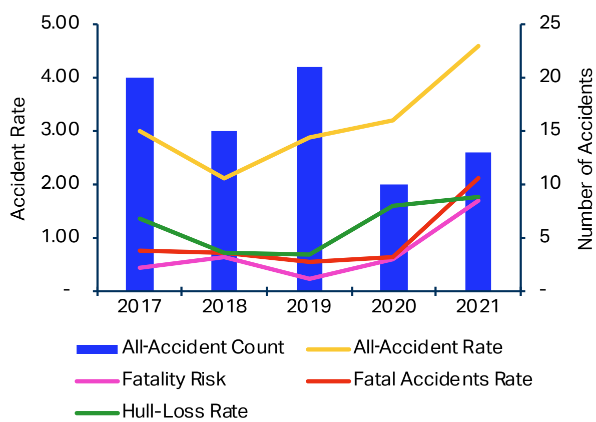
Distribution of accidents as percentage of total



Refer to list of [Phase of Flight definitions](#) for full names.

Five-Year Trend (2017-2021)

See Annex 1 for the definitions of metrics used



Turboprop Aircraft Accidents – Contributing Factors

Turboprop Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	34%
Safety Management	33%
Flight Operations	24%
Selection Systems	19%
Management Decisions, including Regulatory Decisions and Cost Cutting	19%
Flight Ops: Training Systems	11%
Flight Ops: SOPs & Checking	10%
Maintenance Operations	9%
Maintenance Ops: SOPs & Checking	8%
Ground Operations	5%
Ground Ops: SOPs & Checking	5%
Dispatch	5%
Ops Planning & Scheduling	4%
Change Management	3%
Flight Watch/Following/Support	3%
Ground Ops: Training Systems	3%
Design	3%
Technology & Equipment	3%
Cabin Operations	1%
Dispatch Ops: SOPs & Checking	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	28%
SOP Adherence/SOP Cross-verification	25%
Callouts	11%
Failure to GOA after Destabilization on Approach	10%
Failure to GOA after Abnormal Runway Contact	6%
Abnormal Checklist	4%
Pilot-to-Pilot Communication	4%
Documentation	4%
Briefings	4%
Wrong Weight & Balance/Fuel Information	4%
Normal Checklist	3%
ATC	3%
Crew to External Communication	3%
Automation	1%
Ground Navigation	1%
Systems/Radios/Instruments	1%

Turboprop Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	33%
Aircraft Malfunction	27%
Poor Visibility/IMC	20%
Wind/Windshear/Gusty Wind	16%
Airport Facilities	15%
Thunderstorms	13%
Gear/Tire	11%
Contained Engine Failure/Powerplant Malfunction	8%
Terrain/Obstacles	8%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	8%
Operational Pressure	8%
Maintenance Events	6%
Lack of Visual Reference	6%
Ground-based Nav Aid Malfunction or not Available	5%
Contaminated Runway/Taxiway - Poor Braking Action	5%
Nav Aids	5%
Ground Events	5%
Icing Conditions	4%
Dispatch/Paperwork	4%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	4%
Fatigue	4%
Air Traffic Services	4%
Wildlife/Birds/Foreign Object	4%
Optical Illusion/Visual Misperception	3%
Airport Perimeter Control/Fencing/Wildlife Control	3%
Fire/Smoke (Cockpit/Cabin/Cargo)	1%
Brakes	1%
Electrical Power Generation Failure	1%
Traffic	1%
Crew Incapacitation	1%
Hydraulic System Failure	1%
Foreign Objects, FOD	1%

Turboprop Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	18%
Abrupt Aircraft Control	16%
Unnecessary Weather Penetration	16%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	14%
Unstable Approach	11%
Operation Outside Aircraft Limitations	10%
Controlled Flight Towards Terrain	9%
Continued Landing after Unstable Approach	9%
Loss of Aircraft Control While on the Ground	8%
Landing Gear	4%
Engine	4%
Brakes/Thrust Reversers/Ground Spoilers	4%
Flight Controls/Automation	4%
Systems	3%
Weight & Balance	1%
Unauthorized Airspace Penetration	1%
Rejected Takeoff after V_1	1%
Runway/Taxiway Incursion	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	24%
Monitor/Cross-check	18%
In-flight Decision-making/Contingency Management	15%
Leadership	13%
Captain Should Show Leadership	13%
FO Is Assertive When Necessary	6%
Communication Environment	5%
Workload Management	4%
Proactive – In-flight Decision-making	4%
Taxiway/Runway Management	4%
Reactive – Contingency Management	3%
Evaluation of Plans	3%
Inquiry	1%
Automation Management	1%

Refer to the list of Accident Classification Taxonomy.

6

In-Depth Regional Accident Analysis

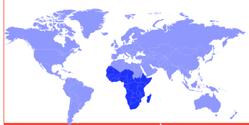
Following the same model as the in-depth analysis by accident category presented in Section 5, this chapter presents an overview of occurrences and their contributing factors broken down by the region of the involved operator(s). The purpose of this chapter is to identify issues that operators located in the same region may share to develop adequate prevention strategies.

Note: IATA determines the accident region based on the operator's "home" country as specified in the operator's Air Operator Certificate (AOC). For example, if a Canadian-registered operator has an accident in Europe, this accident is considered a North American accident. For a complete list of countries assigned per region, consult Annex 1.

The data found in Section 6 can be viewed in the IATA Reader Interactive Microsoft file found here. The interactive file, which includes data from Section 6, can be found in tab 8: Accident per Operator Region. You can also access this tab from the Excel home page, tab 1.

Africa Aircraft Accidents – Accident Count

2021	Number of accidents:	4	Number of fatalities:	18
2017-2021	Number of accidents:	32	Number of fatalities:	216



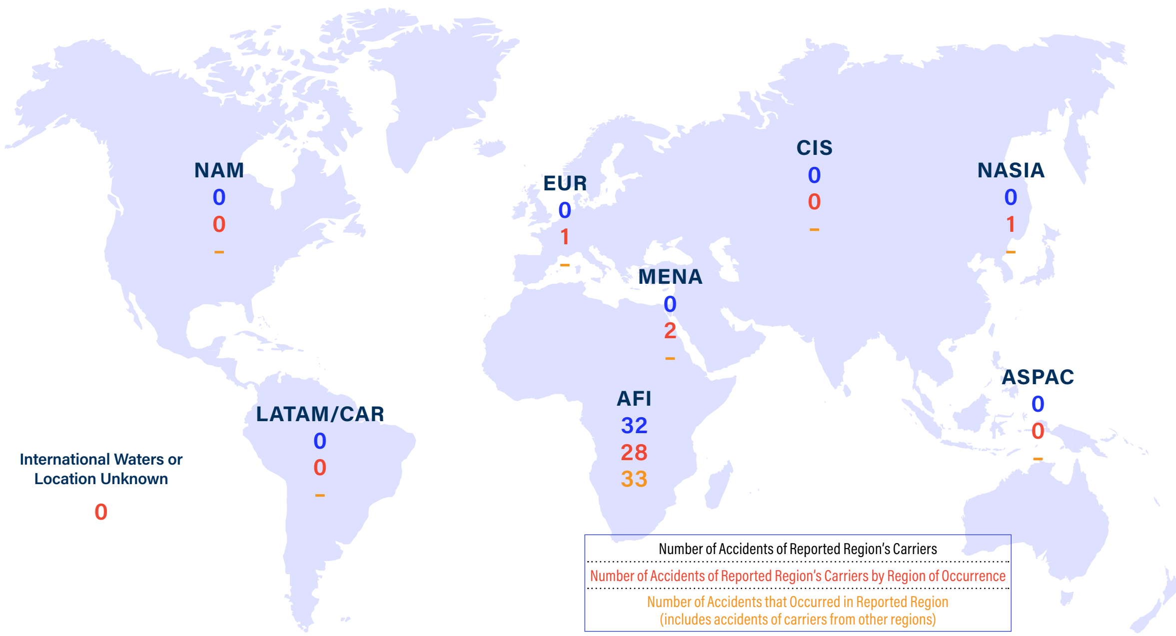
Accident Count % of Total	2021	'17-'21
IATA Member	0%	25%
Full-Loss Equivalents	64%	26%
Fatal	75%	28%
Hull Losses	50%	41%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	75%	25%	0%	0%	100%
2017-2021	59%	41%	0%	34%	66%

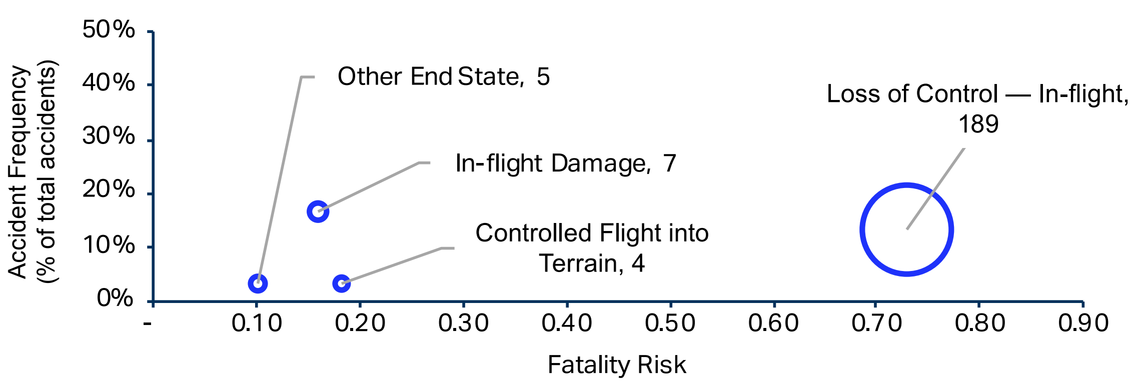
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



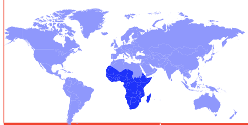
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Africa Aircraft Accidents – Accident Rate*

2021 Accident rate: 5.66
2017-2021 Accident rate: 5.83



Accident Rate*	2021	'17-'21
IATA Member	–	3.03
Fatality Risk**	3.62	1.54
Fatal	4.25	1.64
Hull Losses	2.83	2.37

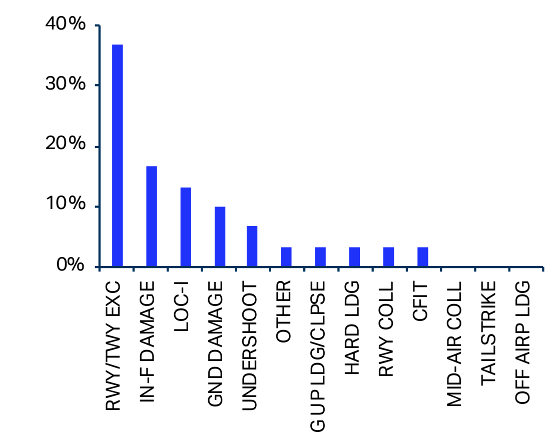
	Jet	Turboprop	
2021	–	11.19	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	4.16	7.39	

*Total number of accidents calculated per 1 million flights

**Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

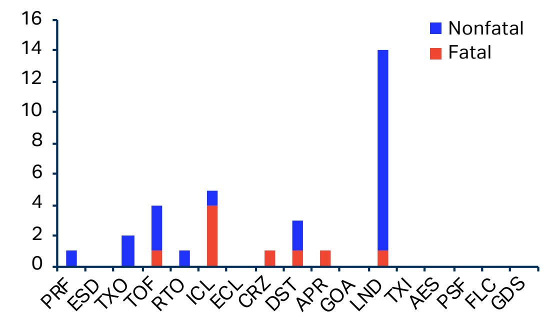
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

Accidents per Phase of Flight (2017-2021)

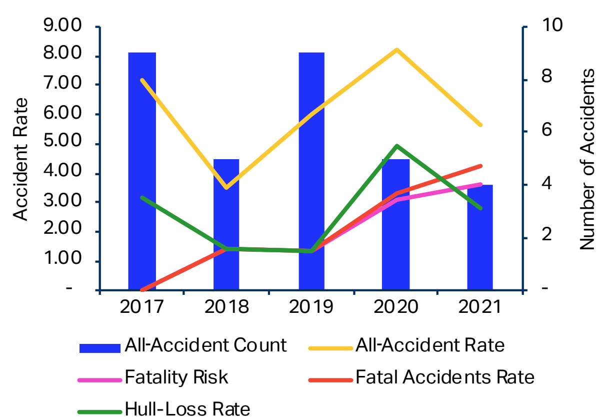
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

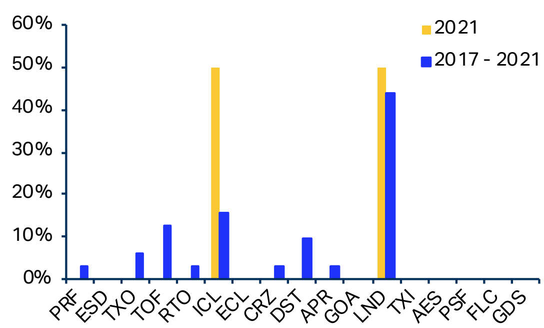
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

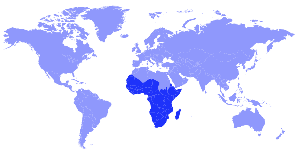
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

AFI Aircraft Accidents – Contributing Factors

Africa Aircraft Accidents



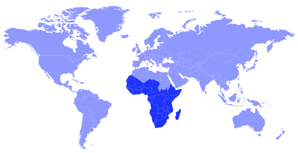
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	38%
Safety Management	38%
Management Decisions, including Regulatory Decisions and Cost Cutting	28%
Selection Systems	16%
Dispatch	9%
Flight Operations	9%
Change Management	9%
Ground Operations	6%
Design	6%
Maintenance Operations	6%
Flight Ops: Training Systems	6%
Flight Ops: SOPs & Checking	6%
Ground Ops: SOPs & Checking	6%
Flight Watch/Following/Support	3%
Ops Planning & Scheduling	3%
Technology & Equipment	3%
Maintenance Ops: SOPs & Checking	3%
Dispatch Ops: SOPs & Checking	3%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	16%
Wrong Weight & Balance/Fuel Information	9%
Documentation	9%
ATC	6%
Crew to External Communication	6%
Abnormal Checklist	3%
SOP Adherence/SOP Cross-verification	3%
Ground Navigation	3%
Automation	3%

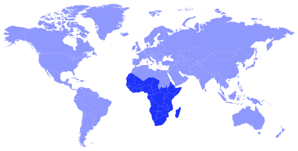
Africa Aircraft Accidents



THREATS

	Percentage Contribution
Airport Facilities	19%
Meteorology	19%
Aircraft Malfunction	16%
Thunderstorms	13%
Wildlife/Birds/Foreign Object	13%
Wind/Windshear/Gusty Wind	13%
Nav Aids	9%
Maintenance Events	9%
Operational Pressure	6%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	6%
Ground-based Nav Aid Malfunction or not Available	6%
Gear/Tire	6%
Poor Visibility/IMC	6%
Dispatch/Paperwork	6%
Ground Events	6%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	6%
Contained Engine Failure/Powerplant Malfunction	6%
Extensive/Uncontained Engine Failure	3%
Hydraulic System Failure	3%
Dangerous Goods	3%
Contaminated Runway/Taxiway - Poor Braking Action	3%
Terrain/Obstacles	3%
Lack of Visual Reference	3%
Foreign Objects, FOD	3%
Airport Perimeter Control/Fencing/Wildlife Control	3%
Brakes	3%

Africa Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Unnecessary Weather Penetration	16%
Loss of Aircraft Control While on the Ground	9%
Operation Outside Aircraft Limitations	6%
Continued Landing after Unstable Approach	6%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	6%
Vertical/Lateral/Speed Deviation	6%
Unstable Approach	3%
Ramp Movements, Including When Under Marshalling	3%
Weight & Balance	3%
Flight Controls/Automation	3%
Controlled Flight Towards Terrain	3%

COUNTERMEASURES

	Percentage Contribution
Leadership	13%
Overall Crew Performance	13%
In-flight Decision-making/Contingency Management	13%
Captain Should Show Leadership	13%
Monitor/Cross-check	9%
Taxiway/Runway Management	9%
Automation Management	6%
Workload Management	6%
Reactive – Contingency Management	3%
Proactive – In-flight Decision-making	3%

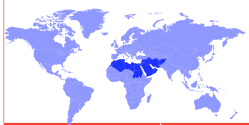
Back to Managing Safety in Aviation - Africa and Middle East section

> The lessons learned in aviation safety are often gained at great expense in life and hardware; ignoring these lessons is to disrespect the expense at which they were learned.

Martin Plumleigh,
SMS Manager,
Boeing Digital Aviation Solutions

Middle East & North Africa Aircraft Accidents – Accident Count

2021	Number of accidents:	1	Number of fatalities:	0
2017-2021	Number of accidents:	6	Number of fatalities:	66



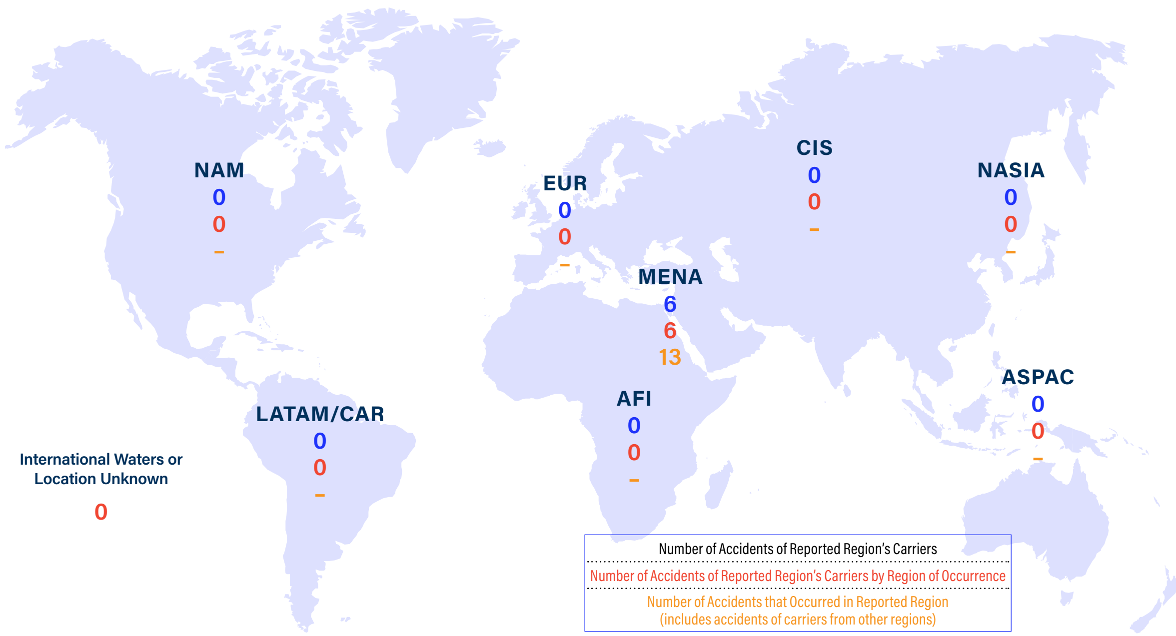
Accident Count % of Total	2021	'17-'21
IATA Member	100%	50%
Full-Loss Equivalents	0%	17%
Fatal	0%	17%
Hull Losses	0%	17%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	100%	0%	0%	0%	100%
2017-2021	100%	0%	0%	67%	33%

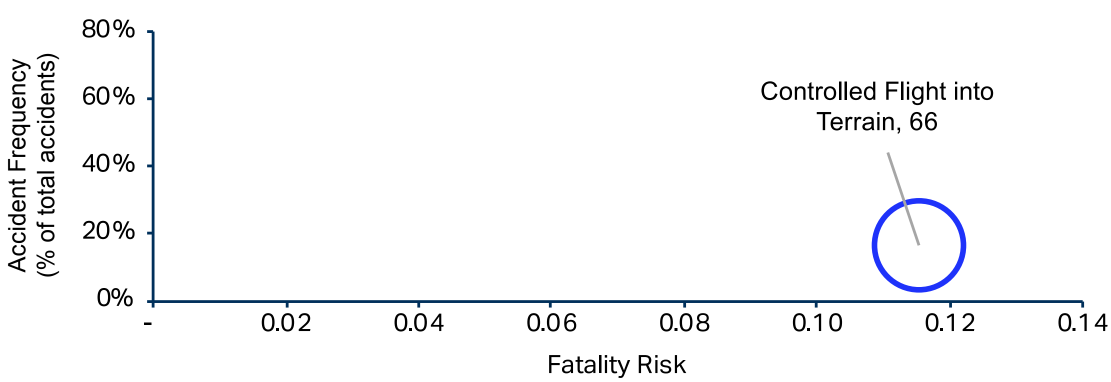
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



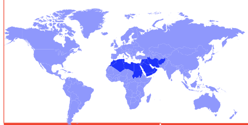
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Middle East & North Africa Aircraft Accidents – Accident Rate*

2021 Accident rate: 0.90
2017-2021 Accident rate: 0.69



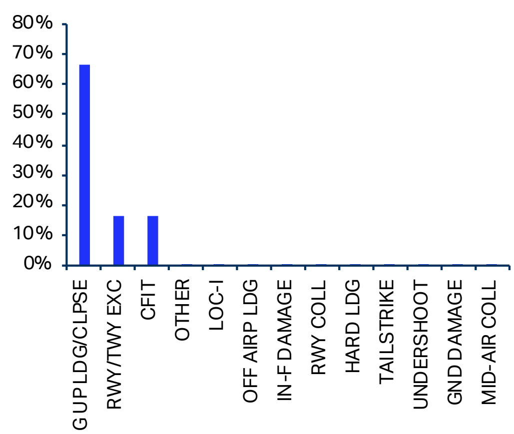
Accident Rate*	2021	'17-'21
IATA Member	1.09	043
Fatality Risk**	–	0.12
Fatal	–	0.12
Hull Losses	–	0.12

	Jet	Turboprop	
2021	–	28.53	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	0.49	4.46	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

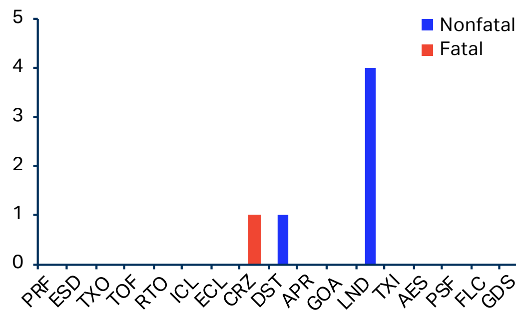
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

Accidents per Phase of Flight (2017-2021)

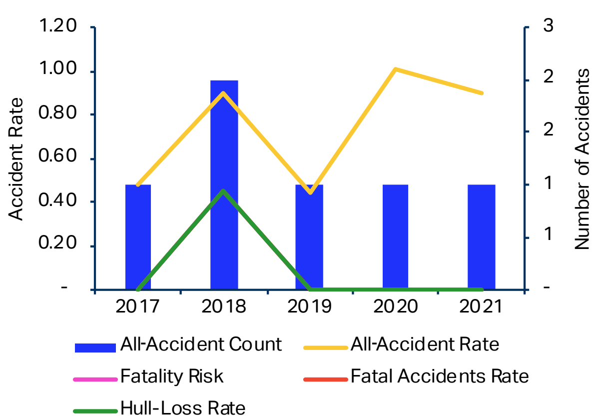
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

Regional Accident Rate (2017-2021)

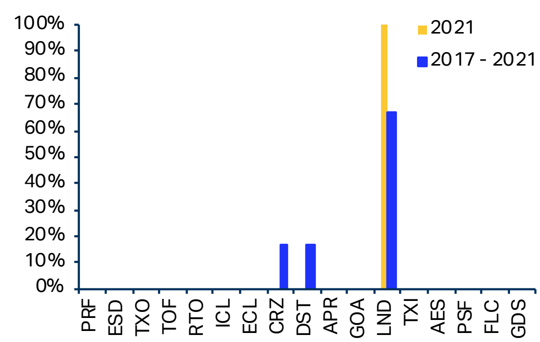
Accident per million sectors



Note: The fatal accident rate, fatality risk and hull loss rate share the same value.

Accidents per Phase of Flight (2017-2021)

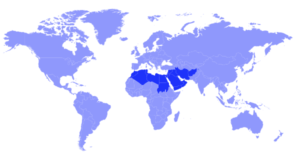
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

MENA Aircraft Accidents – Contributing Factors

Middle East & North Africa Aircraft Accidents



LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	50%
Design	33%
Flight Operations	33%
Safety Management	33%
Maintenance Ops: SOPs & Checking	33%
Maintenance Operations	33%
Selection Systems	17%
Flight Ops: SOPs & Checking	17%

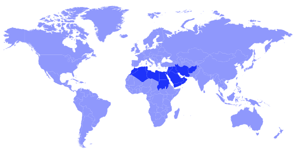
THREATS

	Percentage Contribution
Gear/Tire	50%
Aircraft Malfunction	50%
Maintenance Events	33%
Poor Visibility/IMC	17%
Meteorology	17%
Wind/Windshear/Gusty Wind	17%
Hydraulic System Failure	17%
Terrain/Obstacles	17%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	33%
Callouts	17%
Failure to GOA after Destabilization on Approach	17%
Briefings	17%
SOP Adherence/SOP Cross-verification	17%

Middle East & North Africa Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Unstable Approach	17%
Controlled Flight Towards Terrain	17%
Vertical/Lateral/Speed Deviation	17%
Engine	17%
Continued Landing after Unstable Approach	17%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	17%
Abrupt Aircraft Control	17%
Operation Outside Aircraft Limitations	17%

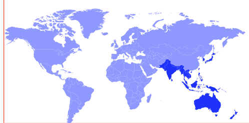
COUNTERMEASURES

	Percentage Contribution
Communication Environment	17%
Overall Crew Performance	17%
Leadership	17%
FO Is Assertive When Necessary	17%
Reactive – Contingency Management	17%
Monitor/Cross-check	17%
In-flight Decision-making/Contingency Management	17%
Captain Should Show Leadership	17%

Back to Managing Safety in Aviation – Africa and Middle East section

Asia/Pacific Aircraft Accidents – Accident Count

2021	Number of accidents: 5	Number of fatalities: 62
2017-2021	Number of accidents: 47	Number of fatalities: 423



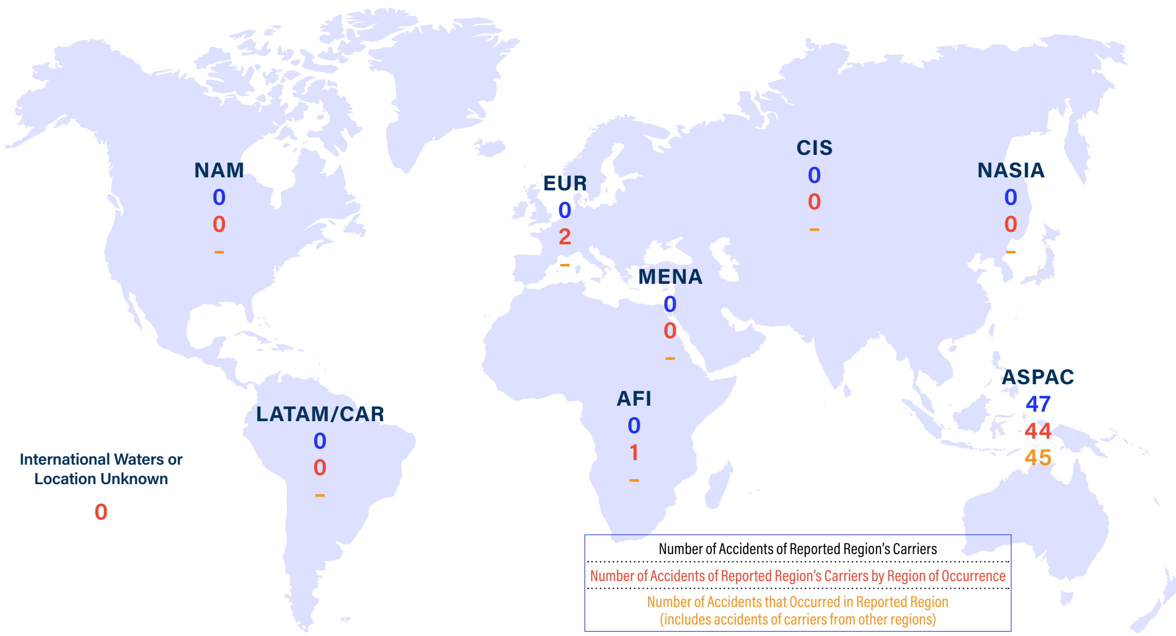
Accident Count % of Total	2021	'17-'21
IATA Member	40%	38%
Full-Loss Equivalents	20%	10%
Fatal	20%	15%
Hull Losses	20%	19%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	40%	60%	0%	80%	20%
2017-2021	85%	15%	0%	72%	28%

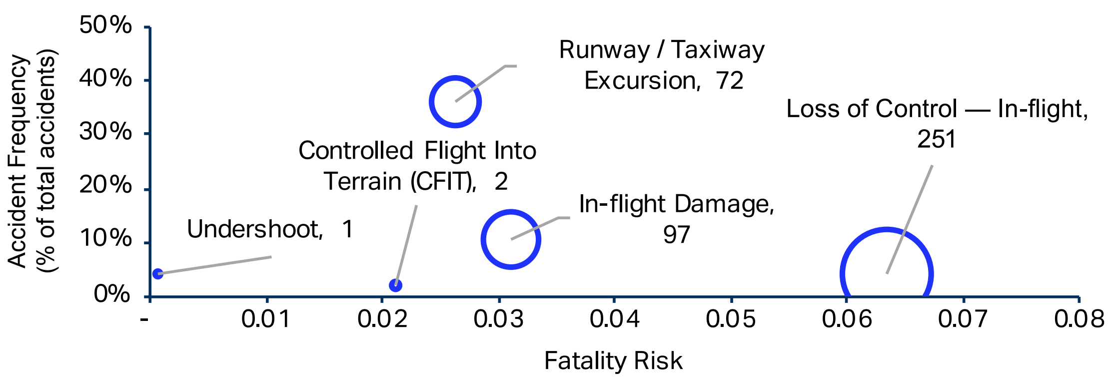
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



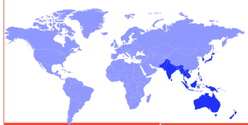
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Asia/Pacific Aircraft Accidents – Accident Rate*

2021 Accident rate: 1.29
2017-2021 Accident rate: 1.49



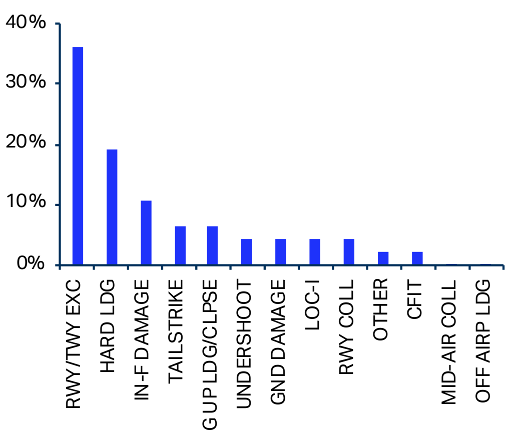
Accident Rate*	2021	'17-'21
IATA Member	0.84	1.24
Fatality Risk**	0.26	0.14
Fatal	0.26	0.22
Hull Losses	0.26	0.29

	Jet	Turboprop	
2021	1.33	1.14	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	1.39	1.82	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

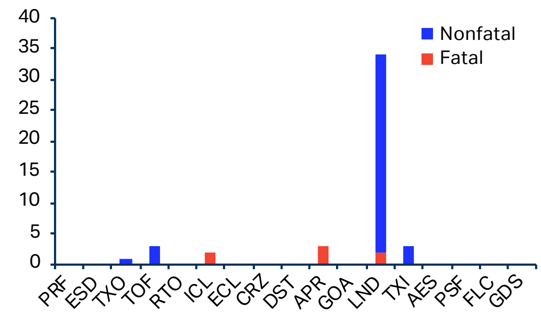
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

Accidents per Phase of Flight (2017-2021)

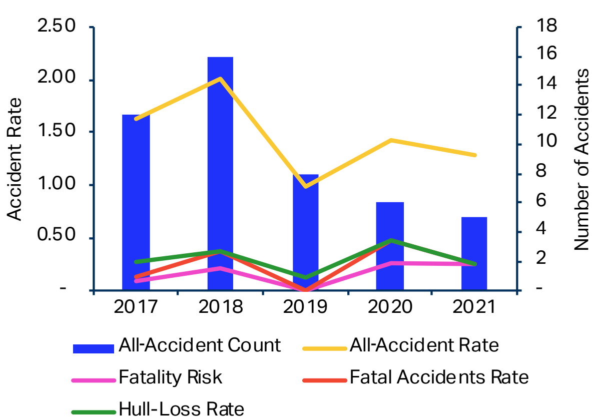
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

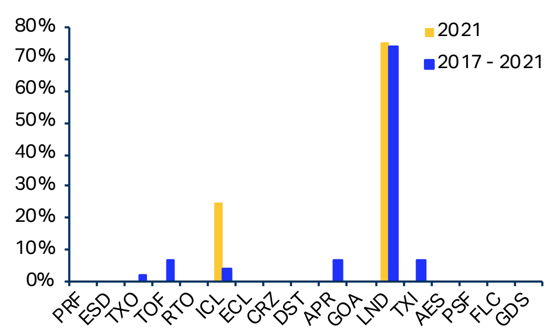
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

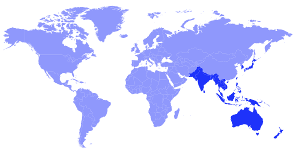
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

ASPAC Aircraft Accidents – Contributing Factors

Asia/Pacific Aircraft Accidents



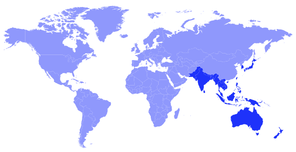
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	55%
Safety Management	51%
Flight Operations	36%
Flight Ops: Training Systems	34%
Maintenance Operations	17%
Flight Ops: SOPs & Checking	17%
Management Decisions, including Regulatory Decisions and Cost Cutting	15%
Selection Systems	13%
Maintenance Ops: SOPs & Checking	13%
Change Management	4%
Technology & Equipment	4%
Flight Watch/Following/Support	2%
Maintenance Ops: Training Systems	2%
Design	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	57%
SOP Adherence/SOP Cross-verification	49%
Failure to GOA after Destabilization on Approach	34%
Callouts	28%
Pilot-to-Pilot Communication	21%
Crew to External Communication	11%
Ground Navigation	9%
ATC	6%
Briefings	4%
Normal Checklist	4%
Maintenance	4%
Automation	2%
Abnormal Checklist	2%

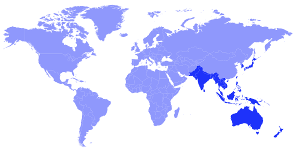
Asia/Pacific Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	40%
Thunderstorms	26%
Airport Facilities	26%
Aircraft Malfunction	19%
Poor Visibility/IMC	19%
Wind/Windshear/Gusty Wind	19%
Maintenance Events	15%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	13%
Contaminated Runway/Taxiway - Poor Braking Action	11%
Optical Illusion/Visual Misperception	11%
Air Traffic Services	9%
Lack of Visual Reference	9%
Gear/Tire	9%
Nav Aids	6%
Ground-based Nav Aid Malfunction or not Available	6%
Operational Pressure	6%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	6%
Crew Incapacitation	4%
Foreign Objects, FOD	4%
Contained Engine Failure/Powerplant Malfunction	4%
Wildlife/Birds/Foreign Object	4%
Traffic	4%
Terrain/Obstacles	4%
Fatigue	4%
Avionics/Flight Instruments	2%
Manuals/Charts/Checklists	2%
Dispatch/Paperwork	2%
Fire/Smoke (Cockpit/Cabin/Cargo)	2%

Asia/Pacific Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	45%
Unstable Approach	34%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	34%
Continued Landing after Unstable Approach	32%
Abrupt Aircraft Control	23%
Unnecessary Weather Penetration	19%
Operation Outside Aircraft Limitations	13%
Controlled Flight Towards Terrain	9%
Brakes/Thrust Reversers/Ground Spoilers	9%
Flight Controls/Automation	6%
Ramp Movements, Including When Under Marshalling	4%
Engine	4%
Runway/Taxiway Incursion	2%
Unauthorized Airspace Penetration	2%
Landing Gear	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	47%
Monitor/Cross-check	34%
Leadership	26%
Captain Should Show Leadership	21%
In-flight Decision-making/Contingency Management	21%
Taxiway/Runway Management	17%
FO Is Assertive When Necessary	13%
Workload Management	11%
Automation Management	9%
Reactive – Contingency Management	6%
Proactive – In-flight Decision-making	6%
Communication Environment	6%
Inquiry	4%
SOP Briefing/Planning	2%
Plans Stated	2%
Evaluation of Plans	2%

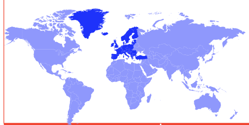
Back to Managing Safety in Aviation - Asia/Pacific section

"Operational briefings should be based on threats with a share mental model between crews and with a capacity of thinking and acting."

Captain Jorge Robles,
F/O Airbus 330,
Avianca Cargo - Tampa

Europe Aircraft Accidents – Accident Count

2021	Number of accidents: 2	Number of fatalities: 0
2017-2021	Number of accidents: 26	Number of fatalities: 7



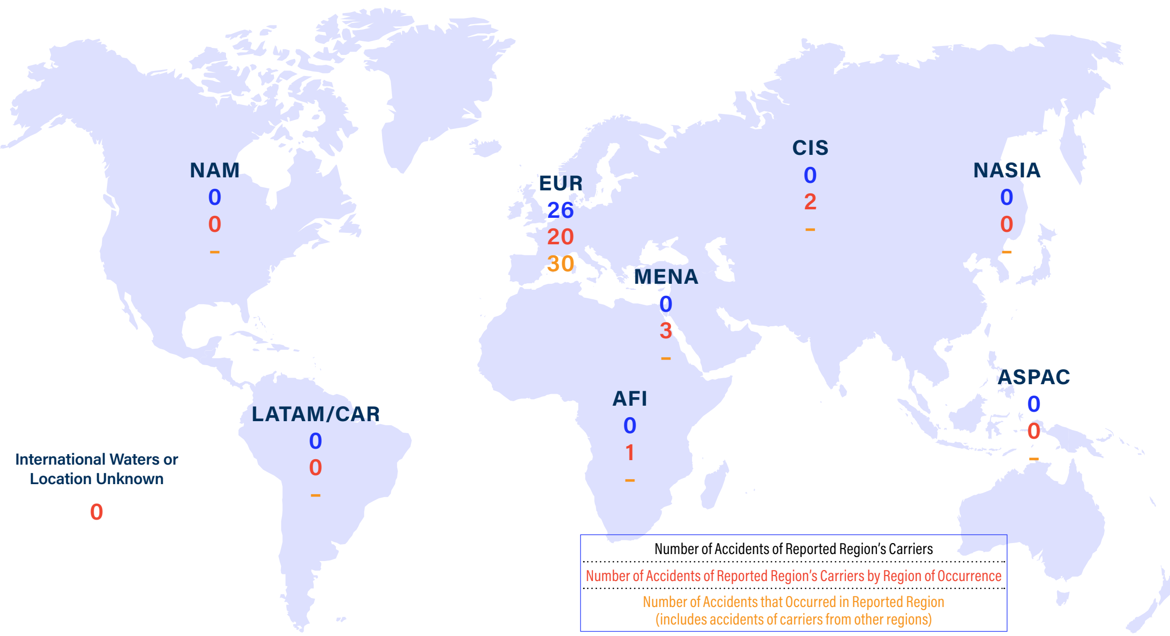
Accident Count % of Total	2021	'17-'21
IATA Member	50%	62%
Full-Loss Equivalents	0%	4%
Fatal	0%	8%
Hull Losses	50%	12%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	50%	50%	0%	100%	0%
2017-2021	85%	15%	0%	81%	19%

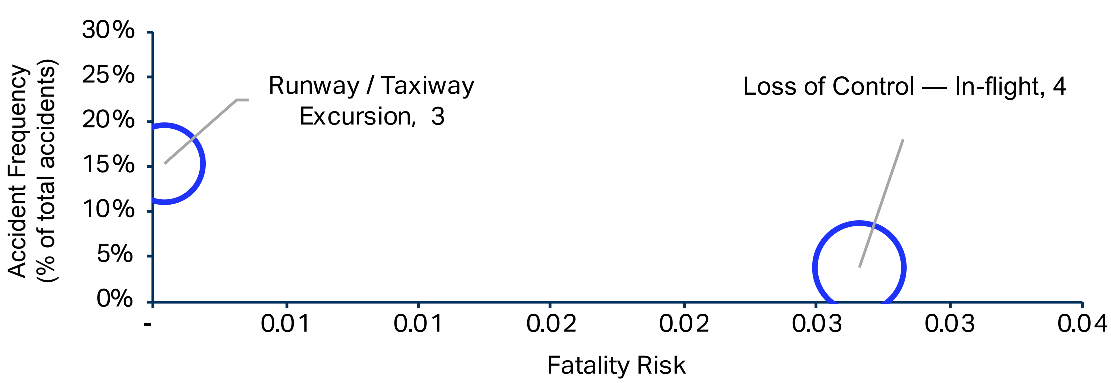
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



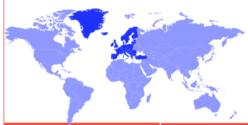
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Europe Aircraft Accidents – Accident Rate*

2021 Accident rate: 0.46
2017-2021 Accident rate: 0.69



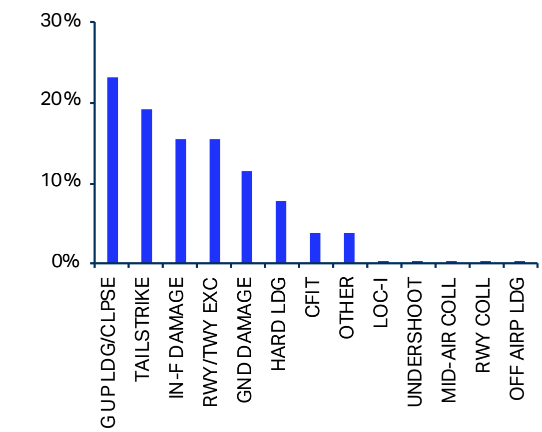
Accident Rate*	2021	'17-'21
IATA Member	0.36	0.76
Fatality Risk**	–	0.03
Fatal	–	0.05
Hull Losses	0.23	0.08

	Jet	Turboprop	
2021	0.53	–	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	0.65	0.92	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

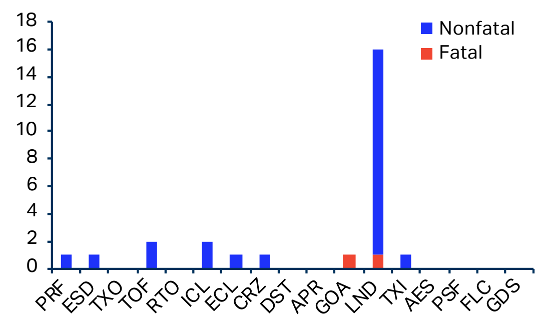
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

Accidents per Phase of Flight (2017-2021)

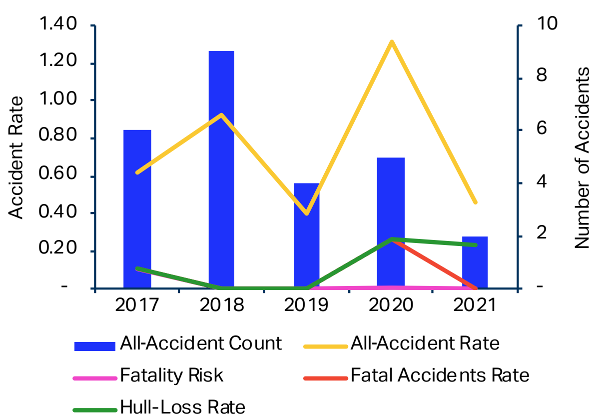
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

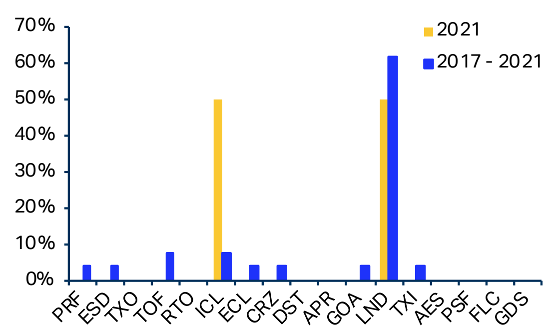
Regional Accident Rate (2017-2021)

Accident per million sectors



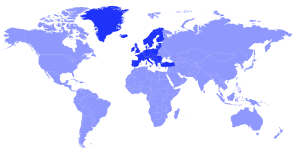
Accidents per Phase of Flight (2017-2021)

Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

Europe Aircraft Accidents



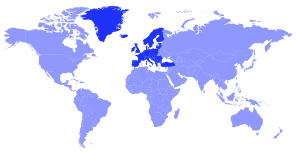
LATENT CONDITIONS

	Percentage Contribution
Safety Management	19%
Regulatory Oversight	19%
Flight Operations	19%
Maintenance Ops: SOPs & Checking	15%
Maintenance Operations	15%
Selection Systems	15%
Flight Ops: Training Systems	15%
Flight Ops: SOPs & Checking	15%
Design	12%
Management Decisions, including Regulatory Decisions and Cost Cutting	8%
Ground Operations	8%
Ground Ops: SOPs & Checking	8%
Technology & Equipment	4%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	38%
Manual Handling/Flight Controls	35%
Callouts	15%
Failure to GOA after Destabilization on Approach	12%
Pilot-to-Pilot Communication	12%
Automation	8%
Documentation	4%
Crew to External Communication	4%
Incorrect or Missing Log Book Entries	4%
ATC	4%
Briefings	4%

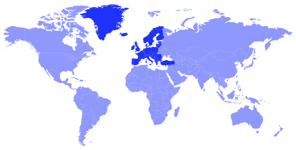
Europe Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	38%
Aircraft Malfunction	31%
Wind/Windshear/Gusty Wind	27%
Gear/Tire	19%
Poor Visibility/IMC	19%
Airport Facilities	12%
Maintenance Events	12%
Fatigue	12%
Operational Pressure	8%
Contaminated Runway/Taxiway - Poor Braking Action	8%
Air Traffic Services	8%
Ground Events	4%
Hydraulic System Failure	4%
Wildlife/Birds/Foreign Object	4%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	4%
Contained Engine Failure/Powerplant Malfunction	4%
Optical Illusion/Visual Misperception	4%
Extensive/Uncontained Engine Failure	4%
Lack of Visual Reference	4%
Traffic	4%
Thunderstorms	4%
Brakes	4%
MEL Item	4%
Icing Conditions	4%

Europe Aircraft Accidents



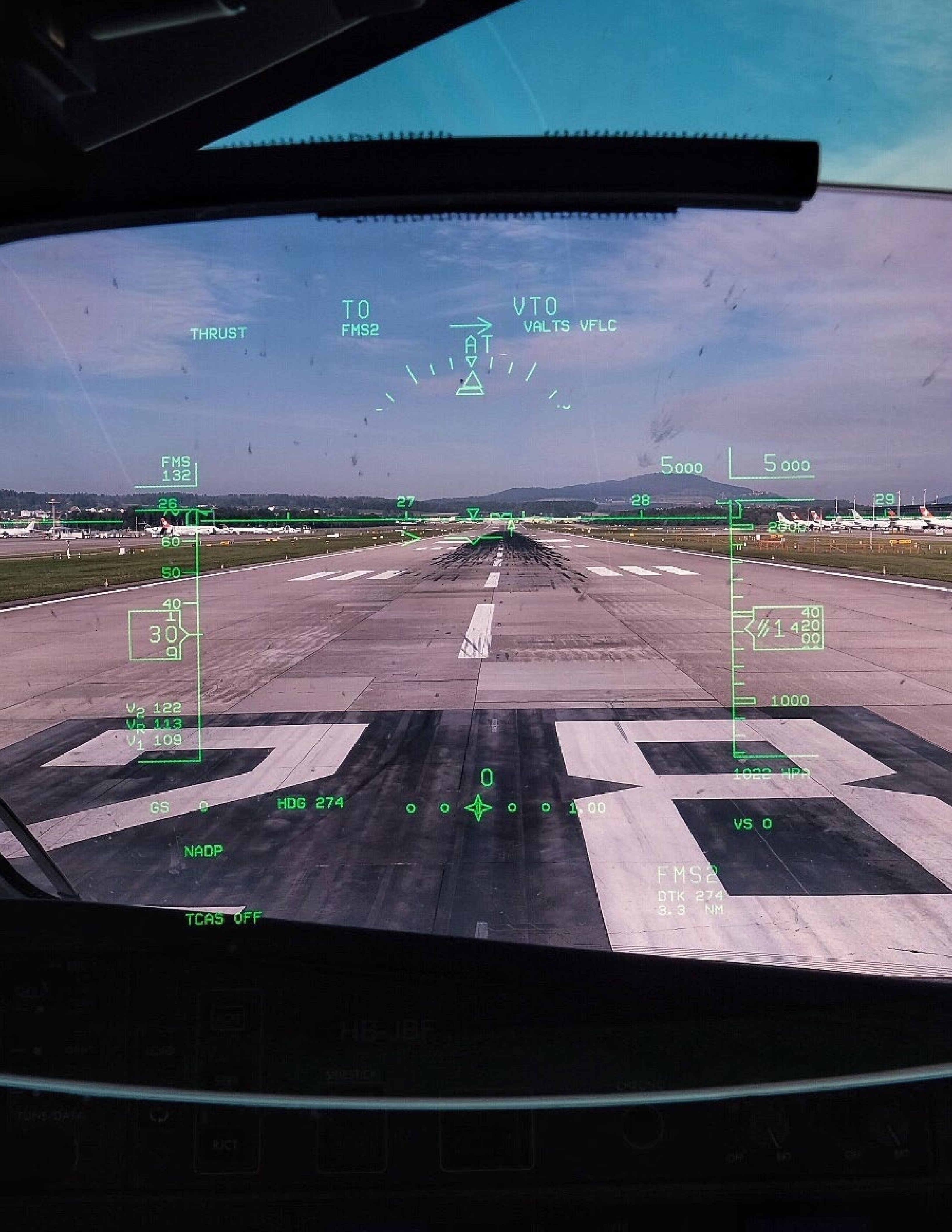
UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	27%
Vertical/Lateral/Speed Deviation	27%
Abrupt Aircraft Control	19%
Continued Landing after Unstable Approach	15%
Unstable Approach	15%
Operation Outside Aircraft Limitations	12%
Unnecessary Weather Penetration	8%
Flight Controls/Automation	4%
Loss of Aircraft Control While on the Ground	4%
Landing Gear	4%
Controlled Flight Towards Terrain	4%
Brakes/Thrust Reversers/Ground Spoilers	4%
Weight & Balance	4%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	31%
Monitor/Cross-check	23%
In-flight Decision-making/Contingency Management	19%
Leadership	15%
Captain Should Show Leadership	12%
Reactive – Contingency Management	8%
Communication Environment	8%
Automation Management	8%
Plans Stated	4%
FO Is Assertive When Necessary	4%
Taxiway/Runway Management	4%

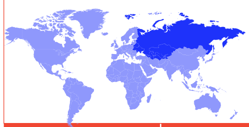
Back to Managing Safety in Aviation - Europe and Commonwealth of Independent States section



THRUST
TO
FMS2
VTO
VALTS VFLC
AT
FMS
132
5000
5000
26
27
28
29
60
50
40
30
V_2 122
V_R 113
V_1 109
1000
1022 HPA
GS 0
HDG 274
0
1.00
VS 0
NADP
FMS2
DTK 274
3.3 NM
TCAS OFF

Commonwealth of Independent States Aircraft Accidents – Accident Count

2021	Number of accidents: 4	Number of fatalities: 41
2017-2021	Number of accidents: 27	Number of fatalities: 202



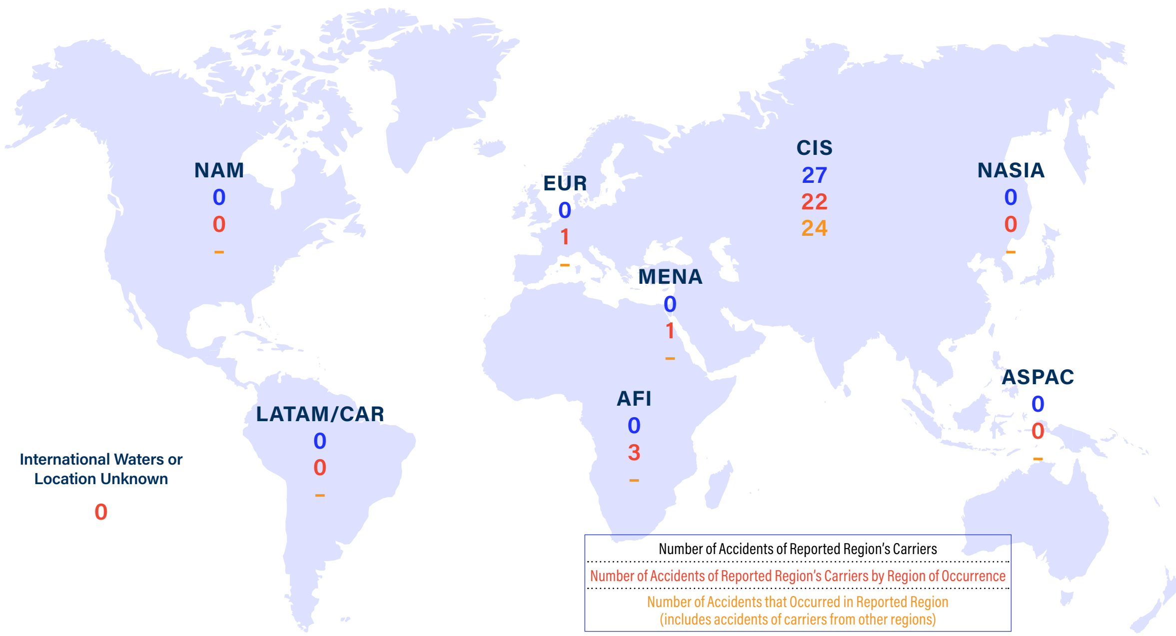
Accident Count % of Total	2021	'17-'21
IATA Member	0%	33%
Full-Loss Equivalents	56%	25%
Fatal	75%	41%
Hull Losses	75%	52%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	75%	25%	0%	0%	100%
2017-2021	74%	26%	0%	63%	37%

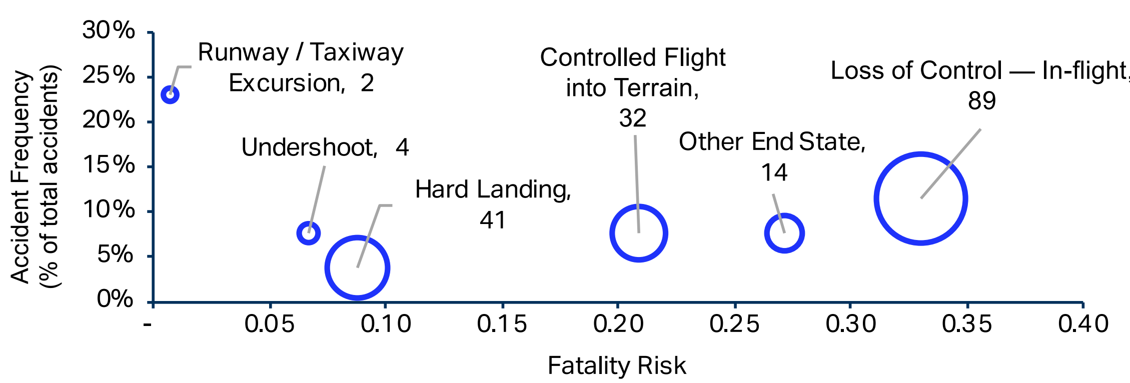
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



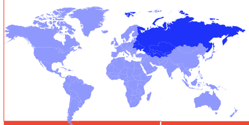
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Commonwealth of Independent States Aircraft Accidents – Accident Rate*

2021 Accident rate: 4.07
2017-2021 Accident rate: 4.51



Accident Rate*	2021	'17-'21
IATA Member	–	2.35
Fatality Risk**	2.29	1.12
Fatal	3.05	1.84
Hull Losses	3.05	2.34

	Jet	Turboprop
2021	–	56.71
2017-2021	3.12	18.93

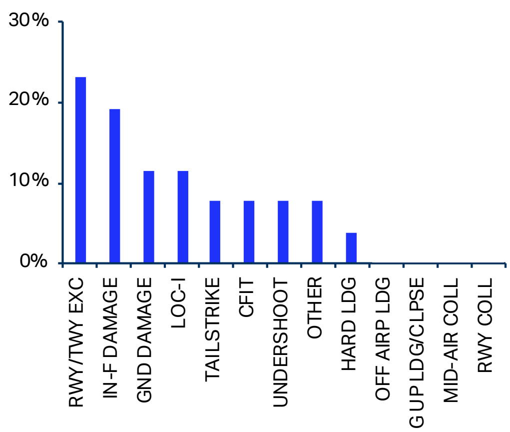
Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights

**Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

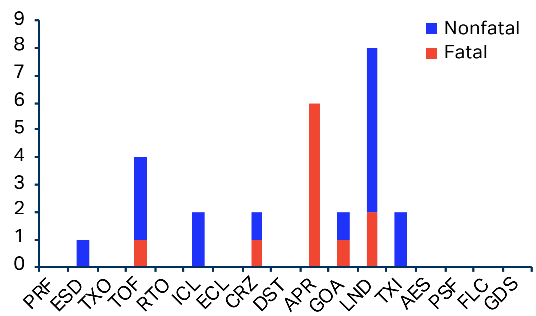
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

Accidents per Phase of Flight (2017-2021)

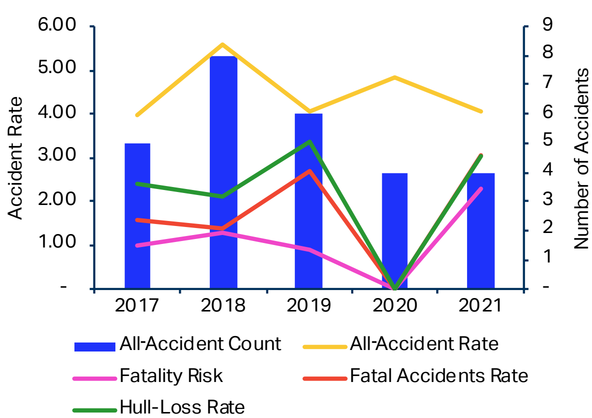
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

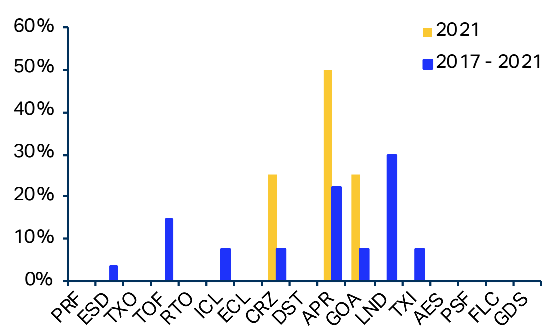
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

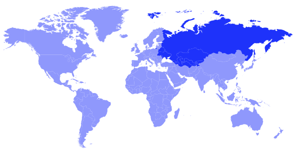
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

CIS Aircraft Accidents – Contributing Factors

Commonwealth of Independent States Aircraft Accidents



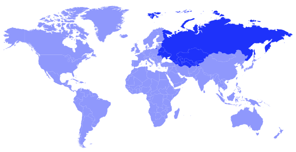
LATENT CONDITIONS

	Percentage Contribution
Safety Management	33%
Regulatory Oversight	30%
Flight Operations	22%
Flight Ops: SOPs & Checking	19%
Flight Ops: Training Systems	15%
Selection Systems	11%
Ground Ops: SOPs & Checking	7%
Ground Operations	7%
Maintenance Operations	7%
Management Decisions, including Regulatory Decisions and Cost Cutting	7%
Ops Planning & Scheduling	4%
Technology & Equipment	4%
Dispatch	4%
Design	4%
Maintenance Ops: SOPs & Checking	4%
Ground Ops: Training Systems	4%
Dispatch Ops: SOPs & Checking	4%
Flight Watch/Following/Support	4%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	48%
Manual Handling/Flight Controls	33%
Failure to GOA after Destabilization on Approach	11%
Pilot-to-Pilot Communication	7%
Normal Checklist	7%
Systems/Radios/Instruments	7%
Callouts	7%
Abnormal Checklist	4%
Documentation	4%
Briefings	4%
Wrong Altimeter Reference Settings (QNH, QFE)	4%
Wrong Weight & Balance/Fuel Information	4%

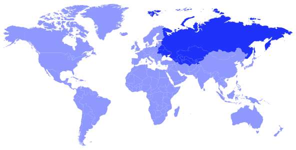
Commonwealth of Independent States Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	48%
Airport Facilities	37%
Thunderstorms	22%
Aircraft Malfunction	22%
Wind/Windshear/Gusty Wind	22%
Poor Visibility/IMC	22%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	19%
Icing Conditions	19%
Contaminated Runway/Taxiway - Poor Braking Action	19%
Operational Pressure	11%
Contained Engine Failure/Powerplant Malfunction	11%
Hydraulic System Failure	7%
MEL Item	7%
Airport Perimeter Control/Fencing/Wildlife Control	7%
Optical Illusion/Visual Misperception	7%
Air Traffic Services	7%
Nav Aids	7%
Wildlife/Birds/Foreign Object	7%
Ground Events	7%
Ground-based Nav Aid Malfunction or not Available	7%
Maintenance Events	7%
Dispatch/Paperwork	4%
Fatigue	4%
Flight Controls	4%
Secondary Flight Controls	4%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	4%
Electrical Power Generation Failure	4%
Spatial Disorientation/Somatogravic Illusion	4%
Brakes	4%
Extensive/Uncontained Engine Failure	4%
Lack of Visual Reference	4%
Gear/Tire	4%

Commonwealth of Independent States Aircraft Accidents



UNDESIRED AIRCRAFT STATE

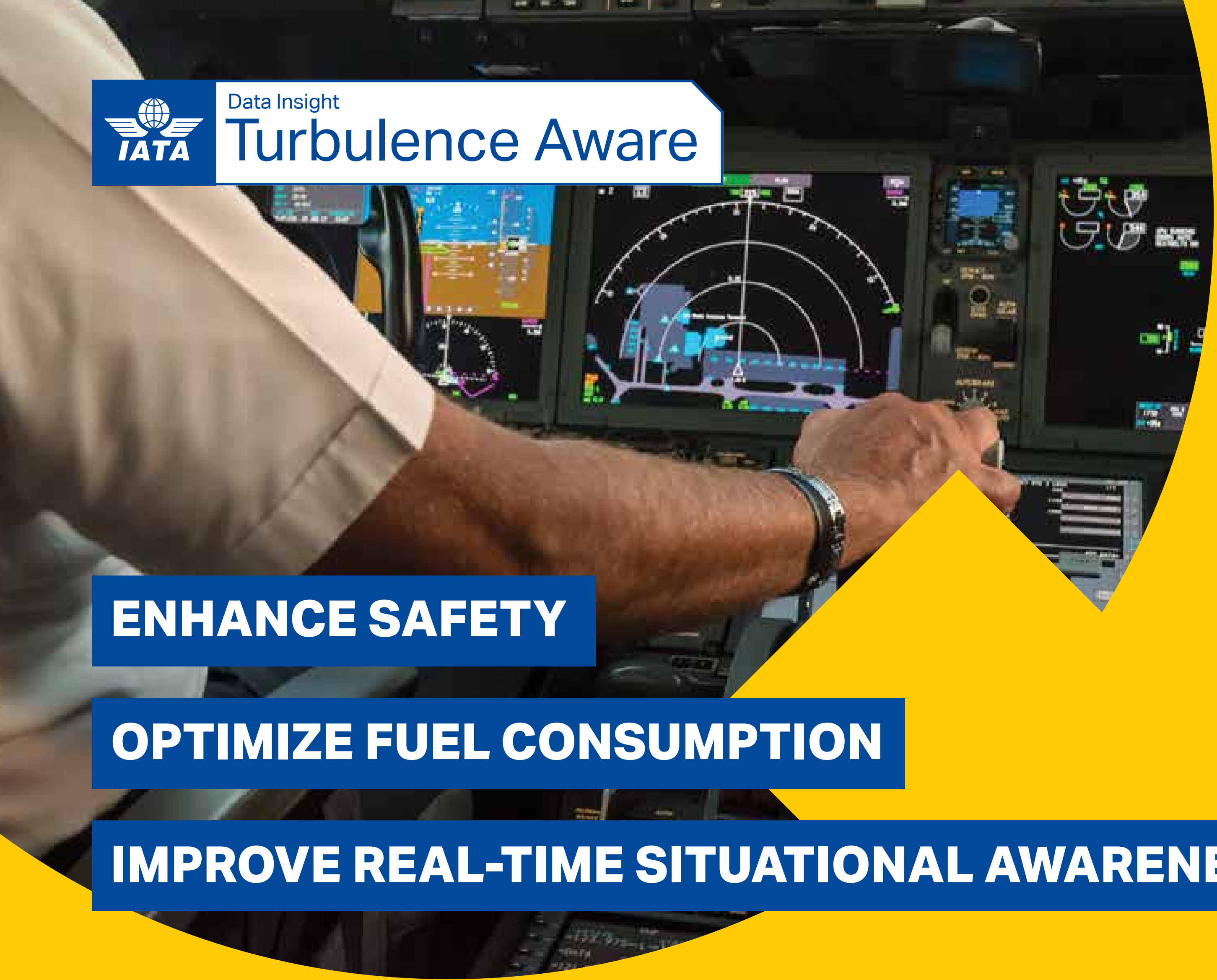
	Percentage Contribution
Unnecessary Weather Penetration	26%
Unstable Approach	19%
Brakes/Thrust Reversers/Ground Spoilers	15%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	15%
Abrupt Aircraft Control	11%
Operation Outside Aircraft Limitations	11%
Vertical/Lateral/Speed Deviation	11%
Continued Landing after Unstable Approach	11%
Loss of Aircraft Control While on the Ground	7%
Systems	7%
Rejected Takeoff after V_1	4%
Controlled Flight Towards Terrain	4%
Flight Controls/Automation	4%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	30%
In-flight Decision-making/Contingency Management	22%
Monitor/Cross-check	15%
Leadership	15%
Captain Should Show Leadership	15%
Taxiway/Runway Management	7%
Communication Environment	7%
Reactive – Contingency Management	7%
SOP Briefing/Planning	4%
FO Is Assertive When Necessary	4%
Proactive – In-flight Decision-making	4%
Evaluation of Plans	4%

Back to Managing Safety in Aviation - Europe and Commonwealth of Independent States section

Data Insight
Turbulence Aware



ENHANCE SAFETY

OPTIMIZE FUEL CONSUMPTION

IMPROVE REAL-TIME SITUATIONAL AWARENESS

Turbulence Aware

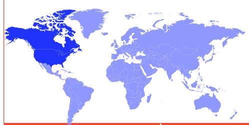
- Provides airline pilots and operation centers with real-time objective, in-situ turbulence information
- A global real-time turbulence data exchange platform
- A community of airlines around the globe sharing turbulence data
- Collects, consolidates, deidentifies and shares turbulence data
- Airlines are free to integrate the data into their existing operational tools
- Data can be used as a data layer to complement existing turbulence forecasts

Email iataturbulence@iata.org to learn more

www.iata.org/turbulence-aware

North America Aircraft Accidents – Accident Count

2021	Number of accidents: 8	Number of fatalities: 0
2017-2021	Number of accidents: 55	Number of fatalities: 8



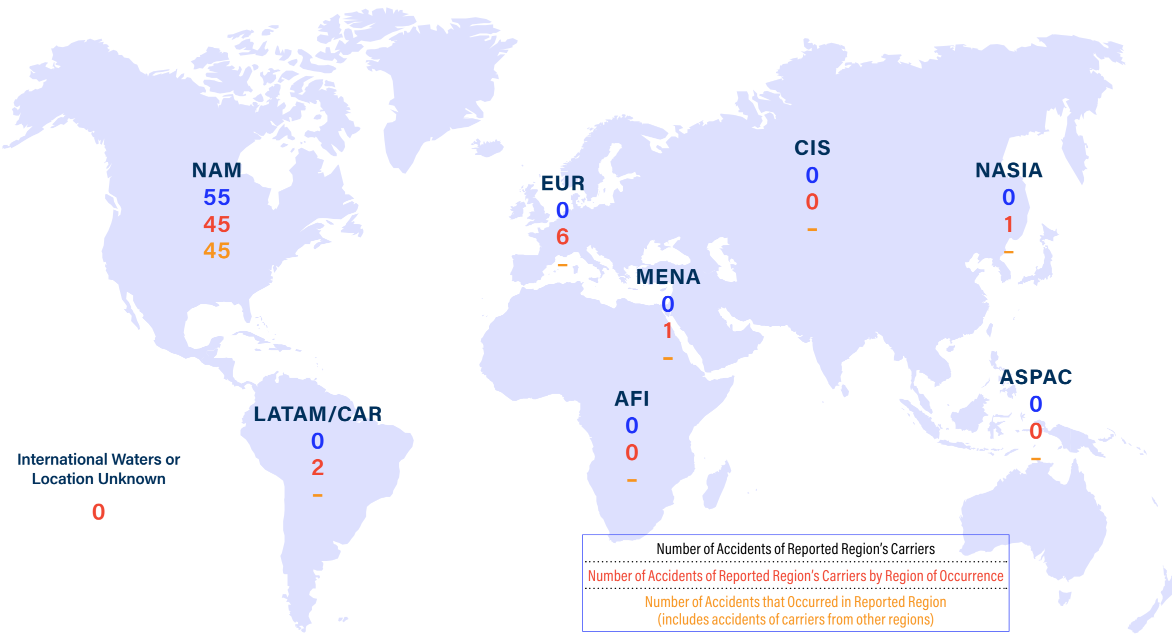
Accident Count % of Total	2021	'17-'21
IATA Member	38%	35%
Full-Loss Equivalents	0%	4%
Fatal	0%	9%
Hull Losses	13%	11%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	50%	50%	0%	75%	25%
2017-2021	75%	25%	0%	75%	25%

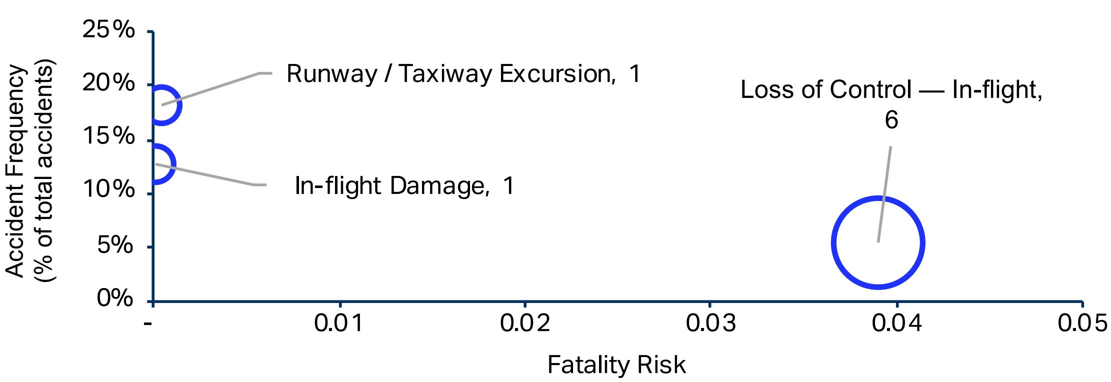
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



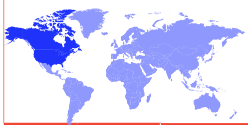
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

North America Aircraft Accidents – Accident Rate*

2021 Accident rate: 1.01
2017-2021 Accident rate: 1.05



Accident Rate*	2021	'17-'21
IATA Member	0.52	0.74
Fatality Risk**	–	0.04
Fatal	–	0.10
Hull Losses	0.13	0.11

	Jet	Turboprop
2021	0.81	3.80
2017-2021	0.91	1.96

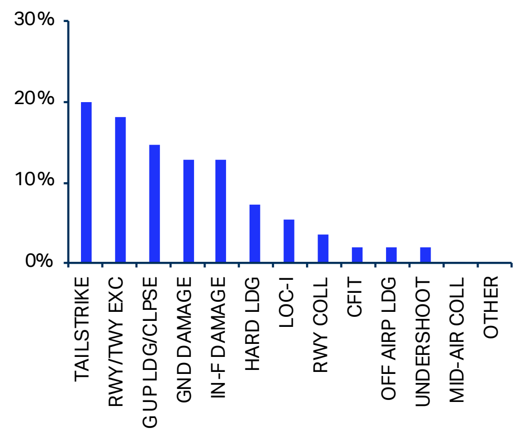
Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights

**Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

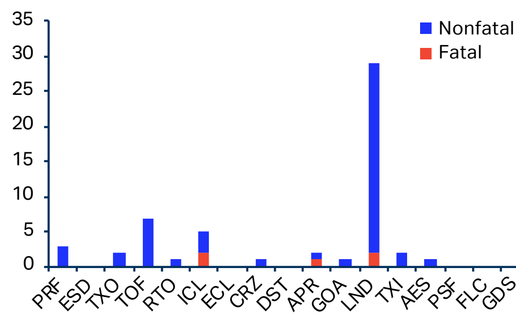
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

Accidents per Phase of Flight (2017-2021)

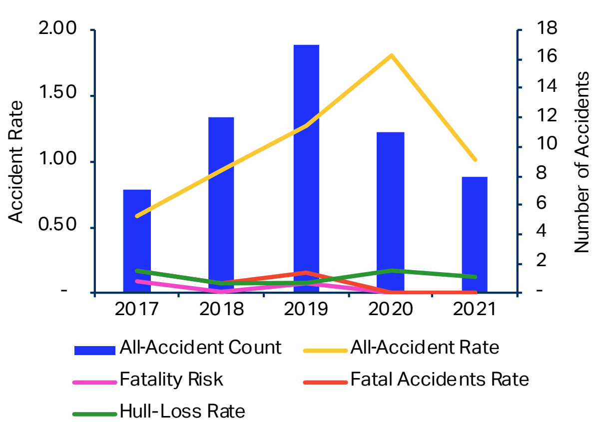
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

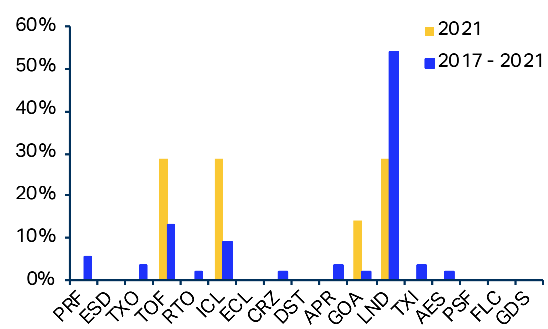
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

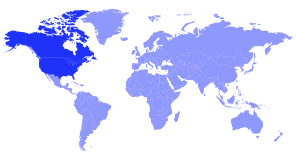
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

NAM Aircraft Accidents – Contributing Factors

North America Aircraft Accidents



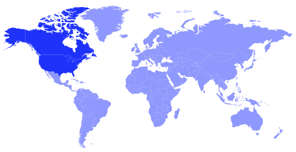
LATENT CONDITIONS

	Percentage Contribution
Safety Management	25%
Regulatory Oversight	22%
Flight Operations	20%
Maintenance Operations	15%
Selection Systems	11%
Flight Ops: Training Systems	9%
Management Decisions, including Regulatory Decisions and Cost Cutting	9%
Flight Ops: SOPs & Checking	9%
Maintenance Ops: SOPs & Checking	9%
Ground Ops: SOPs & Checking	7%
Ground Operations	7%
Ground Ops: Training Systems	5%
Technology & Equipment	4%
Design	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	44%
SOP Adherence/SOP Cross-verification	27%
Pilot-to-Pilot Communication	11%
Failure to GOA after Destabilization on Approach	11%
Callouts	5%
Briefings	2%
Normal Checklist	2%
Abnormal Checklist	2%
Systems/Radios/Instruments	2%

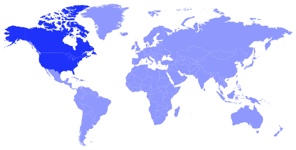
North America Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	36%
Wind/Windshear/Gusty Wind	27%
Aircraft Malfunction	22%
Gear/Tire	13%
Airport Facilities	13%
Contaminated Runway/Taxiway - Poor Braking Action	11%
Poor Visibility/IMC	11%
Maintenance Events	11%
Thunderstorms	9%
Ground Events	9%
Traffic	7%
Operational Pressure	5%
Contained Engine Failure/Powerplant Malfunction	5%
Nav Aids	4%
Wildlife/Birds/Foreign Object	4%
Icing Conditions	4%
Fatigue	4%
Ground-based Nav Aid Malfunction or not Available	4%
Terrain/Obstacles	2%
Structural Failure	2%
Fire/Smoke (Cockpit/Cabin/Cargo)	2%
Primary Flight Controls	2%
Lack of Visual Reference	2%
Flight Controls	2%
Spatial Disorientation/Somatogravic Illusion	2%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	2%
MEL Item	2%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	2%
Foreign Objects, FOD	2%
Extensive/Uncontained Engine Failure	2%
Hydraulic System Failure	2%

North America Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	24%
Abrupt Aircraft Control	20%
Vertical/Lateral/Speed Deviation	16%
Unstable Approach	11%
Operation Outside Aircraft Limitations	9%
Continued Landing after Unstable Approach	9%
Unnecessary Weather Penetration	7%
Brakes/Thrust Reversers/Ground Spoilers	7%
Loss of Aircraft Control While on the Ground	4%
Engine	2%
Landing Gear	2%
Flight Controls/Automation	2%
Controlled Flight Towards Terrain	2%

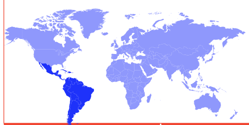
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	24%
Monitor/Cross-check	18%
Leadership	15%
Captain Should Show Leadership	13%
In-flight Decision-making/Contingency Management	7%
Evaluation of Plans	5%
Taxiway/Runway Management	5%
Communication Environment	5%
Workload Management	5%
FO Is Assertive When Necessary	4%
Automation Management	4%
Proactive – In-flight Decision-making	4%

Back to Managing Safety in Aviation - The Americas section

Latin America & the Caribbean Aircraft Accidents – Accident Count

2021	Number of accidents: 1	Number of fatalities: 0
2017-2021	Number of accidents: 24	Number of fatalities: 113



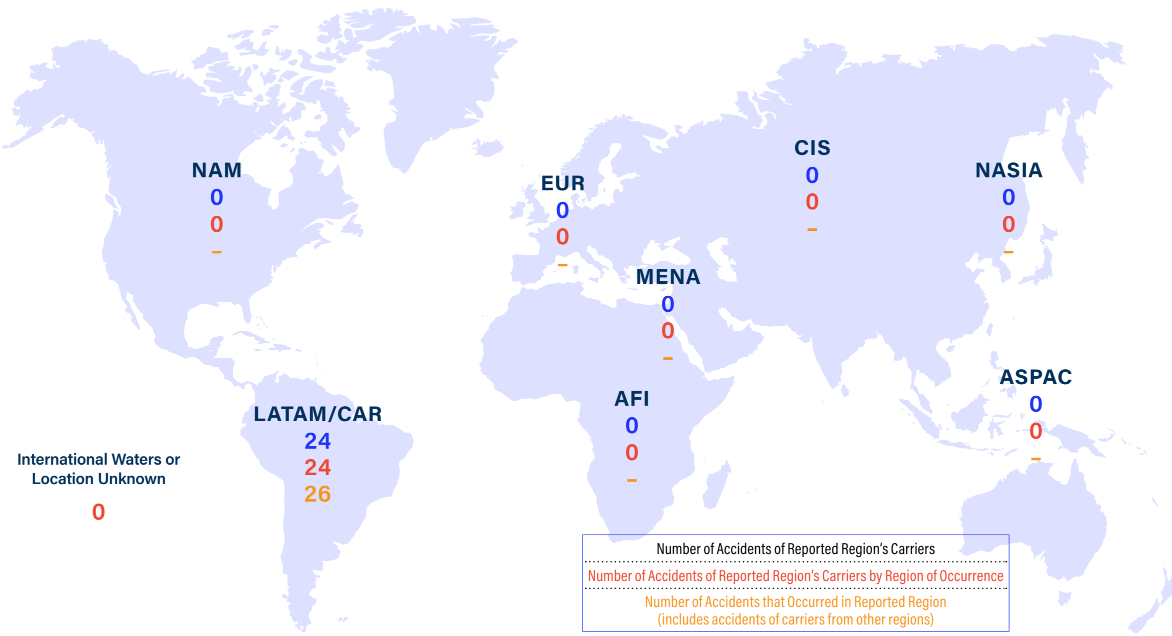
Accident Count % of Total	2021	'17-'21
IATA Member	0%	8%
Full-Loss Equivalents	0%	4%
Fatal	0%	8%
Hull Losses	0%	21%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	100%	0%	0%	100%	0%
2017-2021	83%	17%	0%	46%	54%

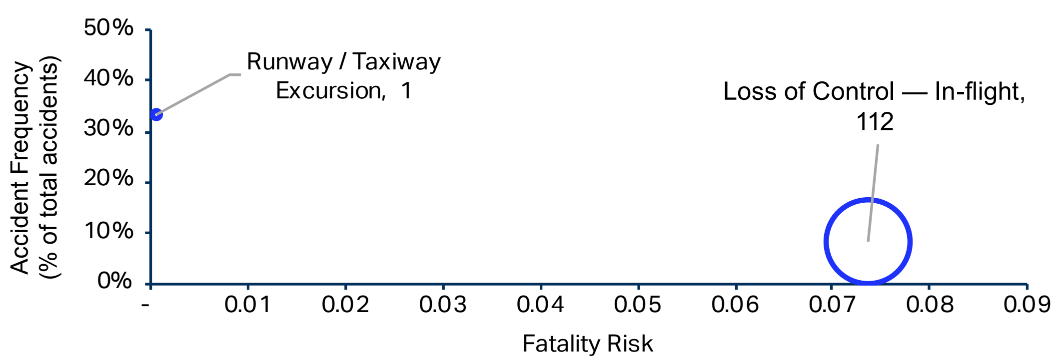
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



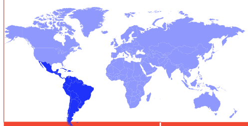
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Latin America & the Caribbean Aircraft Accidents – Accident Rate*

2021	Accident rate: 0.53
2017-2021	Accident rate: 1.78



Accident Rate*	2021	'17-'21
IATA Member	-	0.22
Fatality Risk**	-	0.07
Fatal	-	0.15
Hull Losses	-	0.37

	Jet	Turboprop
2021	0.65	-
2017-2021	1.05	4.36

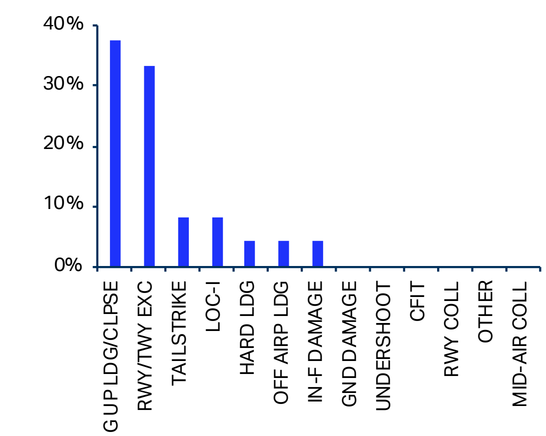
Accident rates for Passenger, Cargo and Ferry are not available.

*Total number of accidents calculated per 1 million flights

**Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

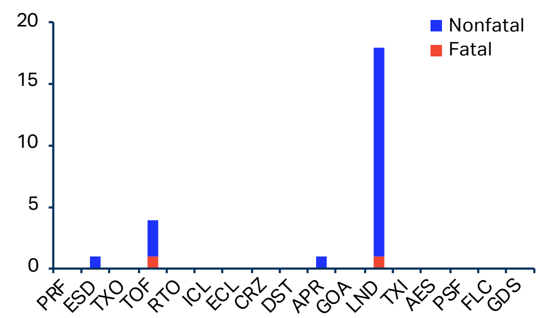
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

Accidents per Phase of Flight (2017-2021)

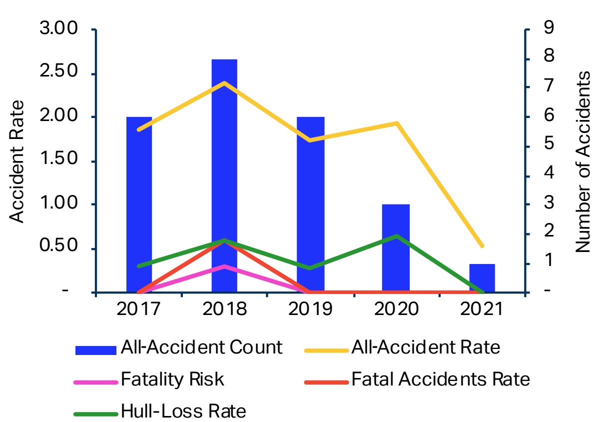
Total number of accidents (fatal vs. nonfatal)



Refer to list of Phase of Flight definitions for full names.

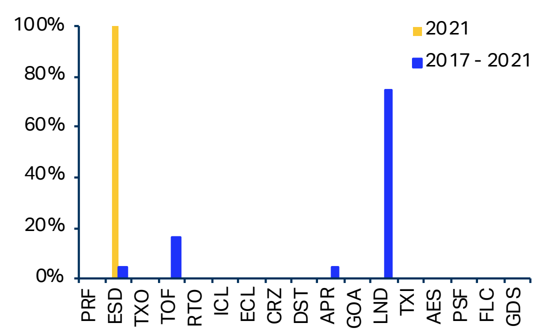
Regional Accident Rate (2017-2021)

Accident per million sectors



Accidents per Phase of Flight (2017-2021)

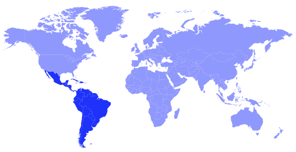
Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

LATAM / CAR Aircraft Accidents – Contributing Factors

Latin America & the Caribbean Aircraft Accidents



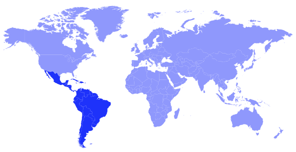
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	38%
Safety Management	29%
Flight Operations	25%
Selection Systems	25%
Maintenance Operations	17%
Maintenance Ops: SOPs & Checking	17%
Dispatch	17%
Flight Ops: Training Systems	13%
Flight Ops: SOPs & Checking	13%
Management Decisions, including Regulatory Decisions and Cost Cutting	8%
Dispatch Ops: SOPs & Checking	8%
Design	8%
Ops Planning & Scheduling	8%
Cabin Operations	4%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	17%
SOP Adherence/SOP Cross-verification	13%
Documentation	8%
Wrong Weight & Balance/Fuel Information	8%
Callouts	4%
Systems/Radios/Instruments	4%
Abnormal Checklist	4%
Normal Checklist	4%
Pilot-to-Pilot Communication	4%

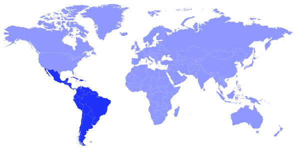
Latin America & the Caribbean Aircraft Accidents



THREATS

	Percentage Contribution
Aircraft Malfunction	42%
Gear/Tire	25%
Maintenance Events	25%
Meteorology	21%
Wind/Windshear/Gusty Wind	13%
Dispatch/Paperwork	13%
Thunderstorms	8%
Poor Visibility/IMC	8%
Operational Pressure	8%
Wildlife/Birds/Foreign Object	4%
Terrain/Obstacles	4%
Nav Aids	4%
Airport Facilities	4%
Electrical Power Generation Failure	4%
Optical Illusion/Visual Misperception	4%
Airport Perimeter Control/Fencing/Wildlife Control	4%
Brakes	4%
Ground Events	4%
Lack of Visual Reference	4%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	4%
Hydraulic System Failure	4%
Ground-based Nav Aid Malfunction or not Available	4%

Latin America & the Caribbean Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Abrupt Aircraft Control	13%
Unnecessary Weather Penetration	13%
Operation Outside Aircraft Limitations	13%
Weight & Balance	8%
Vertical/Lateral/Speed Deviation	8%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	8%
Rejected Takeoff after V_1	4%
Systems	4%
Unstable Approach	4%
Landing Gear	4%

COUNTERMEASURES

	Percentage Contribution
In-flight Decision-making/Contingency Management	17%
Overall Crew Performance	13%
Monitor/Cross-check	13%
Captain Should Show Leadership	8%
FO Is Assertive When Necessary	8%
Workload Management	8%
Leadership	8%
Communication Environment	4%
Proactive – In-flight Decision-making	4%
Evaluation of Plans	4%

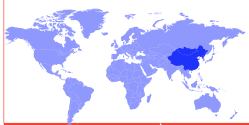
Back to Managing Safety in Aviation - The Americas section

> Workload management and communication are competences that should be measured and improved to reduce incidents.

Captain Jorge Robles,
F/O Airbus 330,
Avianca Cargo - Tampa

North Asia Aircraft Accidents – Accident Count

2021	Number of accidents: 1	Number of fatalities: 0
2017-2021	Number of accidents: 4	Number of fatalities: 0



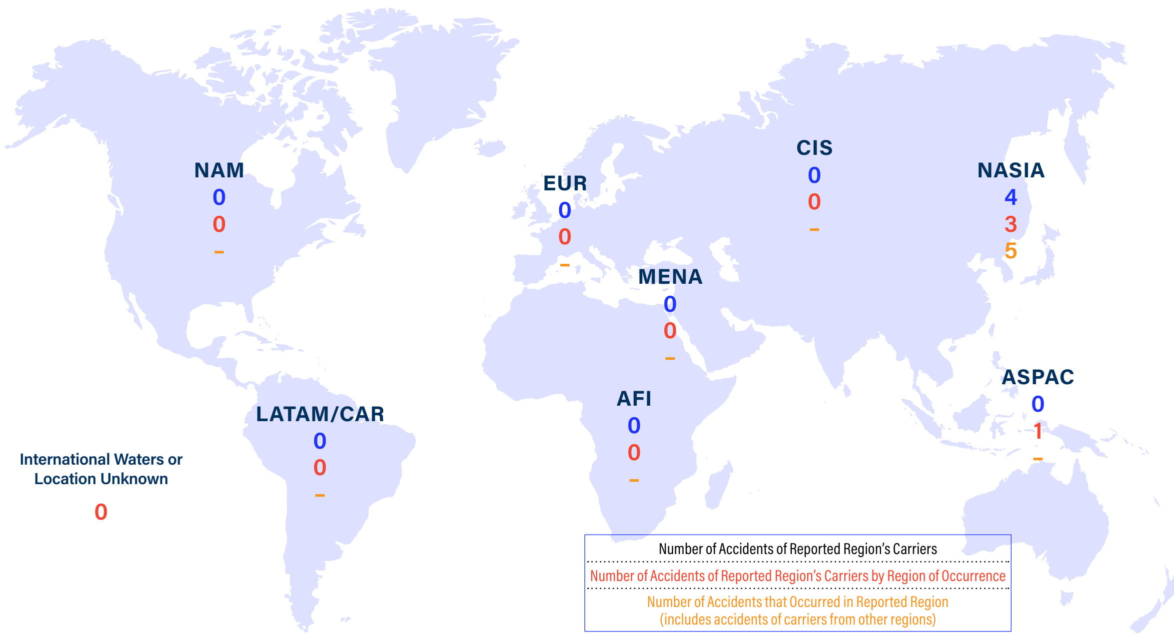
Accident Count % of Total	2021	'17-'21
IATA Member	100%	100%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	25%

	Passenger	Cargo	Ferry	Jet	Turboprop
2021	100%	0%	0%	0%	100%
2017-2021	100%	0%	0%	75%	25%

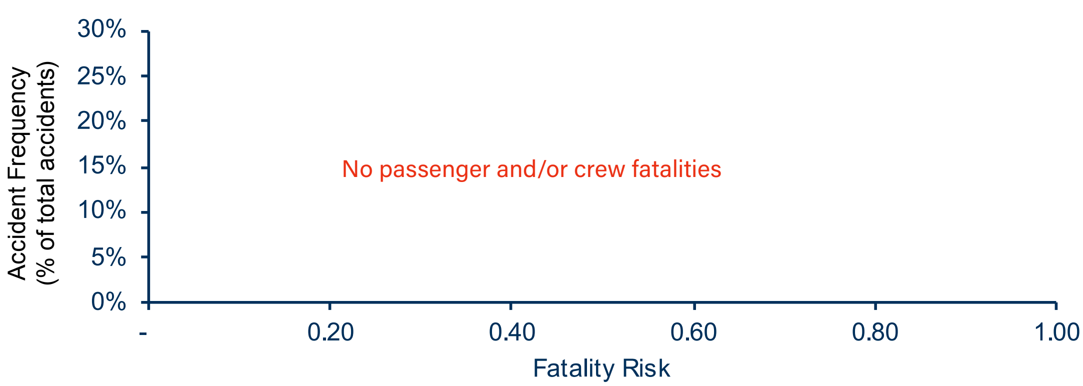
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



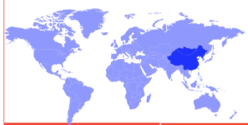
Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

North Asia Aircraft Accidents – Accident Rate*

2021 Accident rate: 0.20
2017-2021 Accident rate: 0.14



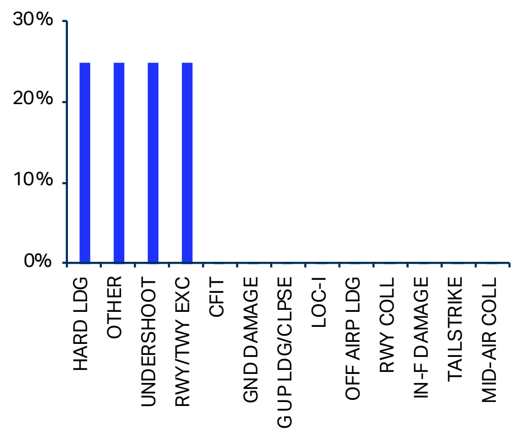
Accident Rate*	2021	'17-'21
IATA Member	0.26	0.18
Fatality Risk**	–	–
Fatal	–	–
Hull Losses	–	0.04

	Jet	Turboprop	
2021	–	19.93	Accident rates for Passenger, Cargo and Ferry are not available.
2017-2021	0.11	2.15	

*Total number of accidents calculated per 1 million flights **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2017-2021)

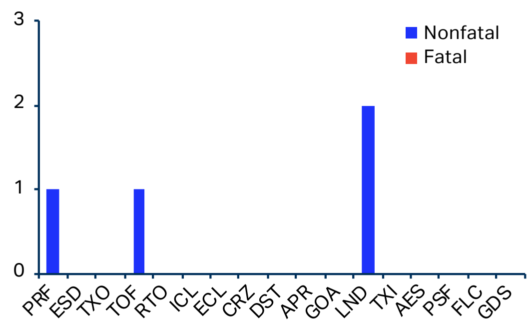
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of [Acronyms/Abbreviations section](#) for full names.

Accidents per Phase of Flight (2017-2021)

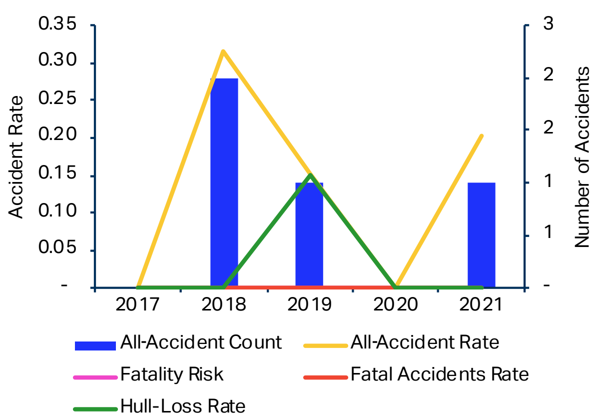
Total number of accidents (fatal vs. nonfatal)



Refer to list of [Phase of Flight definitions](#) for full names.

Regional Accident Rate (2017-2021)

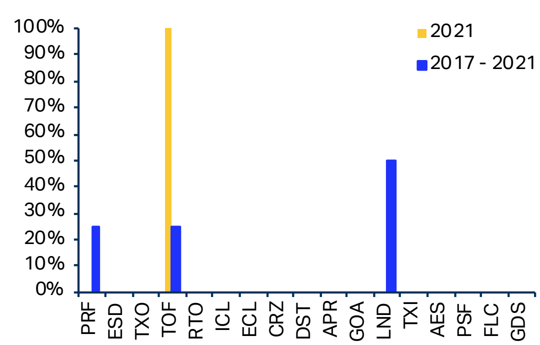
Accident per million sectors



Note: The fatal accident rate and fatality risk share the same value.

Accidents per Phase of Flight (2017-2021)

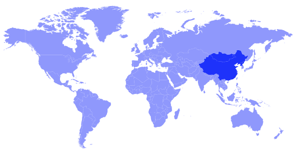
Distribution of accidents as percentage of total



Refer to list of [Phase of Flight definitions](#) for full names.

NASIA Aircraft Accidents – Contributing Factors

North Asia Aircraft Accidents



LATENT CONDITIONS

	Percentage Contribution
Flight Operations	50%
Selection Systems	25%
Safety Management	25%
Regulatory Oversight	25%
Flight Ops: SOPs & Checking	25%
Flight Ops: Training Systems	25%

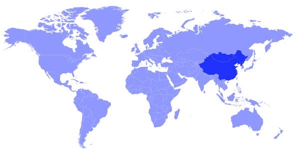
THREATS

	Percentage Contribution
Meteorology	75%
Wind/Windshear/Gusty Wind	50%
Airport Facilities	50%
Poor Visibility/IMC	50%
Thunderstorms	50%
Lack of Visual Reference	25%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	25%
Operational Pressure	25%
Fire/Smoke (Cockpit/Cabin/Cargo)	25%
Aircraft Malfunction	25%
Contaminated Runway/Taxiway - Poor Braking Action	25%
Ground Events	25%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	25%

FLIGHT CREW ERRORS

	Percentage Contribution
Failure to GOA after Destabilization on Approach	75%
SOP Adherence/SOP Cross-verification	50%
Manual Handling/Flight Controls	50%
Normal Checklist	25%
Automation	25%
Callouts	25%

North Asia Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	75%
Unstable Approach	75%
Continued Landing after Unstable Approach	75%
Unnecessary Weather Penetration	50%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	50%
Operation Outside Aircraft Limitations	50%
Abrupt Aircraft Control	25%
Engine	25%
Controlled Flight Towards Terrain	25%

COUNTERMEASURES

	Percentage Contribution
In-flight Decision-making/Contingency Management	50%
Overall Crew Performance	50%
Proactive – In-flight Decision-making	25%
Automation Management	25%
Workload Management	25%

Back to Managing Safety in Aviation - North Asia section

BE PREPARED! GET A GRIP ON THE ICAO GRF

Runway excursions remain a challenge to aviation with negative impacts to safety and operational efficiency.

The assessment and reporting of **Runway Surface Conditions** (RSC) are being addressed by ICAO through the implementation of a revised **Global Reporting Forma**t (GRF). The assessment and reporting of Runway Surface Conditions (RSC) are addressed by ICAO through the implementation of Global Reporting Format (GRF). This methodology for harmonized and global implementation, became effective as of 4th November 2021.

In a joint effort between IATA and ICAO, we developed an e-learning course to assist flight crew, dispatchers and operational staff to understand and use the new Runway Condition reporting requirements as outlined in ICAO Circular 355 (Assessment, Measurement and Reporting of Runway Surface Conditions) and ICAO Doc 10064 (Aeroplane Performance Manual [APM]).

Upon completing this course, you will have the skills to:

- Explain the need and fundamental requirements for a harmonized GRF for Runway Condition Assessment and Reporting
- Summarize the end-to-end process of a Runway Condition Assessment and Reporting
- Describe the factors which require adjustments to braking and acceleration performance to account for runway conditions
- Use a Runway Condition Report (RCR) to assess takeoff and landing performance

For more information, please visit

iata.org/training-talp38

7

Analysis of Cargo Aircraft Accidents

2021 CARGO OPERATOR OVERVIEW

CARGO VS. PASSENGER OPERATIONS FOR JET AIRCRAFT

	Fleet Size	HL	HL / 1000 ACTF	SD	SD / 1000 ACTF	Total Acc	Acc / 1000 ACTF
Cargo	2,451	2	0.82	5	2.04	7	2.86
Passenger	26,830	1	0.04	5	0.19	6	0.22
Total	29,281	3	0.10	10	0.34	13	0.44

HL = Hull Loss SD = Substantial Damage

Note: Fleet Size includes in-service aircraft operated by commercial airlines.
Cargo aircraft are defined as dedicated cargo, mixed passenger/cargo (combi) or quick-change configurations.

CARGO VS. PASSENGER OPERATIONS FOR TURBOPROP AIRCRAFT

	Fleet Size	HL	HL / 1000 ACTF	SD	SD / 1000 ACTF	Total Acc	Acc / 1000 ACTF
Cargo	263	2	7.60	1	3.80	3	11.41
Passenger	3,133	3	0.96	7	2.23	10	3.19
Total	3,396	5	1.47	8	2.36	13	3.83

HL = Hull Loss SD = Substantial Damage

Note: Fleet Size includes in-service aircraft operated by commercial airlines.
Cargo aircraft are defined as dedicated cargo, mixed passenger/cargo (combi) or quick-change configurations.

Cargo Aircraft Accidents – Accident Count

2021	Number of accidents: 10	Number of fatalities: 12
2017-2021	Number of accidents: 49	Number of fatalities: 54

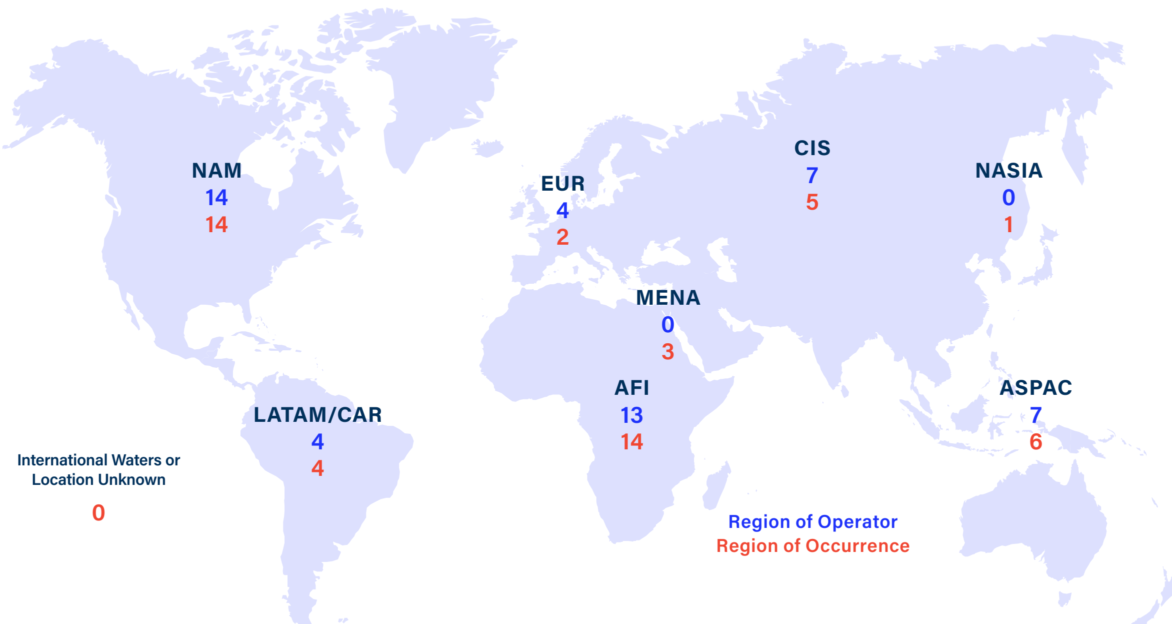
Accident Count % of Total	2021	'17-'21
IATA Member	20%	10%
Full-Loss Equivalents	20%	22%
Fatal	20%	24%
Hull Losses	40%	47%

	Jet	Turboprop
2021	70%	30%
2017-2021	49%	51%

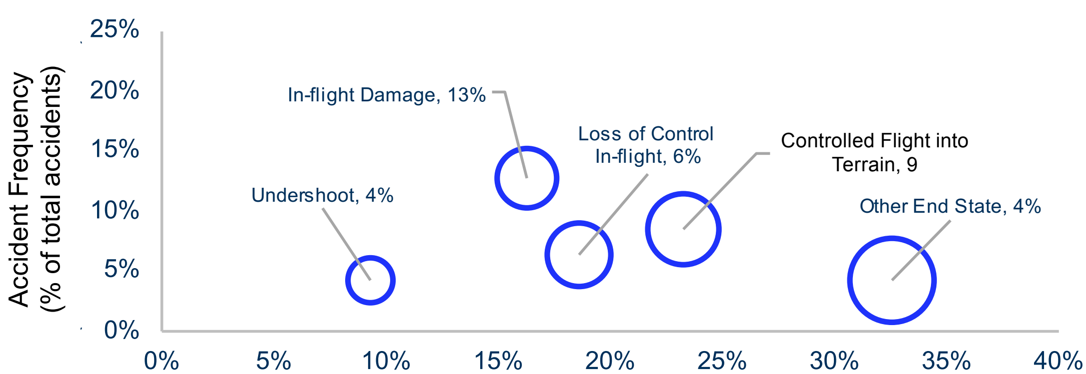
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2017-2021)

The accident rate based on region of occurrence is not available, therefore the map only displays counts.



Accident Category Frequency and Fatality Risk (2017-2021)



The graph shows the relationship between the accident category frequency and the fatality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the bubble is an indication of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Cargo Aircraft Accidents – Accident Rate*

Accident rate*: –

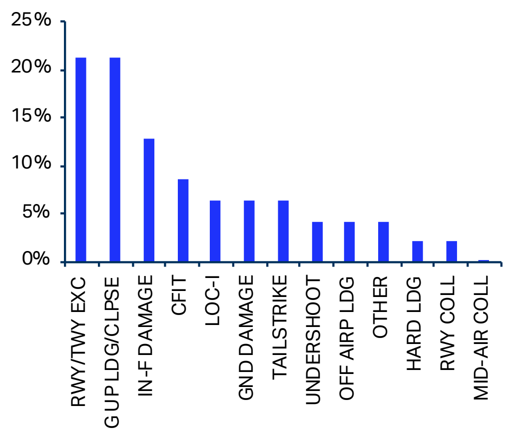
Accident Rate*	2021
IATA Member	-
Fatality Risk**	-
Fatal	-
Hull Losses	-

Cargo	
-	Cargo accident rates are not available

Note: the number of sectors for cargo flights is not available and therefore the rate calculation is not being shown

Accident Category Distribution (2017-2021)

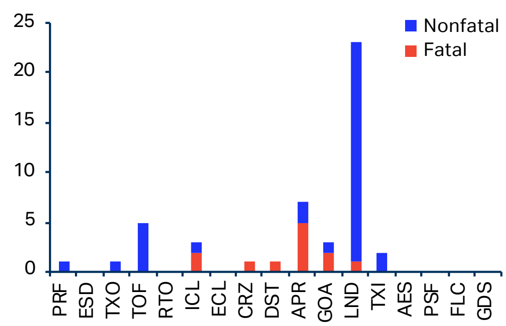
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to list of Acronyms/Abbreviations section for full names.

Accidents per Phase of Flight (2017-2021)

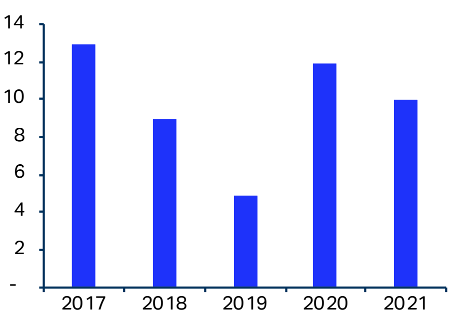
Total Number of Accidents (Fatal vs. Nonfatal)



Refer to list of Phase of Flight definitions for full names.

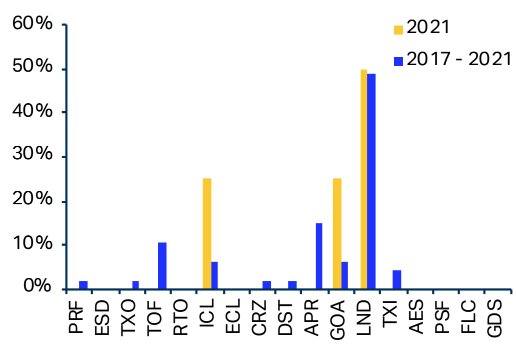
Accident Count (2017-2021)

Total Number of Accidents



Accidents per Phase of Flight (2017-2021)

Distribution of accidents as percentage of total



Refer to list of Phase of Flight definitions for full names.

Cargo Aircraft Accidents – Contributing Factors

Cargo Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Safety Management	37%
Regulatory Oversight	35%
Maintenance Operations	20%
Management Decisions, including Regulatory Decisions and Cost Cutting	20%
Selection Systems	18%
Flight Operations	16%
Maintenance Ops: SOPs & Checking	12%
Flight Ops: SOPs & Checking	10%
Flight Ops: Training Systems	8%
Dispatch	8%
Design	6%
Technology & Equipment	6%
Ground Ops: SOPs & Checking	4%
Ground Operations	4%
Change Management	2%
Ground Ops: Training Systems	2%
Dispatch Ops: SOPs & Checking	2%
Flight Watch/Following/Support	2%
Ops Planning & Scheduling	2%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	27%
Manual Handling/Flight Controls	16%
Callouts	8%
Pilot-to-Pilot Communication	6%
Wrong Weight & Balance/Fuel Information	4%
Documentation	4%
Failure to GOA after Abnormal Runway Contact	2%
Normal Checklist	2%
Briefings	2%
Abnormal Checklist	2%

Cargo Aircraft Accidents

THREATS

	Percentage Contribution
Aircraft Malfunction	29%
Meteorology	24%
Gear/Tire	20%
Maintenance Events	18%
Poor Visibility/IMC	14%
Airport Facilities	14%
Wind/Windshear/Gusty Wind	10%
Contained Engine Failure/Powerplant Malfunction	10%
Fatigue	8%
Thunderstorms	6%
Hydraulic System Failure	6%
Lack of Visual Reference	6%
Brakes	6%
Operational Pressure	6%
Inadequate Overrun Area/Trench/Ditch – Proximity of Structures	6%
Wildlife/Birds/Foreign Object	4%
Poor Sign/Lighting, Faint Markings, Runway/Taxiway Closure	4%
Dispatch/Paperwork	4%
Nav Aids	4%
Terrain/Obstacles	4%
Ground Events	4%
Air Traffic Services	4%
Ground-based Nav Aid Malfunction or not Available	4%
Contaminated Runway/Taxiway - Poor Braking Action	4%
Secondary Flight Controls	2%
Extensive/Uncontained Engine Failure	2%
Airport Perimeter Control/Fencing/Wildlife Control	2%
Dangerous Goods	2%
Icing Conditions	2%
Electrical Power Generation Failure	2%
Spatial Disorientation/Somatogravic Illusion	2%
Flight Controls	2%
Foreign Objects, FOD	2%

Cargo Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Operation Outside Aircraft Limitations	14%
Unnecessary Weather Penetration	10%
Vertical/Lateral/Speed Deviation	10%
Controlled Flight Towards Terrain	8%
Abrupt Aircraft Control	6%
Brakes/Thrust Reversers/Ground Spoilers	6%
Long/Floated/Bounced/Firm/Off-center/Crabbed Landing	6%
Loss of Aircraft Control While on the Ground	6%
Unstable Approach	6%
Continued Landing after Unstable Approach	6%
Weight & Balance	4%
Landing Gear	4%
Rejected Takeoff after V_1	2%
Engine	2%
Flight Controls/Automation	2%

COUNTERMEASURES

	Percentage Contribution
Monitor/Cross-check	18%
Overall Crew Performance	18%
In-flight Decision-making/Contingency Management	14%
Leadership	10%
Captain Should Show Leadership	10%
FO Is Assertive When Necessary	6%
Automation Management	4%
Evaluation of Plans	2%
Taxiway/Runway Management	2%

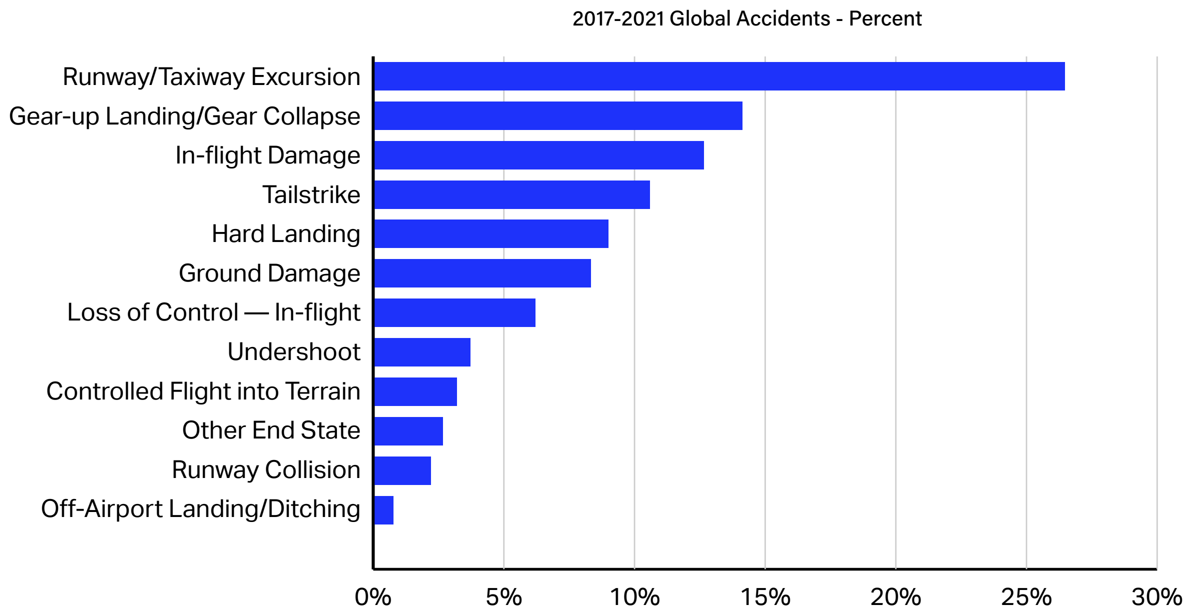
Refer to the list of Accident Classification Taxonomy.

8

Report Findings

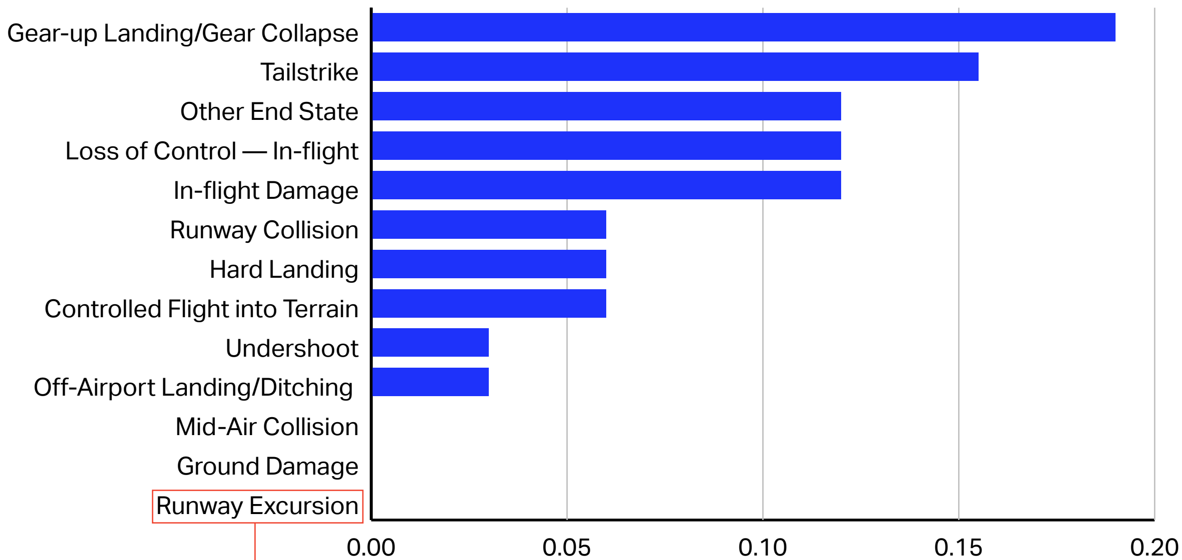
TOP FINDINGS: 2017-2021

Covering a five-year period, the 2017-2021 Accident End State Distribution, as a percentage of the total, as assigned by the ACTF, was as follows:



The Accident End State Distribution, as a percentage of the total of the 26 accidents that occurred in 2021, as assigned by the ACTF, was as follows:

Accident End State Distribution



Runway Excursion	0
Runway Excursion Lateral	0
Taxiway Excursion	0

The accident end states with associated fatalities in 2021 were:

- LOC-I (3) with 75 fatalities
- CFIT (2) with 32 fatalities
- Other End State (2) with 14 fatalities

With a full breakdown of each accident end state, the table below provides an overview of 2021's performance compared to the five-year average:

2021 vs 2017-2021

	2021	Comparison vs 5Y	5 Y Average (2017-2021)
Number of accidents	26	▼	44
Fatality Risk	0.23	▲	0.14
% of accidents involving IATA members	31%	▼	36%
% of fatal accidents	27%	▲	17%
% aircraft propulsion - Jet	50%	▼	64%
% aircraft propulsion - Turboprop	50%	▲	36%
% type of operations - Passenger	62%	▼	78%
% type of operations - Cargo	38%	▲	22%
% Hull losses	31%	▲	24%

COVID-19 – RESTART OF OPERATIONS

COVID-19 has led to a different risk landscape that has introduced new or amplified operational challenges and safety hazards. In addition, the pandemic has revealed gaps that need to be addressed across the aviation supply chain to increase efficiency and improve decision-making. To better understand the operational impacts of COVID-19 and the challenges that can be faced by airlines and air navigation service providers (ANSPs), IATA, along with the Civil Air Navigation Services Organization (CANSO), the International Federation of Air Traffic Controllers' Associations (IFATCA), and the International Federation of Air Line Pilots' Associations (IFALPA) started an initiative in 2020. The initiative included collaborative safety risk assessments (SRAs) in the context of the COVID-19 environment. The SRAs were used to shape educational webinars that were organized with experts representing the different organizations. A document capturing the outcomes of the SRAs and webinars in 2020 and 2021 was developed to provide general considerations for airlines, ANSPs and airports during restart and recovery to normal traffic levels. The guidance document, Considerations for Navigating the Restart and Recovery of Air Traffic, is available online. The main focus areas of the SRAs and guidance document are explained in the following sections. The detailed recommendations can be found in the online document.

Occupational Health and Safety

Given the high complexity of the current public health crisis, States are applying different mitigation measures to manage public health risks. While some governments have issued vaccine mandates, others have not; however, vaccination remains highly recommended by health authorities and encouraged. Nevertheless, the workforce in a given organization may include a mix of vaccinated and non-vaccinated staff. This means requirements for wearing masks, contact tracing, testing, and physical distancing will likely continue for some time. This may also have an impact on staff rostering and corporate policies for health measures, applied even to vaccinated staff. Constant communication and training will continue to be needed to ensure a good understanding by operational staff about residual risks after vaccination and when returning to work. Additionally, regular risk assessment will be needed to evaluate the effectiveness of the multi-layered defense against infection outbreaks to avoid operational interruptions caused by outbreaks among staff. Specifically, during recovery to normal operations, contingency plans should be reviewed to ensure appropriate measures are available in case of an outbreak of COVID-19 infection among operational staff.

Human Factors During Restart of Operations

COVID-19 has been impacting human factors due to rapid and continuous changes in health requirements in the workplace and increasing levels of stress and anxiety specifically due to job uncertainty. Where needed, staff training and validation were postponed. At the same time, after a prolonged period of dealing with the COVID-19 pandemic and all its consequences, there are emerging signs of demotivation to follow recommended protective behaviors, which has been characterized as pandemic fatigue. It is recommended that organizations perform additional risk assessments, considering pandemic impacts of human performance. Education and awareness of operational staff on fitness for duty, self-care, and the availability of support programs will be key during restart and recovery to normal operations. Each type of operation is unique and must address the specific risks related to potential skills decay.

Maintaining Competency and Training

As traffic levels and complexities continue to be dynamic because of the impacts of COVID-19, bringing back Air Traffic Control Officers (ATCOs), pilots and dispatchers who have experienced prolonged absences can require additional attention to training and competency levels. After an extended period away from the flight deck, pilots are often surprised by what knowledge and skills have been retained and which have degraded. Some skills return quickly while others return and develop more slowly.

The following resources are available to support maintaining training and competency during COVID-19:

- Guidance for Post-COVID Restart of Operations: CBTA Training Solutions - IATA
- Guidance for Managing Pilot Training and Licensing During COVID-19 Operations - IATA
- White Paper - ATO-AOC Partnership Including Instructor Provisioning - IATA
- White Paper - Ensuring the quality of training when classroom instruction is delivered via virtual classroom - IATA
- Training Considerations for Return to Operations - IFALPA
- Return to Flying Checklist for Pilots - IFALPA
- Coping with COVID-19 Guide - IFATCA
- Returning to Normal Crew Training - ICAO

Change and Organization Management

The aviation system includes multiple layers of processes, technologies, and people all working together according to global standards that are based on over 100 years of flying experience. The system is complex and includes many actors along the different phases of flight. It takes all processes, technologies, and people working together to ensure a flight can safely take off and arrive at its destination. COVID-19 has disrupted many established procedures across the aviation supply chain, necessitating flexibility and increased awareness.

The 'new normal' created by COVID-19 is challenging some of the assumptions regarding how many functions of the supply chain are carried out. Airlines, ANSPs, and other stakeholders in the aviation supply chain may face difficulty in resource planning and staff/crew scheduling. Airlines and the aviation supply chain will need to adapt and be agile, where possible, to ensure a safe operation during recovery to normal traffic levels. At the same time, the industry is seeing an unbalanced reliance on technology in safety critical tasks, which may result in negative outcomes. This is especially the case as traffic starts ramping up again while operational staff may not have been using parts of their cognitive functions that are normally applied in their jobs. Therefore, there will be a need for operational and safety performance assessments against set KPIs/SPIs with a focus on areas that had reliance on automation since the outbreak of the pandemic.

Interface between Air Traffic Controllers and Crew

As airlines and aviation supply chain actors work together on restarting operations, several considerations need to be made with regard to the effects of training, recency and human factors on both flight crews and ATCOs as they interact with each other. In addition, varying traffic levels after periods of reduced operations could increase the magnitude of certain operational challenges for both airlines and ANSPs. The combination of new and amplified risks and challenges can affect the safety of operations as traffic levels build up.

It will be critical to understand the stressors and challenges on both sides. As air traffic ramps up, it is important for flight crews and ATCOs to take time to make sure that they understand each other, and that any ATC clearance is clearly understood. During periods of low traffic, it was possible to introduce more efficient routes and some operational improvements. During recovery, it may not be possible for ATCOs to continue granting requests for direct routing, for example, because of the increasing traffic levels and additional capacity constraints. Airlines and ANSPs should always work together to achieve system and operational improvements.

The Impact of COVID-19 on Airport and ATM Operations

As traffic levels ramp up, the availability of airport infrastructure may have an impact on traffic management. At the same time, the additional requirements to ensure the biosafety and health of passengers, crews, and staff could affect time spent on the ground, which will impact overall network performance. Ground handling agents across all regions have been experiencing different impacts of COVID-19, including impacts on their staff.

Therefore, it is recommended that airports develop local restart plans that are aligned with airline restart plans. Such plans should be continuously reviewed due to the dynamic operational environment. Airports should also refresh their local risk assessments of the changing environment and promote additional measures and procedures that will be needed to ensure safe operations during recovery. Training and re-training of staff, especially after call back, will be required.

Mental Health and Wellbeing

COVID-19 and its associated restrictions have had a significant influence on the mental health and wellbeing of both passengers and aviation workers, and potentially jeopardize operational safety. Multi-sector collaboration is required to promote the mental wellbeing of aviation personnel and to aid passengers in their trip preparations to deliver a psychosocially safe and supportive aviation environment. The ICAO has published an Electronic Bulletin (EB 2020/55) on Promoting, Maintaining, and Supporting Mental Well-Being in Aviation During the COVID-19 Pandemic, which describes:

- Harsh quarantine rules.
- Home or hotel isolation between flight patterns.
- Increased workload due to intensive cargo operations.
- Long and irregular working hours, reduced rest opportunities, and potential fatigue.

All of these factors have an impact on the state of wellbeing of aviation staff. Safety performance is related to the manner in which people perform their roles, and overall performance relies on sound individual and collective states of wellbeing. Pilot wellbeing programs support pilots during personal crises and/or stresses in their lives, which may impact relationships, health, or professional performance.

Pilot assistance programs provide peer support to fellow pilots, offering referrals to professional resources when appropriate, while upholding strict confidentiality. For other staff groups, Employee Assistance Programs (EAP) work in a similar manner.

The United States FAA, the EEASA, IFALPA, airlines, etc. advocate for peer support programs to be built on SMS principles.

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LOSS OF CONTROL — IN-FLIGHT

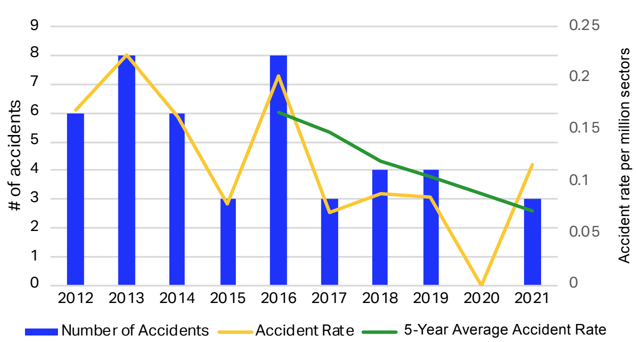
Background

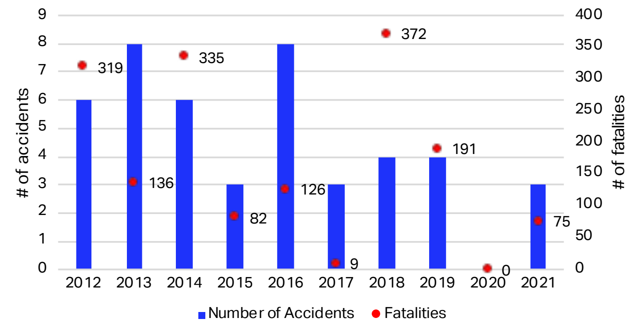
Loss of Control — In-flight (LOC-I) refers to accidents in which the flight crew was unable to maintain control of the aircraft in flight, resulting in an unexpected deviation from the intended flight path. LOC-I can result from a wide range of contributing factors that include, among others, system/component failures (engine and non-engine), hazardous weather conditions (e.g., icing, windshear), inappropriate energy management (stalls), poor automation management and monitoring (autopilot, autothrottle), incorrect maintenance, spatial disorientation, as well as other human and technical factors. Reducing this accident category through understanding of contributing factors and intervention strategies is an industry priority.

Discussion

Although the LOC-I category represented only 8% of all accidents during the last 10 years (2012-2021), it resulted in the highest percentage of fatal accidents (46%) and fatalities (63%). Among all accident end states, LOC-I is the greatest factor leading to fatalities. LOC-I prevention, because of the variety of possible contributing factors, does not benefit from a single system/equipment solution. Therefore, it deserves the highest attention that the commercial aviation safety sector can pay to it.

Nevertheless, the introduction of flight by Wire is gradually adding protections to the flight envelope that help pilots prevent and reduce the likelihood of LOC-I accidents. When looking at the rolling average of the LOC-I accident rate for the five years going back to 2012-2016 in the IATA ADX database, the average LOC-I accident rate recorded was 0.17 accidents per million sectors. For the next five years (between 2013-2017), the accident rate was 0.15. In the graph below, it is apparent that the rolling average five-year accident rate continues to trend downwards. Today, the average five-year (2017-2021) accident rate is 0.07 per million sectors. However, the 2021 LOC-I accident rate is 0.12, which is above the five-year average rate.





To assist the commercial aviation industry's awareness of LOC-I hazards and risks, IATA has developed an accident analysis report using data from LOC-I accidents. The risks of LOC-I can be mitigated, and it is hoped that the contents of the interactive LOC-I Accident Analysis Report will help achieve the goal of building pilot awareness of the conditions that can lead to loss of control. In addition, it should be mentioned that maintaining high pilot competency standards through training that includes Crew Resource Management (CRM) and basic manual flying skills, including during hazardous weather conditions, is the most effective barrier against LOC-I accidents. The report presents data from 64 LOC-I accidents that occurred over 10 years, spanning from 2009 to 2018.

Recommendations

Some of the recommendations from the LOC-I Accident Analysis Report for operators to consider are:

- Conduct training on energy management in a variety of scenarios and flight phases, including but not limited to, engine failure, thrust loss, and abnormal engine configurations.
- Institute Upset Prevention and Recovery Training (UPRT) using Full Flight Simulator (FFS) training modules, as recommended in ICAO AC-RASG-AFI-01, 2018, Model AFI Advisory Circular on Loss of Control — In-flight (LOC-I) and Upset Prevention and Recovery Training.
- Provide classroom and simulator as well as in-aircraft training to flight crew on a regular basis that provides a positive experience considering the flight characteristics and performance of the aircraft being flown by the pilots, including during hazardous weather conditions.
- Include and emphasize training for pilots to monitor the aircraft flight path and system, and encourage manual intervention, as appropriate.
- Reinforce workload management as well as task allocation and prioritization to maximize monitoring during Areas of Vulnerability (AOV).
- Ensure training is completed within the validated training envelope of the Flight Simulation Training Devices (FSTD).
- Refer to IATA Guidance Material and Best Practices for the Implementation of Upset Prevention and Recovery Training (REV 2).

- Consult the 3rd edition of the Airplane Upset Prevention and Recovery Training Aid (AUPRTA), which emphasizes both recognition and prevention.

- Incorporate, where applicable, the Commercial Aviation Safety Team (CAST) safety enhancements (SEs). All SEs, including 192-211 on Airplane State Awareness, are available on Skybrary.

While not an exhaustive list, pilots can prevent or recover from LOC-I accidents by taking the following actions:

- Increase awareness of the precursors leading to an upset or stall.

- Take definitive and decisive actions to recover from an upset.

- Increase awareness of the flight phases where poor monitoring can be most problematic.

- Strategically plan workload to maximize monitoring during AOV.

- Emphasize the briefing on pre-flight and, in certain phases, impending night or Instrument Meteorological Conditions (IMC) entries that complicate situational awareness and recovery.

- Increase awareness and understanding of certain controls and displays, such as the Flight Modes Annunciator (FMA) on the Primary Flight Display (PFD)/Electronic Attitude Director Indicator (EADI).

- Maintain constant awareness of the stall margin throughout all phases of flight.

- Download the LOC-I Accident Analysis Report to get an evaluation of the risk factors from LOC-I accidents and information designed to aid the industry in the implementation of mitigation strategies.

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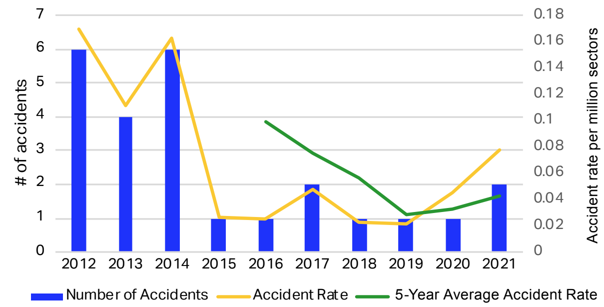
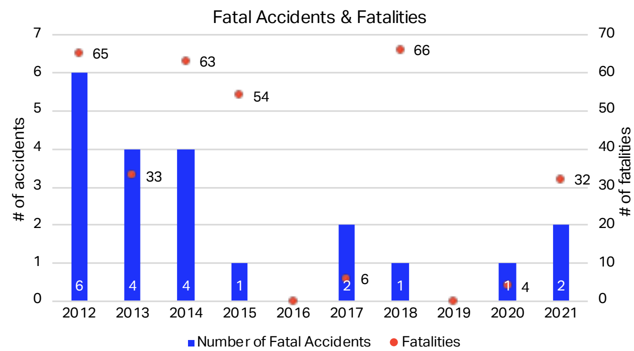
CONTROLLED FLIGHT INTO TERRAIN

Background
Controlled Flight into Terrain (CFIT) is when an aircraft collides during flight with a terrain, water, or an obstacle without indication of loss of control. Analyzing data for the last 10 years, CFIT is the second-most frequent cause of fatal accidents, resulting in 323 fatalities. When looking at the rolling average accident rate for the five years going back to 2012-2016, the average accident rate recorded was 0.10 accidents per million sectors. During the next five years (between 2013-2017), the accident rate was 0.07. The rolling five-year average accident rates continue to trend downwards. Today, the five-year (2017-2021) average accident rate is 0.04 per million sectors. However, the CFIT accident rate in 2021 is 0.08, which is above the five-year average.





Today, accident data shows that CFIT accidents are much lower than a decade ago, and the number of aircraft that have landed safely after an EGPWS or TAWS alert is growing every year. Nevertheless, CFIT accidents continue to occur. Dedication and commitment from leadership and all industry stakeholders, establishing a positive safety culture, as well as technological advances, such as EGPWS and TAWS, have played a role in the reduction of CFIT accidents. These alone do not prevent CFIT accidents, however. Reduction of this accident category requires:

- Efficient flight training to enable better crew performance

- Enhanced crew resource management

- Increased situational awareness (including weather conditions)

- Immediate response to EGPWS warnings

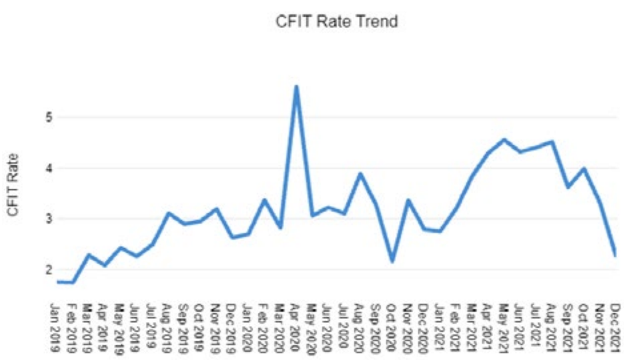
- Updating EGPWS software and Terrain/Obstacle/Runway database in a timely manner

- Good decision-making and execution

The industry is aware that the mandate of EGPWS and the immediate response to EGPWS warnings has been proven to be a great barrier to prevent CFIT accidents when used as intended. Evidence shows, to obtain the greatest safety benefit from EGPWS and ensure the system remains effective, a call for action by the operators is needed to ensure they update their systems, a task that can be achieved at very little cost. Outdated EGPWS equipment results in persistent nuisance and unwanted EGPWS warnings that could be avoided if the equipment was updated to the latest EGPWS software and Terrain/Obstacle/Runway database available. Such action would decrease the number of unwanted warnings experienced and thus increase the integrity and reliability of the EGPWS and the likelihood of timely pilot response. IATA is focusing its efforts to increase awareness of pilot response to EGPWS with guidance material that aims to improve the pilot response rate to EGPWS warnings and reduce further CFIT accidents. Refer to IATA/Honeywell guidance on performance assessment of pilot response to EGPWS.

Discussion
Although few in number, the outcome of CFIT accidents is almost always catastrophic, and can cause a high number of fatalities. As such, IATA will continue to identify the risks through its FDX and other monitoring programs, and contribute to reducing the number of accidents by raising awareness of the precursors and promoting safety measures. FDX is an aggregated de-identified database of Flight Data Analysis/ Flight Operational Quality Assurance (FDA/FOQA)-type events that allows IATA to identify commercial flight safety issues that may not be visible to an airline with a dataset limited to its own operations.

The chart below shows the event rate of CFIT/TAWS trend from January 2017 to December 2021. The FDX Event Rate is represented by the number of eventful flights per 1,000 flights in the FDX program.



IATA has also published a detailed interactive analysis report on CFIT accidents using 10-year data that can be found here. Data shows that a good number of CFIT accidents occur in the approach and landing phases of flight. Implementation of precision approaches or PBN approaches are effective methods to reduce the risk of CFIT accidents. Authorities and operators are, therefore, encouraged to comply with ICAO recommendations and guidelines regarding PBN implementation, particularly Approaches with Vertical Guidance (APV). Installation of lighting systems such as a Visual Glideslope Indicator (VGSI) or a Visual Approach Slope Indicator System (VASIS) are other methods to promote a Continuous Descent Final Approach (CDFA) technique that will help contribute to a stabilized approach.

To summarize, CFIT data from 2012-2021 shows that:

- While CFIT accidents are much lower than a decade ago, they continue to occur.
- CFIT ranked as the second-most common fatal accident category.
- The number of aircraft that have landed safely after an EGPWS warning is growing.

The most common contributing factors are:

Latent Conditions	▪ Deficient regulatory oversight or lack thereof ▪ Absent or deficient safety management ▪ Technology and equipment not installed ▪ Absent or deficient flight ops SOPs and checking
Threats	▪ Meteorology, including poor visibility/IMC ▪ Ground-based navigation aid malfunction or not available ▪ Lack of visual reference
Undesired Aircraft States	▪ Aircraft handling ▪ Unstable approaches ▪ Controlled flight towards terrain ▪ Vertical/lateral/speed deviation ▪ Unnecessary weather penetration
Errors	▪ Failure to cross-verify (automation) inputs ▪ Failure to follow SOPs ▪ Intentional deviation by flight crew ▪ Manual handling errors ▪ Omitted takeoff, descent, or approach callouts
Counter-measures	▪ Overall crew performance ▪ Monitor/Cross-check ▪ In-flight decision-making/contingency plan ▪ FO Is Assertive When Necessary and is able to take over as leader ▪ Captain shows leadership and coordination of flight deck activities ▪ Automation management

In support of the IATA/Honeywell guidance on performance assessment of pilot response to EGPWS guidance document, IATA has developed a CFIT Detailed Implementation Plan (DIP) and is working with airlines, OEMs, international organizations and other relevant stakeholders to see they are applied. This DIP, which can be found here.

- Facilitates the execution of the proposed recommendations
- Identifies and communicates with the concerned resources for the execution of the plan
- Reports progress against the plan
- Measures the implementation and the effectiveness of the plan

What Is Required from Operators?

Safety Management System

- Dedication and commitment from leadership and all industry stakeholders.
- Establish a positive safety culture.
- Encourage operators to use FOQA data to monitor proper responses by flight crew to EGPWS events.

- Increase awareness and visibility of the implications of deviating from established procedures.

- Consult with and promote the performance assessment of EGPWS Guidance Material (GM) and its recommendations.

Training
- Training departments should perform gap analysis against the latest EGPWS training GM available from IATA, EASA, FAA, ICAO, OEMs, and others.

- Enhance flight crew training by implementing CBTA to include an EBT program.

- Consult with the performance assessment of EGPWS GM and its recommendations.

Flight Operations
- Use of terrain display and access to latest information on weather conditions to enhance full situational awareness and ensure timely and appropriate pilot response.

- Encourage pilots and operators to report instantly to the relevant ATC units and authorities all incidents related to GPS or radio altimeter anomalies.

- Encourage flight crew to immediately respond to an EGPWS warning.

- Consult with and promote the performance assessment of EGPWS GM and its recommendations.

Technical Operations (Engineering and Maintenance)
- Ensure the EGPWS software/terrain database are kept up-to-date and highlight the safety benefits that can be obtained by keeping the software/database up-to-date.

- Ensure the use of GPS/GNSS for the position source to EGPWS.

- Consult with the performance assessment of EGPWS GM and its recommendations.

What Is Required from the Manufacturers' Perspective?
- Ensure the timely update of the EGPWS software and Terrain/Obstacle/Runway database.

- Consult with and promote the performance assessment of EGPWS GM and its recommendations.

What Is Required from Pilots?

- The EGPWS is NOT to be used as a primary reference for terrain or obstacle avoidance and does NOT relieve the pilot from the responsibility of being aware of the surroundings during flight. Situational awareness must be maintained at all times.

- Pilots are directly responsible and are the final authority as to the operation and safety of the flight. They are responsible for terrain, other aircraft, and obstacle clearance and separation.

- Once the pilot is cleared to conduct a visual approach, the pilot has full responsibility to maintain separation from terrain and obstacles. Safe separation from the terrain, obstacles and other aircraft must be maintained throughout the flight by using accurate navigation, especially during takeoff, decent and final approach, including briefings and proper checks. If pilots are unable to maintain terrain/obstacle clearance or separation, the controller should be advised and pilots should state their actions.

- Through thorough briefing, the flight crew would be able to know:

  - The main features of the departure route, descent, approach and missed approach.

  - Terrain and hazard awareness, including weather conditions.

- Briefings should include:

  - Significant terrain, obstacles and other hazards, such as weather along the intended departure route.

  - Standard Instrument Departure (SID) and Minimum Safe Altitude (MSA).

- The approach briefing should include:

  - Descent profile management and energy management.

  - Terrain awareness and approach hazard awareness, including weather.

  - Elements of unstable approach and missed approach procedures.

  - MSAs and other applicable minimums (visibility, runway visual range, cloud base).

  - Go-around altitude.

To conduct a safe go-around, advance preparation and a comprehensive crew briefing are essential components of risk mitigation. Operators should encourage flight crews to implement a TEM arrival briefing that includes aspects regarding the prescribed missed approach procedure and any threats, such as at airports surrounded by high terrain (with higher required climb gradients), aircraft performance in case of a one-engine inoperative situation, or a balked landing.

Recommendations

- Ensure EGPWS software and Terrain/Obstacle/Runway database are kept up-to-date.

- Ensure GPS/GNSS is used as a position source for the EGPWS.

- Ensure a policy is in place that at least one pilot selects terrain display during critical phases of flight (such as climb and descent below MSA) for additional situational awareness. If weather is not a threat, then both pilots could decide to select terrain display.

- Establish a training program to ensure flight crew is trained to respond to EGPWS alerts effectively.
- Airlines should have procedures to ensure EGPWS equipment always remains activated and serviceable.
- Pilots and operators should promptly notify the respective authorities of the interference location and the relevant ATC if they experience GPS or radio altimeter anomalies.
- Consult the IATA/Honeywell Performance assessment of pilot response guidance material (GM) and recommendations

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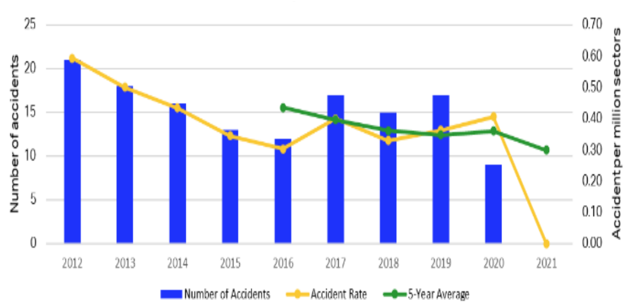
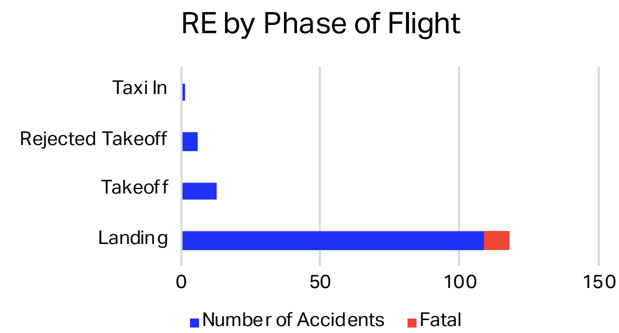
RUNWAY/TAXIWAY EXCURSIONS

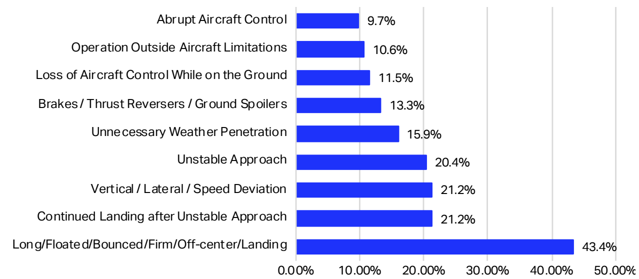
Background
Runway excursions are the result of an aircraft rolling beyond the end of a runway or veering out of its lateral limits. Historically, this category accounts for the most common end state in the accident database. While there are many factors involved in any accident, runway excursions often include factors related to weather or a high energy state when approaching the runway. Either on takeoff or landing, slippery runways with poor braking action due to contamination from snow, rain or ice, often associated with gusting winds, make aircraft control difficult and, as such, are often cited as threats in runway excursions. Long, floated, bounced landing is the undesired aircraft state most commonly cited, indicative of a high energy state while approaching the runway and may be suggestive of landings continued out of unstable approaches.

Discussion:
Analyzing the data from the last 10 years (2012-2021), Runway Excursion (RE) is marked as the most frequent accident category with 138 accidents and the third most frequent cause of fatal accidents with 9 accidents, resulting in 93 fatalities. These accidents occurred while the aircraft was taking off or landing, and involved many factors ranging from unstable approaches to the condition of the runway.

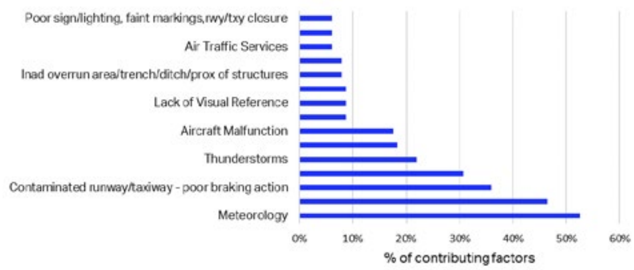


In 2021, there were zero RE accidents, and the rate of RE accidents has steadily decreased in the database over the past 10 years. However, for the past five years, the rate has plateaued in a range between 0.30 and 0.40 per million sectors. Despite there being zero accidents in 2021, the trend indicates that RE will continue to be a concern.





Overwhelmingly, the data indicates that most runway excursions occur in the landing phase of flight with common undesired aircraft states of long/floated/bounced landing and/or landing from an unstable approach. Stable approach criteria have been adopted by most operators and included into SOPs. While the rate of runway excursions has reduced, there are still a significant number of accidents due to unstable approaches. It is important that realistic and appropriate stabilized approach gates be set for the operation and recommended best practices for stabilized approach criteria be implemented, such as recommended by IATA/CANSO/IFATCA/IFALPA in the Unstable Approaches: Risk Mitigation Policies, Procedures, and Best Practices. Incorporating these recommendations along with effective CRM practices into SOPs is more effective when accompanied by a culture of compliance. Flight crews are expected to perform a go-around when arriving at a mandatory stabilized approach gate out of parameters and should feel comfortable doing so by flight planning with adequate fuel reserves. A non-punitive policy regarding go-arounds together with adequate training using various scenarios will increase flight crew confidence in their handling of the maneuver and will improve their go-around decision-making. A healthy flight monitoring program and SMS should monitor stabilized approach criteria to determine the effectiveness of policy and tailor training as appropriate to maintain a safe operation. Training for both Pilot Flying (PF) and Pilot Monitoring (PM) should reflect best practices, making crews not only aware of what the stabilized approach criteria are, but how to fly within parameters, recognize situations leading to unstable approaches, and when and how to properly conduct a go-around. Incorporating technology such as Runway Overrun Awareness and Alerting Systems into the aircraft to help alert crews when an insufficient amount of runway remains for a safe landing would further aid the crew in decision-making.



Meteorology was the most common threat identified in RE accidents by the ACTF along with related threats of windshear/gusty winds, runway contamination, and thunderstorms. To mitigate these threats, pilots need accurate information to use for calculating performance and in-flight decision-making. Use of the Global Reporting Format (GRF) standardizes reports of contamination and allows operators to develop procedures to guide crews in determining performance calculations and crosswind parameters for takeoff and landing based on the conditions. These reports should be easily and readily available. Using Digital Automatic Terminal Information System (D-ATIS) would help in distributing and updating reports as opposed to the already difficult NOTAM system. Accurate wind reporting for the runway in use would also aid in assessing the amount of crosswind or even when a tailwind is present. These factors all contribute to runway performance calculations, and all too often change adversely with a fast-moving weather system or thunderstorm.

Furthermore, the runway environment itself should be considered to make excursion accidents more survivable. A crowned, grooved runway clearly marked and free from rubber deposits allows for shedding of water and generally improved braking action to slow the airplane. A level clear area surrounding the runway, including sufficient overrun or Engineered Arresting Material, allows aircraft to dissipate energy safely as opposed to an environment with structures or steep drop-offs near the runway, which may cause significant damage to an aircraft in the event of an excursion.

Recommendations:
The Global Action Plan for the Prevention of Runway Excursions (GAPPRE), which includes a series of consensus-based recommendations that represent best practices and interventions that go beyond regulatory compliance, has been developed with the aim of preventing runway excursions. The Global Runway Safety Action Plan (GRSAP), which was developed to provide recommended actions for all runway safety stakeholders, with the aim of reducing the global rate of runway excursions and runway incursions is being updated. As pertains to runway excursions, the ICAO Runway Safety Tool kit provides links to access more reference material. Recommendations are highlighted and summarized below.

- All stakeholders should participate in runway excursion safety information sharing to further identify risks and best practices.

- SOPs should be developed, in accordance with OEM guidance and regulations, to clearly define safe approach planning, stabilized approach criteria, go-around, safe landing and bounced landing to include crosswind limitations by runway condition.

- SOPs and policies should:

  - Implement TEM strategies and SOPs on takeoff, landing and go-around phases of flight.

  - Include training that emphasizes, among others, the role of effective and active PM, and clearly defines actions for both PF and PM, including performance-based reactions to include PM intervention.

  - Require pilots to always be go-around-prepared and go-around-minded.

  - Include rejected takeoff/landing policy that defines all scenarios that may require the discontinuation of an approach or takeoff and encourages pilots to perform them, if necessary.

  - Adopt, as a minimum, the defined limits set by the OEMs for deviations from approach parameters.

- Review recommendations from available resources to identify ways to increase awareness of weather and airport surface conditions by pilots. A procedure should be in place to perform the landing performance calculation considering a deterioration of the forecasted weather conditions at the time of the arrival.

- Empower flight crew to advise ATC when unable to comply with an instruction or a clearance that would decrease safety margins.

- Support flight crew to use the most suitable or appropriate level of automation at busy airports until Decision Height/Minimum Decent Altitude (DH/MDA), and a visual reference for the runway is in sight.

- Ensure TEM strategies and SOPs are included in flight crew training programs, taking advantage of methods such as CBTA, including EBT. Training may include, but not be limited to, the following:

  - Assessment and analysis of non-normal situations not covered by SOPs.

  - Effective use of current and new technologies to determine landing distances in all weather conditions.

  - Planning and conducting approaches with appropriate contingency plans.

  - Preparing for a go-around in the event of deterioration of weather conditions.

  - Bounced landings that are specific to each aircraft type, following OEM guidance.

  - Scenario-based training to develop pilot competencies for effective TEM to prevent runway excursion (e.g., contaminated runway, last minute change of runway, deterioration of weather conditions).

- TEM pre-departure and arrival briefings.
- Effective determination of the takeoff and landing performance calculation and emphasis on the resulting runway safety margin.
- Effective usage of the ICAO GRF.

- A culture that stimulates safe behavior, encouraging risk averse decision-making, should be fostered by promoting a non-punitive go-around policy, use of alternates and compliance with stabilized approach criteria.
- Responsible Flight Data Monitoring programs should identify runway excursion risks for monitoring by a robust SMS.
- Technology should be implemented as available to monitor and alert flight crews to insufficient runway remaining, risk of runway excursion and high-energy approaches (such as Runway Overrun Awareness and Alerting Systems).
- Runways should be constructed with clear distance markings, water shedding to promote better braking, and sufficiently safe clear areas.

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UNSTABLE APPROACHES

Background
Approach and landing procedures are some of the most complex procedures in flight operations. The approach and landing phase of flight has a critical function in bringing an aircraft safely from airborne to runway, and a stable approach is a key feature to a safe landing. IATA ADX indicates that Unstable Approach (UA) was a contributing factor in 26% of the approach and landing accidents from 2016-2020.

The reduction of unstable approaches is an ongoing objective of the aviation industry. Operators have strict criteria that must be met to continue an approach. These criteria are based on a series of 'gates' that normally prescribe speed, aircraft configuration, rate of descent, power settings and the correct lateral and vertical path, taking into account real-time variables such as prevailing wind and weather conditions on the approach. If these criteria are not met at a certain point, a go-around is mandatory.

In 2017, IATA, in collaboration with CANSO, IFALPA and IFATCA, produced the 3rd edition of Unstable Approaches: Risk Mitigation Policies, Procedures and Best Practices. The purpose of this guidance is to raise awareness of the elements that contribute to unstable approaches, as well as to state some proven prevention strategies. The guidance also emphasizes the importance of pilots, ACTOs and airport staff working together with regulators, training organizations and international associations to agree on measures and procedures to reduce unstable approaches.

In 2020, during the COVID-19-induced downturn in air transport activity, an analysis of flight operations data revealed a substantial increase in the proportion of unstable approaches. UA was cited as a contributing factor in 29% (10 accidents) of all accidents that happened in that year. At that time, IATA alerted the industry of the increase through the issuance of an Operational Notice that recommended operators review and implement the recommendations found in the 3rd edition of the Unstable Approaches: Risk Mitigation Policies, Procedures and Best Practices document.

Discussion
It is common to think of unstable approaches as a precursor of RE accidents. A deeper analysis of IATA ADX accident data shows UA is one of the most common contributing factors to many accidents, like CFIT, Hard Landings, LOC-I, and Tail Strikes, among others. This realization, coupled with the increase of UA in 2020, gave rise to the UA Analysis Project, led by IATA and CANSO, and with the participation IFALPA, IFATCA, ATR, Boeing, Embraer, CAST, WMO, ICAO, and many airline members and industry safety partners.

The objective of the UA Analysis Project was to evaluate the effectiveness of current industry practices that have been implemented to improve the UA rate and provide recommendations to enhance their effectiveness or recommend new ones that might be missing. To support this work and its recommendations, a number of steps were taken, which included:

- Industry experts conducted five safety risk assessments (SRAs).
- A survey was conducted to help gauge the state of the industry and the effectiveness of current industry UA strategies, policies, training and communication efforts.

This initiative identified issues that significantly influenced the possibility of UAs, examined their impacts, and showed their importance in preventing UAs. Such issues are:

- Variations were noted across the industry in the implementation of stabilized approach SOPs recommended by aircraft manufacturers.
- Deviations by pilots from the operators' SOPs and industry best practices for stabilized approach criteria, as well as missed approaches and go-arounds.
- Lack of an industry-accepted definition of "high risk" UAs, which might help operators focus resources and achieve effective improvements in the UA rates.
- Lack of participation in industry safety information-sharing programs, and local and regional safety groups, which could produce systematic industry improvements in UA rates.
- Wider use of the 3rd edition of Unstable Approaches: Risk Mitigation Policies, Procedures and Best Practices and other industry documents is of paramount importance.
- Punitive safety cultures.
- Ineffective crew resource management.

Collaboration, cooperation, transparency, and communication between all participants, including the operators, manufacturers, state regulators, training organizations, ANSPs, ATCOs and, of course, the pilots themselves, is required to implement procedural changes to systematically reduce the rate of UA at runways identified as higher risk.

Recommendations
To overcome the issues identified by the safety experts, many options were considered by the group to enhance or implement new safety measures. They were weighted based on their effectiveness, cost, implementation time, and efficiency. In the end, the group settled on the following recommendations:

- Develop an industry standard for Risk Classification of Unstable Approaches ("high risk").
- Validate consistency for the use of stabilized approach SOPs in the industry.
- Promote the importance of establishing and actively participating in safety information-sharing programs (e.g., EASA - Data for Safety (D4S), FAA - ASIAS, IATA – FDX, Asia Pacific RASG - AP Share).
- Improve crew resource management behavior.
- Implement a positive safety culture and employ a non-punitive approach to reporting and learning from adverse events.
- Improve/implement national regulations to protect safety information and its sources.
- Measure implementation of information-sharing regulations in ICAO's Universal Safety Oversight Audit Programme (USOAP) and rank countries accordingly. Propose to ICAO to highlight safety information protections in their USOAP reports to countries.
- Update and promote the IATA, CANSO, IFATCA, IFALPA 3rd edition of Unstable Approaches: Risk Mitigation Policies, Procedures and Best Practices.
- Urge pilots to comply with SOPs and industry best practices for stabilized approach criteria, as well as missed approaches and go-arounds, due to the dangers of a UA.

A full report with the full set of recommendations will be made available on our runway safety page of the iata.org/safety.

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GROUND DAMAGE

Background
This category includes accidents that cause damage to aircraft while on the ground as a result of ground movements, such as taxiing to or from an active runway, or because of ground handling operations when parked on the ramp. In accordance with ACTF taxonomy, it includes:

- Occurrences during (or as a result of) ground handling operations
- Damage while taxiing to or from a runway in use
- Foreign Object Damage (FOD) not on the runway in use
- Fire/smoke/fumes while on the ground

Other events related to this classification are:

- Contact with another aircraft, person, ground vehicle, obstacle, building, structure, etc. while on a surface other than the runway in use.
- Damage while servicing, boarding, loading or deplaning the aircraft.
- Deficiencies or issues related to snow, frost and/or ice removal from the aircraft.
- Pushback/powerback/towing events.
- Jet blast downwash ground handling occurrences.
- Damage while in parking areas (ramp, gate, tiedowns).
- Preflight procedural or configuration errors leading to subsequent events (e.g., improper loading/servicing/secured doors and latches).

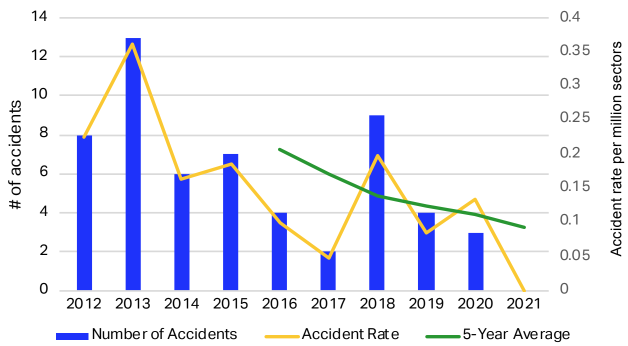
Discussion
When aircraft are taxiing to or from an active runway, they have to successfully navigate through designated paths, following and respecting the instructions given to them and using the signs and markings. Complex regulations, processes and procedures are put in place by regulators and airport operators to ensure no obstacles or threats pose a risk to aircraft movements.

While on the ramp, aircraft are surrounded by various equipment, ground vehicles, and ground personnel (including ground handling, airport, cargo, maintenance, and security crews, among others), all of which are always on the move and follow precise procedures and timelines to ensure safe and on-time operations. If this choreography of movements is not managed correctly, they can pose a threat to safe operations.

During ground operations, FOD is another concern, as it imposes a significant threat to safety. FOD can damage aircraft during critical phases of flight. The risk of FOD can be reduced by implementing FOD preventive measures and using FOD detection and removal equipment effectively.

ACTF recommends that all stakeholders, including GSPs, airports operators, and aircraft operators implement several measures to reduce ground damage accidents and promote safety culture.

In the last decade, the number of ground damage accidents followed a good downward trend until 2018, when the accident rate reached 0.20 per million sectors, well above the average five-year (2014-2018) accident rate of 0.14. In 2020, we saw another increase in the accident rate, which reached 0.14 per million sectors (above the average five-year (2016-2020) accident rate of 0.11 per million sectors).



Although there were no ground damage accidents reported in 2021, ground damage accounts for 9% (56) of total accidents reported in the IATA ADX from 2012-2021. Of the 56 ground damage accidents, we found:

- 50 involved passenger flights and 5 cargo flights
- 43 involved jet aircraft and 13 turboprop aircraft
- No fatal accidents

When categorized by phase of flight, we found the following distribution for the 56 ground damage accidents:

- 39% during taxi in/out
- 27% during engine start
- 18% during pre-flight
- 7% in parked position (post-arrival)
- 5% during ground servicing
- 4% on landing

The results of the ACTF TEM analysis of the same accidents shows the following contributing factors:

Threats	Environmental	▪ Meteorology ▪ Air traffic services
	Airport	▪ Airport facilities ▪ Poor signs/lighting/ markings ▪ Rwy/twy closure
	Traffic	▪ Airport traffic ▪ Vehicles
	Airline	▪ Aircraft malfunction ▪ Brakes
	Flight Controls	▪ Ground events
	Psychological/ Physiological	▪ Optical illusion ▪ Misperception
Errors	Procedural	▪ SOP adherence/cross-verification
	Communications	▪ Crew-ramp ▪ Crew-ground control
	Aircraft Handling	▪ Manual handling
Undesired Aircraft States	Gnd. Navigation	▪ Ramp movements ▪ Loss of aircraft control on ground ▪ Wrong twy, ramp, rwy, gate, hot spot
	Incorrect Aircraft Configuration	▪ Brakes, engine, thrust reverses, ground spoilers ▪ Operation outside aircraft limitations

Actions that can be taken to reduce ground damage accidents while taxiing or on the ramp include:

- Vehicle operators and flight crew must maintain situational awareness.
- Vehicle operators and flight crew must operate in accordance with all company and airport rules.
- Vehicle operators and flight crew must remain vigilant to the potential of other vehicles crossing at designated apron maneuvering areas.
- Flight crew must remain vigilant for a taxi lane that is compromised by another aircraft, vehicle or object.
- Flight crew, when taxiing in gusty wind conditions or at busy airports, must maintain a safe taxiing speed to ensure directional control and have the ability to recognize any potential hazards in time to avoid them.
- To help flight crew determine the wingtip path while taxiing when the wingtips cannot be easily seen from the cockpit, an anticollision aid, such as a camera system, should be installed.

Recommendations

ACTF proposes the following points to be revisited by both service providers and airport management to reduce ground damage accidents:

- Improve quality via a common audit program that could meet targets from GSPs and airlines.
- Implement combined training, including regulations, industry standards, best practices, and SMS.
- Follow aircraft ground handling procedures set by international organizations like the IATA IGOM, ISAGO and IATA AHM.
- Complete obstruction-free clearance, including FOD on runways, taxiways, and aprons.
- Perform requirements and procedures for regular inspection to detect and remove FOD.
- Hold detailed discussions with risk and safety departments regarding the introduction of any improved safety procedures to examine lessons learned.
- Ensure flight crew are familiar with the airport maneuvering areas and procedures, especially during construction and unusual circumstances.
- Enhance the ground communication between flight crew, ATC personnel and vehicle drivers during aircraft and vehicle operations in the maneuvering areas of airports to ensure greater situational awareness.
- Pay special attention to keep NOTAMs updated and with clear text.
- Develop a package of SPIs and SPTs to manifest and measure ground safety performance.
- Develop a package of Safety Performance Indicators and Safety Performance Targets to focus on collisions on the ground that are directly related to ground handling activities.
- Train ground personnel on CRM and competences such as leadership, teamwork, decision-making and problem-solving.
- Focus training on real exercises in situ with abnormal situation simulations rather than on theory.

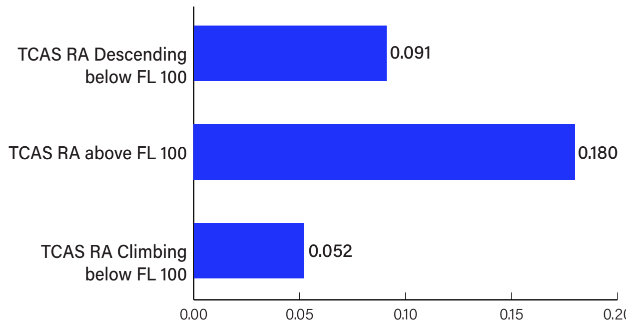
MID-AIR COLLISION

Background

Safety information continues to show that Mid-Air Collision (MAC) remains a high-risk area in aviation. In the IATA ADX, two accidents were attributed to MAC in the last 10 years, with zero MAC accidents in 2021. Although in 2021 the air traffic volume still has not reached pre-pandemic levels, the risk of MAC is still present in the industry. The outcome of a MAC accident would most likely be catastrophic with multiple fatalities.

Discussion:

Due to the consistent low number of MAC accidents, it is worth taking a close look at other data, especially data on the precursors to MAC, such as TCAS TAs and RAs. The IATA FDX database and an IATA/EUROCONTROL joint study provides good statistical data that helps to better evaluate the risk of MAC. At the time this report was prepared, the data shows the risk of encountering a TCAS RA between January 2017 and October 2021, excluding corporate jets, was 0.180 per 1,000 flights for the flight phase above FL100. TCAS RAs below FL100 have been split into TCAS Climb RAs (0.052 per 1,000 flights) and TCAS Descend RAs (0.091 per 1,000 flights), as the later are prone to develop additional conflicts (e.g., Ground Proximity).



FDX TCAS Rate (per 1,000 FDX flights)

Introducing TCAS in aircraft has, without a doubt, contributed largely to the low number of MAC accidents the industry has experienced in the last decade. TCAS has proven to be a reliable countermeasure to MAC, but there are shortcomings to be observed. Consistent updates of hardware and software, as well as effective pilot training, are crucial points to keep the system effective. Despite efforts made by the industry over the years, the recent IATA/EUROCONTROL study gave indications about some areas where the industry can still improve.

Opposite Initial Pilot Response (OIPR): It was discovered that, in several cases, pilots reacted to RAs in the opposite vertical direction than required (e.g., initiating a climb when a descent was needed). In most of these cases, the pilots corrected their actions within seconds and subsequently flew the RA in the correct vertical direction. The initial opposite reactions were occurring across a wide range of aircraft types and operators. The OIPR events may diminish the effectiveness of collision avoidance advice given by TCAS or trigger excessive reactions to correct the RA.

Excessive g-loads while responding to RAs: Occasionally, pilots apply excessive g-loads while responding to RAs. These cases should be captured by RA monitoring and investigated, as excessive g-loads carry a risk of injury to the aircraft occupants and, in some cases, damage to the aircraft.

To further enhance safety within the MAC category, operators must implement a TCAS monitoring program and investigate these types of events. The lessons learned will be fed into their safety promotion program and, when necessary, into their training program. Furthermore, existing procedures should be reviewed to determine whether they are suitable for every situation that can occur in their flight operations.

There are still large areas of airspace where commercial air traffic and general aviation operate in close proximity. In some areas, smaller aircraft are exempted from the use of transponders and see-and-avoid is the main barrier to prevent MAC. With today's speeds of modern aircraft, this proves increasingly ineffective, as one accident, involving two non-commercial planes (therefore not included in our database), that happened in Denver, CO, in 2021 showed in an impressive manner.

Improved positive safety culture: This includes improving resource management, air and ground communications, training, compliance with TCAS warnings, etc.

Recommendations:

- Flight crew should always respond to an RA without undue delay, but avoid hasty and abrupt reactions to prevent incorrect maneuvers. IATA recommends that all operators and flight crew consult with the 3rd edition of the IATA/EUROCONTROL Performance Assessment of Pilot Compliance with TCAS using FDM guidance material.

- Flight crew should refrain (except when mandated by SOP or operational guidance) from switching their TCAS to 'TA only' and always use TCAS TA/RA mode, especially during approach in high-density airspaces.

- FSTD manufacturers, airplane operators and ACTOs should work together to develop realistic TCAS training scenarios that provide a variety of real-world TCAS scenarios.

- Existing FSTDs should be upgraded to be able to provide these scenarios.

- TCAS training should be improved to address these realistic scenarios and some special cases (e.g., Low-Level TCAS Descend RA, TCAS scenarios during parallel RWY ops).

- The 'see-and-avoid' principle alone is too weak to be effective, especially combined with the speeds of modern jet aircraft and today's recovering traffic load. Where commercial airline traffic is allowed to be present in an airspace, the regulator should ensure TCAS systems for all traffic are compatible with each other and all traffic is known to ATC. This also applies to UAVs. This is indispensable around commercial airports.

- Pilots have to be able to easily determine in their charts where the boundaries between controlled and uncontrolled airspaces are located.

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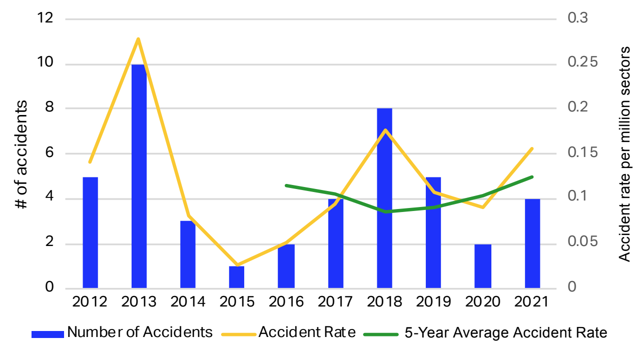
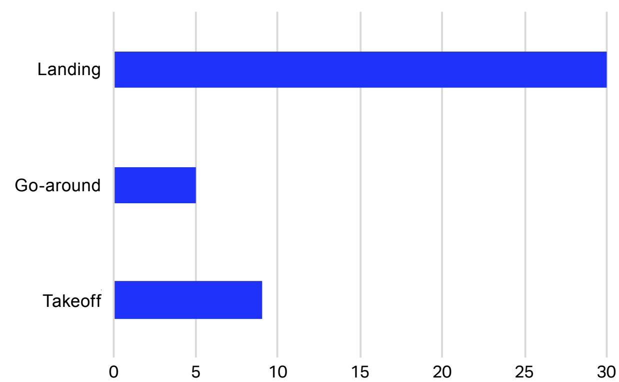
TAIL STRIKES

Background

While statistics show tail strike accidents can be a surprising threat during takeoff and go-around, they are much more common on landing. They can cause serious damage to aircraft and cost operators millions to repair. Tail strike accidents occur when the attitude of the aircraft is such that the tail makes contact with the runway in a way that causes substantial damage.





Discussion

Most tail strike accidents over the past 10 years occurred on landing. The most common threats cited are centered around weather conditions: meteorology and wind/windshear/gusty winds. Landing in gusty wind conditions is a difficult task. Higher approach speeds are required to maintain a safe margin from stall and rapid corrective control inputs are necessary as wind gusts displace the aircraft from the intended path. These factors result in arriving at the runway in a higher energy state, which contributes to the most commonly cited undesired aircraft state of long/floated/bounced landings followed closely by the undesired states of abrupt aircraft control and vertical/lateral/speed deviations. While these factors have been identified in tail strike accidents on landing or go-around, they are often mitigated in successful landings given similar conditions. Application of training, policies and procedures are often the difference between a successful landing or tail strike accident. Guidance on crosswind limits, stabilized approach criteria and pilot monitoring expectations help to mitigate this risk along with training in bounced landings, go-arounds, pilot monitoring, and gusty crosswind landings.

Tail strike accidents on takeoff are less frequent and often due to errors in calculating performance. These calculations have to account for the actual weight of the aircraft, the runway used, and current weather conditions. Errors due to documentation, weight and balance or dispatch paperwork are often cited in tail strikes on takeoff. Procedures must be in place to ensure proper performance calculations are made and communicated to flight crews. Training should be conducted to ensure the correct performance numbers are loaded and used for takeoff, including methods to mitigate errors when a change in runway or weather conditions occurs.

The tail strike data identified in the IATA ADX database only represents events that meet the threshold of substantial damage and, as such, do not fairly represent the number of tail strike incidents that occur and may underrepresent this risk factor as a precursor to more significant events. A flight data monitoring program should be used in conjunction with a robust SMS to monitor stabilized approaches, bounced landings and go-arounds to validate the effectiveness of policies and recommend changes to training, as appropriate to maintain safe operations.

Recommendations:

- Manufacturers and operators should establish clear parameters and guidance for wind limits, including crosswind, tailwind and wind gusts.

- Training should be conducted to make flight crews aware of risks and limitations of tailwind operations, as indicated in IFALPA's publication Tailwind Operations | IFALPA.

- Realistic stabilized approach criteria should be established as appropriate for the operation, as recommended in the IATA guide to stabilized approaches Unstable Approaches: Risk Mitigation Policies, Procedures and Best Practices, 3rd Edition (iata.org).

- Policies and training should be implemented on the role of effective and active Pilot Monitoring (PM) to clearly define actions for both Pilot Flying (PF) and PM, including performance-based reactions to include PM intervention.

- Training should include realistic, evidence and competency-based scenarios requiring TEM in regard to descent planning, stabilized approach, go-around and landing, including bounced landings, crosswinds and contaminated runways. Go-Around, Missed Approach and Balked Landings | IFALPA.

- Reliable methods and procedures need to be established for performance calculations, including weight and balance, as well as how these numbers are communicated to the pilots and/or loaded into the aircraft as recommended by IATA's FMS data prevention document IATA Teaching Plan.

- When the runway used for takeoff or landing is changed, reliable procedures and guidance should be implemented to verify that accurate performance is changed and used appropriate to the new runway.

- Technology should be considered to aid in takeoff performance monitoring, such as recommended by IFALPA's Take-Off Performance Monitoring System | IFALPA to possibly include Runway Overrun Awareness and Alerting Systems.

- Ensure TEM strategies and SOPs are included in flight crew training programs, taking advantage of methods such as CBTA, including EBT. Training may include, but not be limited to, the following:

  - Initiating scenarios with early or late flare.

  - Preparing for a go-around in the event of deterioration of weather conditions.

  - Using the most suitable or appropriate level of automation at busy airports until DH/MDA, and a visual reference for the runway is in sight.

  - Bounced landings specific to each aircraft type, following OEM guidance.

  - TEM pre-departure and arrival briefings.

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HUMAN FACTORS IN ACCIDENTS

Background:
As understanding aviation accidents is sometimes difficult, owing to the inherent complexity of how accidents come about within elaborate sociotechnical systems, we will focus on human factors on this section. ICAO defines human factors as the scientific study of the interactions between people, machines, and each other (ICAO, 2003).

The FAA further defines human factors as the multidisciplinary effort to generate and compile information about human capabilities and limitations and apply that information to produce safe, comfortable, and effective human performance. Another definition of human factors established by the Health and Safety Executive (HSE) is that human factors refer to environmental, organizational and job factors, as well as human and individual characteristics, which influence behaviors at work in a way that can affect health and safety.

Accident data analyzed from 2012-2021 shows that:

- Aircraft handling (37%) had the highest percentage of causal factors in undesired aircraft states.

- Aircraft handling, unstable approaches, unnecessary weather penetration were causal factors in many aircraft accidents.

- Environmental threats where present in 34% of accidents.

- Runway/Taxiway excursion is the accident category with the highest number of accidents.

Discussion:
Human factors were identified in most of the accident data. Human factors have been widely recognized as critical to aviation safety and effectiveness. Sustainable long-term improvements in aviation safety will come primarily from human factors solutions (e.g., research and development, analysis, and application of human factors methods in airline operations).

From a safety perspective, identifying the sources of human errors presents no simple task. Properly investigated and analyzed causal factors cannot rely solely on attributions to "human/operator error." It is widely acknowledged that errors are largely a result of a confluence of factors and/or conflicting objectives (rather than one simple factor), and that these multiple components involve complex processes associated with human behavior (e.g., cognition, organizational dynamics, individual and cultural differences), and how they interact with system design, tools, and the operational environment.

The modern interdependencies of errors, the tightness of aviation component coupling, and the high consequences of errors require extending human-system capabilities to enhance performance and take advantage of technological advances in materials, avionics, data collection, information access, and decision support systems. These technological changes, as well as the expectation of the human to accommodate them, create uncertainties and require additional human performance research to help develop future systems that are error resistant and error tolerant.

Recommendations:
The recommendations below are not exhaustive, as each organization should develop human factors strategies and interventions based on their unique organizational needs.

1) Managing patterns of failure:
Managing human failures is about predicting how people may fail through errors or intentional behaviors within the system. Operational risk assessments need to recognize the limits of human performance and consider the impact of task, personal, environmental, and organizational factors when deciding on control measures. The management of human error includes error prevention and interventions for disallowing errors from adversely affecting system output. Some of those techniques include human factors engineering, feedback/feedforward information systems, ergonomics, paperwork management, and behavioral safety, among others. It is up to the operator to determine the most suitable approach according to the operational context. Risk assessments and incident investigations are SMS elements of managing human performance.

Risk assessments should consider the critical elements of human failure, its implications, and ensure the associated Performance Shaping Factors (PSFs) are understood and the appropriate controls are defined.

The desired safety outcomes of risk assessments:

- Controls reflect limitations of human performance and consider task, personal and organizational factors.
- Systems and processes are designed to be tolerant of human performance failings.
- Performance-shaping factors are optimized.

Furthermore, incident investigation should consider the critical elements that enable understanding of performance variability, operator sensemaking, and allow human performance failings to be identified and root causes to be addressed. Event investigations conventionally focus on what went wrong, but the same methods can also be applied to what made sense to the operator and how many events went well before. Even in the context of adverse event investigations, questions can be asked about what went right during the event, how things usually go well, and why things sometimes go exceptionally well. Introducing modifications into an organization's classification schemes and taxonomies are likely to be needed.

The desired safety outcomes of the incident investigations should be to establish:

- Conditions that allowed performance variability to reach the brittleness boundary
- Conditions that allowed human failings to occur
- That system failings are corrected
- Designing systems that are tolerant of human performance failings
- Capturing the resilient capability of the actors when things go well for organizational and individual learning

2) Procedures:
Procedural noncompliance, or procedural drift, has been a causal factor in many aviation accidents. Procedural drift refers to the gap between work as prescribed and work as done.

Procedures include method statements, work instructions, SOPs, flight profiles, company guidance, etc. Incomplete, incorrect, unclear, or outdated procedures can lead to shortcuts and human failures. Procedures should be managed and use a format, style, and level of detail appropriate for the user and the task, and consider the consequence of failures. Procedures should:

- Consider the critical elements that are linked to (safety-critical tasks).
- Be selected, designed, and managed to promote human reliability.
- Be designed in a way that is easy to understand.
- Be kept up-to-date.
- Be easy to access.

The application of human-centered design and systems methods in procedure design is an effective method for taking into consideration work-as-done principles with the goal of closing the gap between work-as-imagined, work-as-prescribed, and work-as-done.

The desired safety outcomes:

- Procedures are implemented where they are needed and contain correct scope-actions-tasks, including emergency actions and sufficient detail.
- Tasks are executed safely and consistently with the intended design of the procedure, resulting in standardization.

- Procedures, checklists, and paperwork are established, and crews are trained in one consistent, predictable way, applying the company's basic operating philosophy.

- Standardization serves as an intervention against human error.

3) Training and Competency:
Studies and data have demonstrated that many of the causal factors identified in aviation accidents are related to human factor lapses in group decision-making, ineffective communication, inadequate leadership and lapses in flight deck management. Hence, the importance of CRM and training in enhancing safety in aviation operations.

Industry should consider the critical elements of enhancing flight crew training by implementing CBTA. Under a CBTA program, such as EBT, the pilot competencies encompass what was previously known as technical and non-technical skills to include the CRM skills of workload management, situational awareness, decision-making, communication and leadership, which are of utmost importance to ensure flight safety.

Given the essential contributions of the instructors/evaluators (IE) to flight safety, IATA led the definition of a pilot IE competency set that was endorsed by ICAO and EASA. Under CBTA, TEM is naturally and fully embedded in the training curriculum. The pilot and IE competencies provide individual and team countermeasures to threats and errors to avoid a reduction of safety margins during training and operations. CBTA is applicable to the whole spectrum of pilot training, from pilot aptitude testing, pilot initial licensing training, IE training and operator training.

4) Fatigue Management:
Fatigue poses an important safety risk to aviation. In addition to decreasing performance in flight, chronic fatigue has negative long-term health effects. (see "Fatigue in Aviation: Safety Risks, Preventive Strategies ...") Some of the main airline accidents identify chronic fatigue, sleep loss, and desynchronosis (jet lag) as three "human factors" that contributed to unsafety.

Fatigue refers to issues that arise from excessive working time or poorly designed roster patterns. It can lead to human failures, slower reaction times, reduced ability to process information, memory lapses, absent-mindedness, and loss of attention.

Fatigue management should consider the following critical elements:

- Roster patterns and duty hours are designed and managed to control crew fatigue levels.

- Flight crews are aware of fatigue, and rest periods are utilized effectively to get the required restorative sleep.

- Fatigue of crews is monitored and managed such that system safety is not compromised.

- Crew member fatigue is acknowledged as a hazard that predictably degrades various types of human performance and can contribute to aviation accidents and incidents.

- As fatigue cannot be eliminated, it should be managed.

The desired safety outcomes are that roster patterns and duty hours are designed to balance the demands of the flight duty with the time for rest and recovery so that personnel are alert when on duty. In this effort the Fatigue Management Guide for Airline Operations marks the collaboration between IATA, ICAO, and IFALPA to jointly lead and serve the industry in the ongoing development of fatigue management, using the most current science. It presents the common approach of pilots, regulators, and operators to the complex issue of fatigue. For more information, contact FRMS@iata.org

5) Organizational Culture:
Setting expectations, leading by example and decision-making that takes safety into consideration are essential in creating a strong safety culture. This means taking personal accountability for safety. The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management.

A learning organization values and encourages learning from its core and other organizations' experience. Learning organizations are characterized by "constant vigilance" and seek out bad news as well as good news. Understanding human factors can turn organizational learning into preventive solutions and using behavioral safety methods as an approach promotes safe behaviors and discourages unsafe behaviors.

Organizational culture should consider the following critical elements:

- Management of hazards is consistent within the business

- Production/safety conflicts are managed responsibly

- Risks are understood across the business

- Crew members are empowered to act safely

The desired safety outcomes are that organizational culture supports safe flight operations. The positive outcomes are timely risk recognition and management as well as effective TEM.

The operator should consider a systems thinking approach to safety. A systemic approach to safety implies considering the system, as well as the interactions and interconnections between its various elements—human, technology, organization, and context—rather than considering single elements in isolation. ("Systems thinking applied to safety culture approach in ...").

Developed by IATA, the I-ASC Survey is a solution aimed at addressing the industry's need to measure and continuously improve safety culture, using a standardized methodology and key performance indicators. With I-ASC, airlines can also benchmark their safety culture against their peers across the industry using comparable KPIs. ("IATA - Aviation Safety Culture Survey (I-ASC)").

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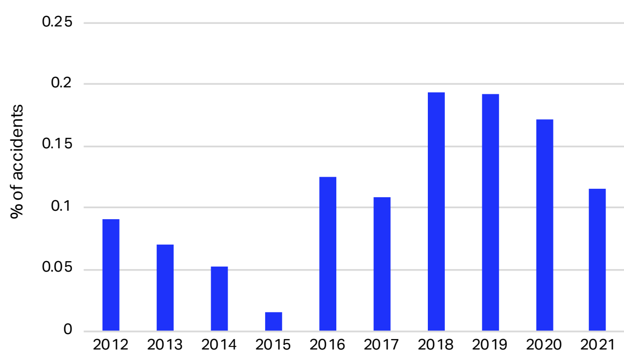
IN-FLIGHT DECISION-MAKING AND CONTINGENCY MANAGEMENT

Background:
With increasing financial pressure on airlines and airports, and airspace becoming more congested and severe weather phenomena becoming more frequent, the chance of a diversion from the original destination airport will grow.

In-flight Decision-making is a systematic approach to the cognitive process of selecting the best course of action by pilots in response to a given set of circumstances. It involves sound decision-making by the pilot during a flight, when operating in a complex operational environment. It requires pilots to maintain situational awareness, relevant skills, and experience. The decision to divert without sacrificing situational awareness, for example, due to weather or other unfavorable flying conditions, usually involves economic consequences. Choosing not to divert, however, can lead to an unwanted outcome.

In-flight decision-making was a contributing factor in 10% (62) of all accidents from 2012-2021. The ACTF taxonomy added proactive In-flight Decision-making and reactive Contingency Management as Flight Crew Countermeasures in 2019. Missing or insufficient in-flight decision-making significantly increases the risk of accidents. A number of events had already raised concerns about many of the approach and landing accidents, giving rise to recommendations. The chart below shows the percentage of accidents per year that have missing or insufficient In-flight decision-making as a contributing factor.



It is apparent in the accident data of the last 10 years that in-flight decision-making is a factor in a number of accidents. Refer to the following table:

End State	2021	2012-2021
Runway/Taxiway Excursion		22 (29%)
Hard Landing	1 (4%)	9 (10%)
Loss of Control — In-flight		9 (12%)
Controlled Flight into Terrain	1 (4%)	7 (10%)
Tail Strike		6 (9%)
In-flight Damage		3 (7%)
Gear-up Landing/Gear Collapse		2 (3%)
Other End State		2 (4%)
Off-Airport Landing/Ditching		1 (3%)
Undershoot	1 (4%)	1 (4%)

Good pilot judgment and sound in-flight decision-making are, therefore, crucial for safe aircraft operations and accident prevention. With good judgment and sound decision-making, the inherent risk in a flight is reduced. It is also important to mention that sound decision-making does not always involve choosing the best solution, but making a choice that is adequate to ensure the safety of a flight, rather than eliminating economic consequences.

Discussion:
Many airlines offer strategies to their pilots for reactive decision-making in abnormal conditions and onboard failure cases, such as an unexpected deterioration of weather conditions or a failure of an onboard system. These are sound concepts based on TEM models, well documented and demonstrated to crews on a regular basis during training.

However, very few strategies can be found for normal operations in terms of giving the crews guidelines for a proactive selection of desirable conditions and triggers for a diversion to an alternate airport. Planned alternate airports are mainly based on official weather minima. In the case of a real diversion, crews may find themselves in conditions that are the same or even worse than at the original destination, but now with considerably less fuel.

The difference between a legal alternate and a sound valid alternate option is often not considered by crews when diverting, nor is this trained. This may end up in a cul-de-sac situation with minimum fuel or, in the worst case, in a hopeless situation with no fuel. Often, the airlines' operational control centers do not have all the necessary operational information about possible diversion alternates available. Operational constraints, apart from weather-related threats, are not consistently considered during the decision-making for an alternate airport.

Recommendations to Operators
Create, document, and train a proactive model for in-flight decision-making during normal daily operations. These models should ensure a solid guideline that allows crews to have a stringent and timely strategy for diversion airport assessment. A valid diversion airport should always have adequate weather conditions, which may be different from legal minima. Operational conditions should be such that the traffic situation

as well as system constraints and outages present no threat to a safe landing. The airport layout should allow for more than one landing possibility (e.g., at least a parallel taxiway) to prevent a cul-de-sac scenario.

Enable operational control centers or dispatch to have access to relevant enroute conditions, alternate airport databases and means to transfer this information to flight crews enroute in a timely manner.

Ensure that a reactive decision model is documented and trained to flight crews on a regular basis.

Recommendations to Industry
Develop and maintain databases for hazards enroute or at specific airports and make them available to airlines and their crews and operational control centers.

Develop exemplary models for proactive and reactive decision-making models as a template for airlines.

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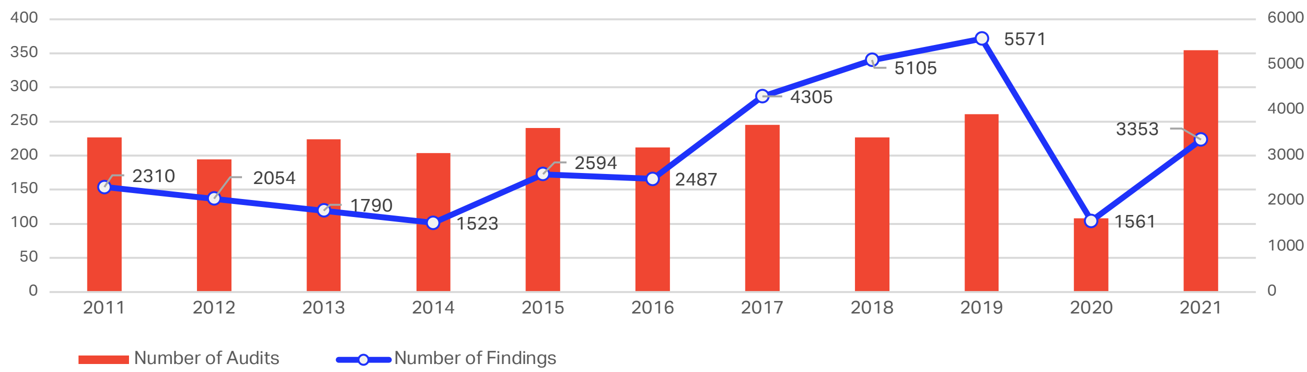
IATA Operational Safety Audit 2021 Insight

In 2021, a record 355 IOSA audits were conducted. These audits led to 3,353 corrective actions to improve failed barriers built to prevent incidents and accidents (IOSA Standards and Recommended Practices - ISARPs).

Audits/Findings per Year (2011-2021)

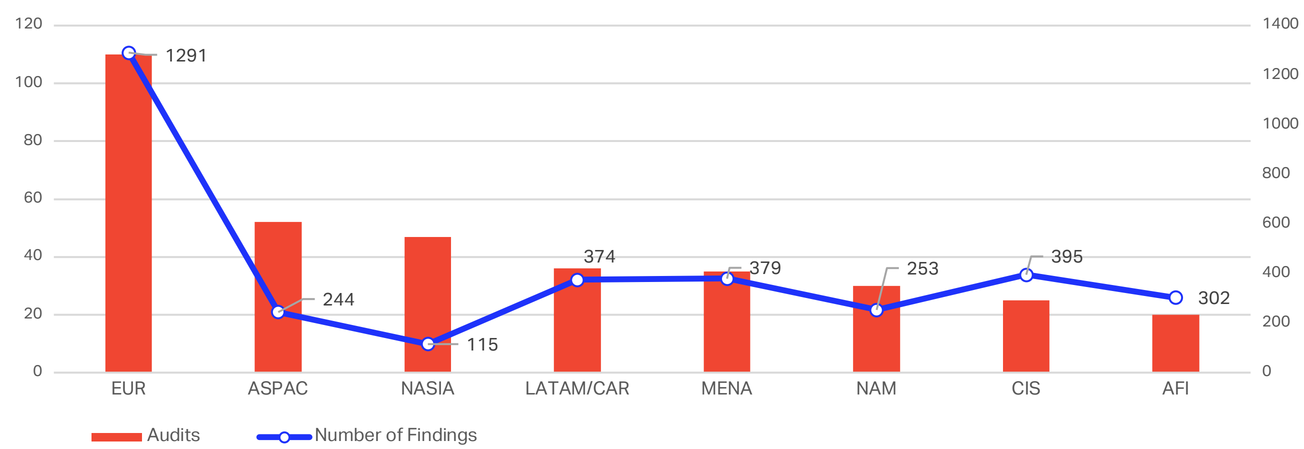
Distribution of findings compared to audits performed between 2011-2021



Note: *Due to the COVID-19 pandemic, the number of IOSA audits drastically reduced in 2020. In 2021, 180 of the 355 audits were performed remotely with a checklist that includes a reduced number of ISARPs.*

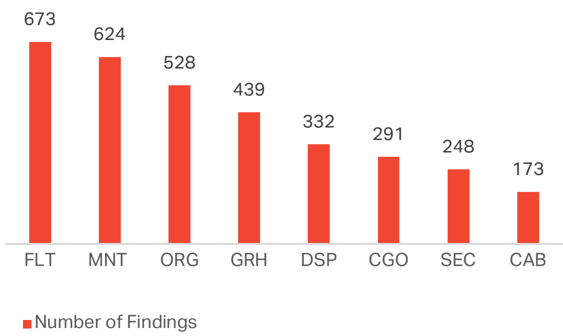
Audits/Findings per Region (2021)

Distribution of findings compared to audits performed per region



Findings per IOSA Scope (2021)

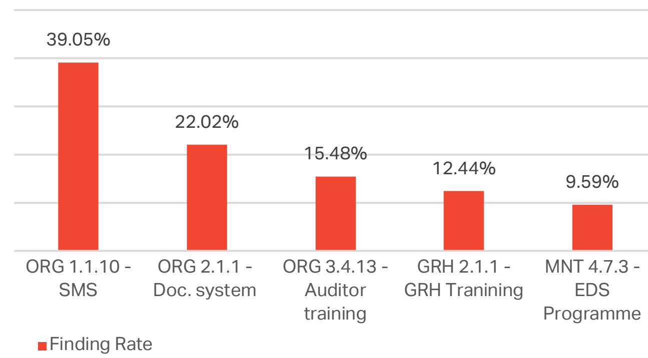
The number of findings per IOSA Scope



Definitions of these abbreviations can be found in the charts below

Top Findings per ISARPs (2021)

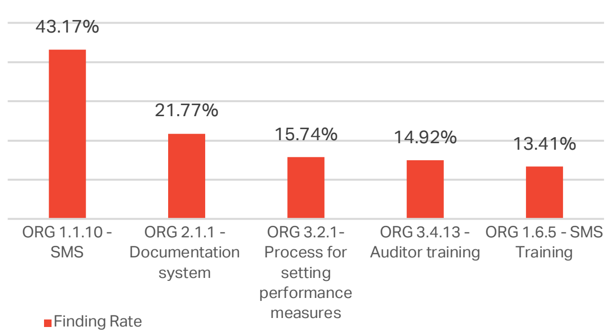
Top findings per ISARP



IOSA Audit Results – (2019 – 2021)

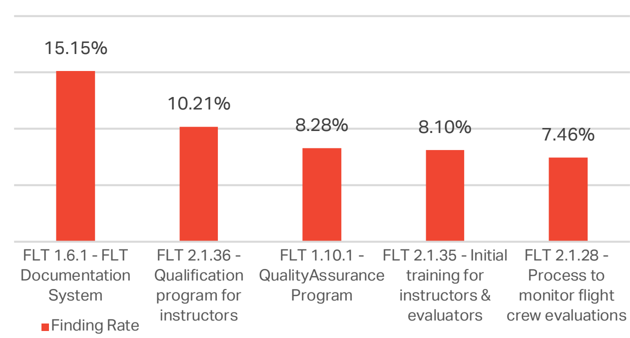
ORG Section Top Findings (2019-2021)

Organization and Management System (ORG)



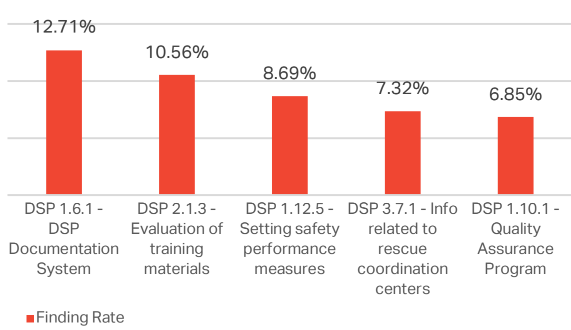
FLT Section Top Findings (2019-2021)

Flight Operations (FLT)



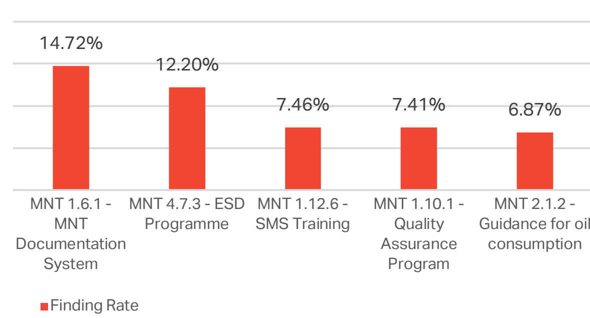
DSP Scope Top Findings (2019-2021)

Operational Control and Flight Dispatch (DSP)



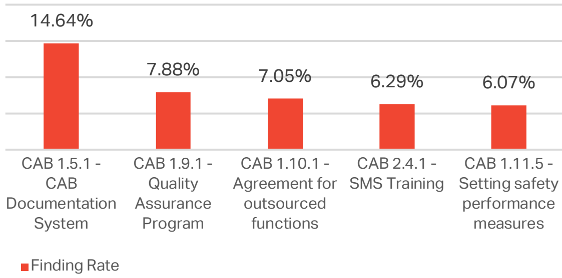
MNT Scope Top Findings (2019-2021)

Aircraft Engineering and Maintenance (MNT)



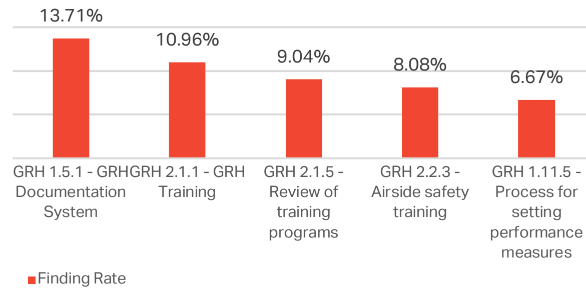
CAB Section Top Findings (2019-2021)

Cabin Operations (CAB)



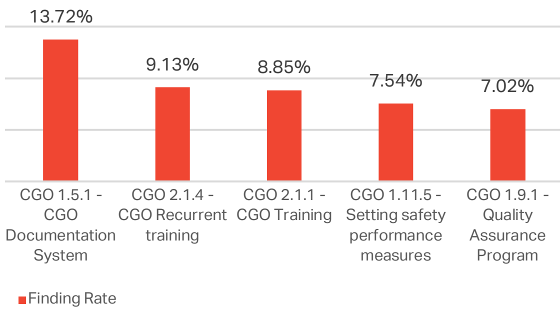
GRH Section Top Findings (2019-2021)

Ground Handling Operations (GRH)



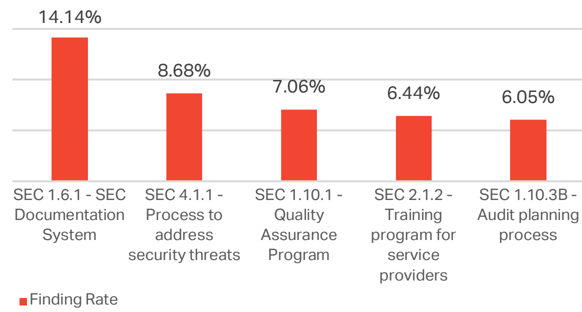
CGO Scope Top Findings (2019-2021)

Cargo Operations (CGO)



SEC Scope Top Findings (2019-2021)

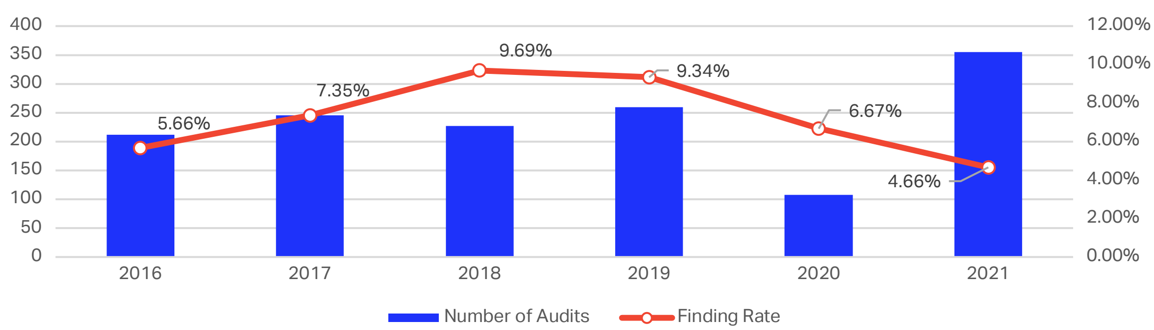
Security Management (SEC)



IOSA Audit Results – (SMS)

ORG 3.1.1 – Hazard Identification Program (2016-2021)

The trend of ORG 3.1.1 findings compared to audits performed in year



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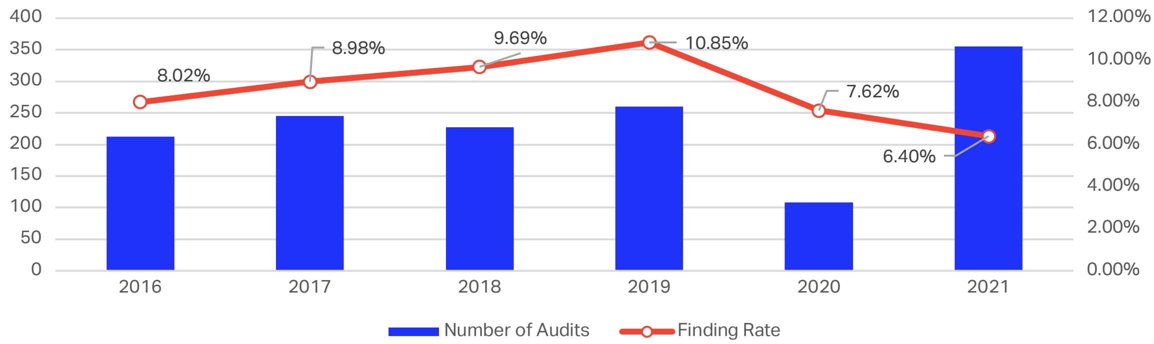
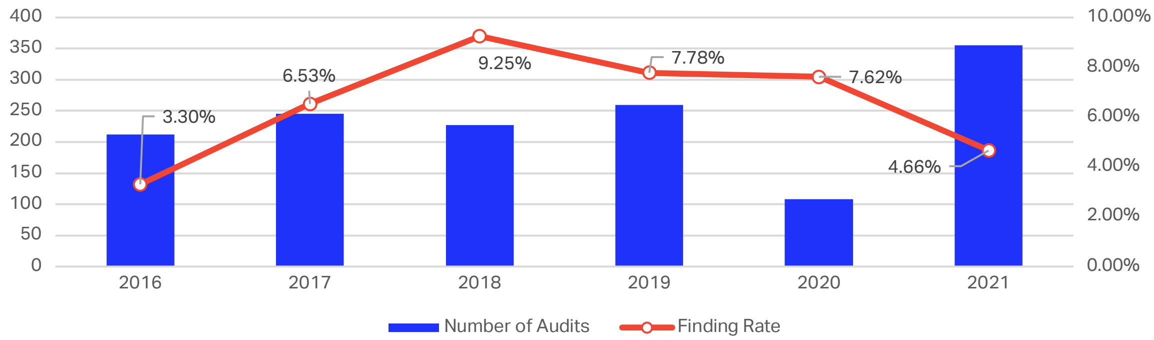
ORG 3.1.2 – Safety Risk Assessment & Mitigation Program (2016-2021)

The trend of ORG 3.1.2 findings compared to audits performed in year



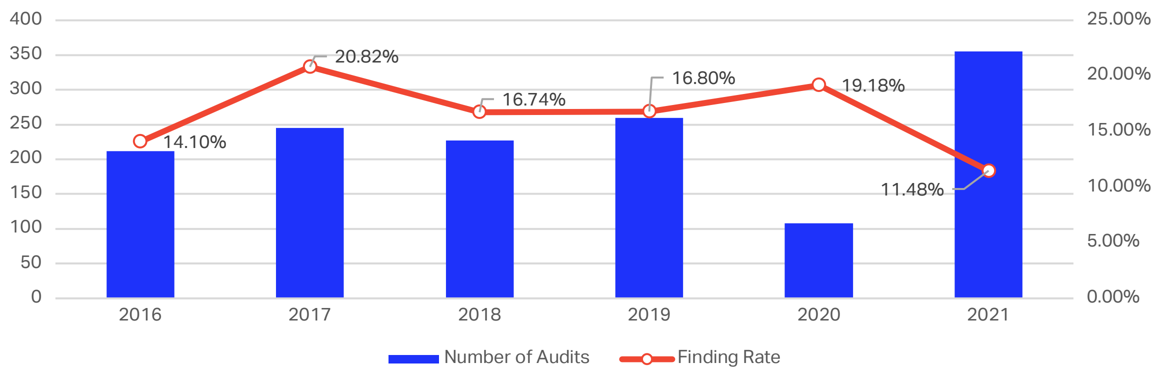
ORG 3.1.3 – Operational Safety Reporting System (2016-2021)

The trend of ORG 3.1.3 findings compared to audits performed in year



ORG 3.2.1 – Safety Performance Measures (2016-2021)

The trend of ORG 3.2.1 findings compared to audits performed in year



In 2021, a record 355 **IOSA audits** were conducted. These audits led to **3,353** corrective actions to **improve failed barriers** (ISARPs) built to prevent incidents and accidents.

IOSA Program Office

10

Cabin Safety

This section of the IATA Safety Report is intended to provide the reader with an update of the activities of IATA Cabin Safety during 2021 to support IATA members worldwide and drive improvement to cabin operations and safety.

CABIN OPERATIONS SAFETY TASK FORCE

The IATA Cabin Operations Safety Task Force (COSTF) is established to maintain a close working link between IATA and the airline operational environment. The members of the COSTF are industry experts in cabin safety and include safety investigators, policymakers, cabin crew trainers and safety auditors. A global representation of 15 member airlines is maintained, and membership is reviewed every two years.

The COSTF's mandate includes reviewing and updating the IOSA standards relating to cabin operations, updating all IATA Cabin Safety guidance materials, keeping IATA Cabin Safety informed of emerging risks within cabin operations and identifying key SPIs, which can be used to assess the efficacy of current procedures and mitigations.

Membership of the COSTF was renewed during 2021. Current membership comprises representatives from the following airlines:

1. Westjet
2. Delta Air Lines
3. GOL
4. British Airways
5. TAP Portugal
6. Swiss
7. Lufthansa
8. Blue Air
9. ITA
10. Turkish Airlines
11. Kenya Airways
12. Qatar Airways
13. Emirates Airline
14. Virgin Australia
15. Cathay Pacific

IATA SAFETY CONNECT

The purpose of the IATA Safety Connect program is to create a connected community for airlines to discuss safety issues and concerns and to be kept updated with IATA's safety-related activities worldwide. The program is open to airline safety teams around the world and was launched in September 2021. Since then, the membership has grown to 240+ safety professionals from 122+ airlines around the world, actively engaging in regular discussions on issues relating to Flight Safety, Cabin Safety, Cargo Operations, and many more. IATA Safety Connect allows airlines to be kept appraised of both regional and global safety initiatives that IATA is working on and provides a direct connection between airline safety teams around the world.

CABIN OPERATIONS SAFETY CONFERENCE

The global IATA Cabin Operations Safety Conference has become an established and popular venue for the exchange of ideas and education of cabin safety specialists. The format of the event aims to educate and inform delegates with plenary and interactive workshops focusing on the issues identified through IATA's activities as needing focus and attention.

With the ongoing COVID-19-related travel restrictions and difficulties evident during 2021, a decision was made to produce a virtual online event that was delivered in December. Presentations and discussions included current issues faced by airlines including:

- Unruly passengers
- Cabin crew mental health and wellbeing
- Carriage of passengers with disabilities
- Airline's experiences during restart of operations
- Using safety data within Cabin Safety Management

In addition to the live presentations, a series of prerecorded videos on other topics were included in the event application for delegates to review at their leisure.

As of January 2022, work is underway to produce an in-person event to take place in Lisbon, Portugal from 14 June to 16 June. Full details are published on our webpage.

CABIN OPERATIONS SAFETY BEST PRACTICES GUIDE

The IATA Cabin Operations Safety Best Practices Guide is intended to give airlines the tools they need to create and update safety procedures and policies using a global range of references and expert opinions. The guidance is aimed at supporting IOSA standards relating to the cabin and helping airlines demonstrate their competency during audits of cabin operations.

The guide was comprehensively updated during 2021 and published in electronic format in January 2022. IATA member airlines may receive a complimentary copy after joining the IATA Safety Connect platform and completing the request form on the Cabin Safety page.

Non-IATA member entities may purchase the guide on the IATA store.

CABIN OPERATIONS SAFETY RISK ASSESSMENT

As new and emerging risks are identified, either through the work of the COSTF members or from other airlines within IATA Safety Connect and the IATA Global Safety Risk Management Framework, they are added to a risk assessment process.

Once risks are assessed by the COSTF, they are published to all members of IATA Safety Connect. During 2021, new risks were added and assessed in relation to restart activities, recruitment and training of cabin crew and other aspects of cabin operations as airlines slowly recover from the pandemic.

ACCIDENT REVIEW

This section of the IATA Safety Report highlights the categories of cabin safety end states that resulted from an accident. Only those that were classified as an accident in accordance with the IATA definition are included in this analysis.

The following definitions apply to the end states in this section:

- **Normal Disembarkation:** Passengers and/or crew exit the aircraft via boarding doors during normal operations.
- **Rapid Deplaning:** Passengers and/or crew rapidly exit the aircraft via boarding doors and jet bridges or stairs, as a precautionary measure.
- **Abnormal Disembarkation:** Passengers and/or crew exit the aircraft via boarding doors (normally assisted by internal aircraft or exterior stairs) after a non-life-threatening and non-catastrophic aircraft incident or accident and when away from the boarding gates or aircraft stands (e.g., on a runway or taxiway).
- **Evacuation (land):** Passengers and/or crew evacuate the aircraft via escape slides/slide rafts, doors, emergency exits, or gaps in the fuselage; usually initiated in life-threatening and/or catastrophic events.
- **Evacuation (water):** Passengers and/or crew evacuate the aircraft via escape slides/slide rafts, doors, emergency exits, or gaps in the fuselage and into or onto water.
- **Hull Loss/Nil Survivors:** Aircraft impact resulting in a complete hull loss or no survivors.

Cabin End States

	2021	2019-2021
Total 'Passenger-only' Accidents	16	86

There were 16 accidents involving passenger-only aircraft in 2021. To identify patterns or trends, this figure is added to the previous two years' data to create the following charts.

A cabin end state classification is recorded where such information is available within the accident report in the database. In some cases, an end state cannot be identified, for example when aircraft damage that meets the criteria for an accident is identified after an event, but had no impact on cabin operations at the time.

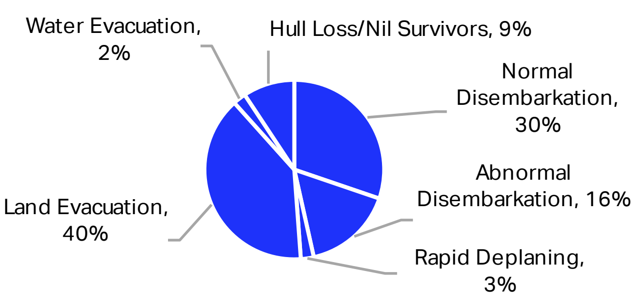
Overall, cabin end state classifications were identified in 73 of the 86 accidents in the data set for 2019-2021.

	2019-2021					
	Normal Disembarkation	Abnormal Disembarkation	Land Evacuation	Water Evacuation	Hull Loss/ Nil survivors	Total
All	19	9	36	1	8	73
IATA Member	10	7	12	0	2	31
IOSA-Registered	14	8	20	0	2	44
Fatal	0	0	6	0	8	14
Hull Loss	0	0	8	0	7	15
Jet	13	7	17	1	4	42
Turboprop	6	2	19	0	4	31

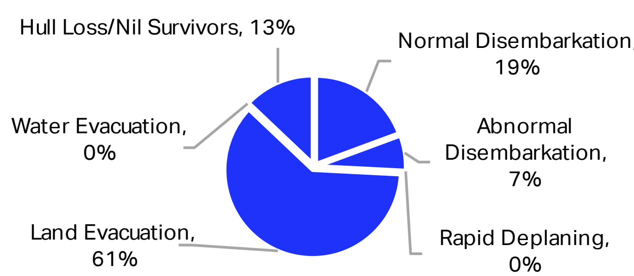
These demonstrate the following key points for cabin crew training discussions:

- Water evacuation remains a very rare event (1.36% of accidents).
- Land evacuation was required in 49% of accidents.
- Emergency evacuation was not required in 38% of accidents:
  - Normal disembarkation was possible in 26% of accidents.
  - Abnormal disembarkation was used in 12% of accidents.

Cabin End State – Jet



Cabin End State - Turboprop



When comparing cabin end states between jet and turboprop aircraft types, the following differences are observed:

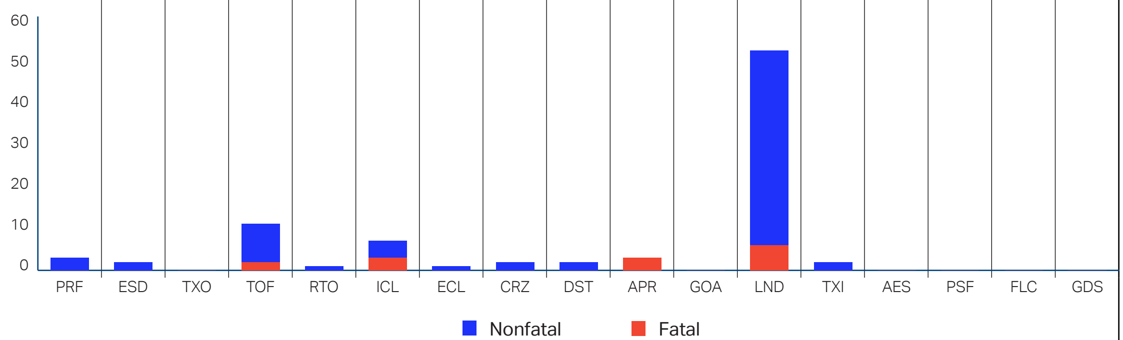
- A land evacuation is more common on turboprop aircraft, with 61% compared to 40% on jet aircraft.

- A normal disembarkation is more common on jet aircraft, with 30% compared to 19% on turboprop aircraft.

On smaller turboprop aircraft, evacuation to the ground is easier to facilitate as evacuation systems such as integral steps pose lesser risk to the occupants than slides. Additionally, on small aircraft, more passengers are likely to be in closer proximity to any evident hazards. It may, therefore, be easier to determine that an evacuation is the safest option following accidents on turboprop aircraft, compared to larger jet aircraft with more complex evacuation systems, a greater distance between passengers and hazards, and higher doors from the ground.

Cabin End States per Phase of Flight (2019-2021)

	PRF	ESD	TXO	TOF	RTO	ICL	ECL	CRZ	DST	APR	GOA	LND	TXI	AES	PSF	FLC	GDS
Total Accidents	3	2	0	11	1	7	1	2	2	3	0	52	2	0	0	0	0
Normal Disembarkation	33%	0%	0%	36%	0%	14%	100%	0%	50%	0%	0%	21%	0%	0%	0%	0%	0%
Abnormal Disembarkation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	17%	0%	0%	0%	0%	0%
Rapid Deplaning	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Land Evacuation	0%	50%	0%	27%	100%	14%	0%	50%	50%	33%	0%	50%	50%	0%	0%	0%	0%
Water Evacuation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%
Hull Loss/Nil Survivors	0%	0%	0%	18%	0%	43%	0%	0%	0%	67%	0%	2%	0%	0%	0%	0%	0%



Total Accidents: 86

Note: Refer to Annex 1 for definition of each phase of flight
Percentages are calculated based on the total number of accidents, not all of which are classified with a cabin end state; therefore, sum may not add to 100%.

The above table shows the distribution of cabin end states per phase of flight. There were a number of accidents in which the cabin end state classification could not be clearly identified from the report; therefore, the columns do not always calculate to a total of 100%.

Takeoff, initial climb, approach, and landing are the key stages of flight when accidents are more likely to occur. In all of the accidents occurring during these stages, cabin crew would be secured in their crew seats after performing cabin secure checks. IATA recommends that while seated in their crew seats, cabin crew are performing a "silent review" of emergency procedures that they would carry out should an accident occur, so they are best prepared and ready to act immediately, if necessary.

Further classifications within IATA's ADX are used to demonstrate to airlines the level of preparation and time available for cabin crew to undertake any additional emergency procedures prior to any accident. In almost all of the accidents classified during 2021, events occurred suddenly within normal operations and cabin crew did not have time to perform any additional briefings or emergency preparation. This highlights that it is important for passengers to pay attention to regular safety briefings and for cabin crew to ensure cabin secure checks are fully effective for each takeoff and landing.

Accident End States and Cabin End States (2019-2021)

	Total	Normal Disembarkation	Abnormal Disembarkation	Rapid Deplaning	Land Evacuation	Water Evacuation	Hull Loss/ Nil Survivors
Runway / Taxiway Excursion	20	0	1	0	18	1	0
In-flight Damage	10	6	1	0	2	0	1
Hard Landing	10	4	4	0	2	0	0
Gear-up Landing / Gear Collapse	9	0	3	0	6	0	0
Loss of Control — In-flight	5	0	0	0	0	0	5
Tailstrike	5	5	0	0	0	0	0
Undershoot	4	1	0	0	3	0	0
Controlled Flight into Terrain	2	0	0	0	1	0	1
Ground Damage	2	1	0	0	1	0	0
Other End State	2	1	0	0	0	0	1
Runway Collision	1	0	0	0	1	0	0
Mid-air Collision	0	0	0	0	0	0	0
Off Airport Landing / Ditching	0	0	0	0	0	0	0

This table shows accident classifications and their associated cabin end state, in order of frequency and can provide useful information for cabin crew training exercises and discussion.

It shows, for example, that the most common event is a runway excursion and that this will most likely result in a land evacuation or abnormal disembarkation. It also shows that gear collapse accidents resulted in six land evacuation responses and three abnormal disembarkation events.

Water evacuation remains a very low probability with only one event in this dataset, but as the severity is high, procedures and training are focused on giving the cabin crew the tools they may need to manage such rare situations. In this incident, water evacuation was necessary following a runway excursion after landing.

Unruly Passengers

The issue of unruly passengers onboard aircraft remained in the media throughout 2021. The continuation of mask mandates had an impact on the number of noncompliance reports worldwide, as some passengers refused to wear face coverings or masks, even when prompted or reminded to do so by cabin crew. In 2021, the US FAA reported there were 5,981 incidents reported to them and, of these, 4,290 related to mask mandate compliance.

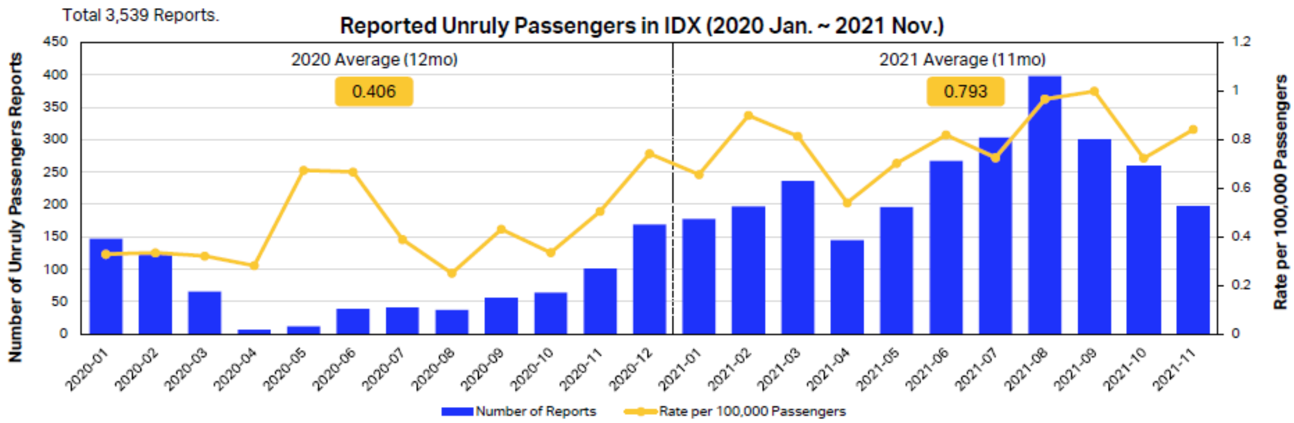
A passenger showing noncompliant behavior may, in some cases, be considered unruly, as failure to comply with the lawful commands of the Captain, delegated to the cabin crew, may have a negative impact on the good order and discipline onboard the aircraft and thus the safety of the aircraft.

Noncompliance with any requirement may not be intentional, and it is apparent that reports of such incidents need to make it clear whether the passenger simply made an error, or whether they intentionally decided not to comply, so that accurate incident rates for noncompliant passengers can be tracked.

Cabin crews around the world are weary of enforcing restrictions on their passengers, particularly as the numbers of incidents are increasing. Any incident of unruly behavior can introduce an emotional response from the cabin crew member, which might impact the outcome. Effective recurrent cabin crew training in all aspects of unruly behavior management will help to ensure the response is objective and appropriate, and aimed to de-escalate the situation.

Unruly behavior is typically categorized into the following four levels:

Level	Description/Examples	Safety Relevance
Level 1 **Minor**	▪ Intentionally noncompliant with safety regulations and policies. ▪ Boisterous/lively/excitable, particularly when traveling as part of a group. ▪ Verbally argumentative.	▪ Generally minimal impact on aircraft safety, but often requires cabin crew intervention to maintain order. ▪ A high number of such incidents might distract cabin crew from their primary safety duties.
Level 2 **Moderate**	▪ Physically aggressive. ▪ Obscene or lewd physical contact. ▪ Causing damage to aircraft fixtures or equipment.	▪ Poses a threat to others in the cabin and requires immediate cabin crew de-escalation.
Level 3 **Serious**	▪ Dangerous. ▪ Display of or use of weapon. ▪ Intent or threat to injure	▪ An immediate threat to other passengers and cabin crew.
Level 4 **Attempt to enter flight deck**	▪ Attempt to hijack. ▪ Sabotage. ▪ Credible threat of death.	▪ An immediate threat to the safe operation of the aircraft.



WHAT IS THE DATA CURRENTLY TELLING US?

Several IATA member airlines contribute their safety data to IATA's Incident Data Exchange (IDX) program. The updated software was launched immediately prior to the COVID-19 outbreak, which has impacted the onboarding of members as well as submission and processing of data. Nevertheless, there is sufficient data to demonstrate a consistent and steadily rising number of reports since January 2020. From January 2020 to November 2021, the average unruly passenger rate is 0.643 per 100,000 passengers (one report for every 155,580 passengers).

The global rate of unruly passengers in IDX shows a spike during the beginning of the COVID-19 pandemic, due to the significant drop of the number of passengers from April to July 2020. Afterward, the rate of unruly passengers in IDX shows a gradual increase. A statistical test was performed to validate that the trend between Jan. 2020 and Nov. 2021 shows a statistically significant increasing trend [1].

While the majority of reports include passengers who do not comply with rules and regulations onboard, an increase is noted in the intensity level of the incidents reported, with a marked increase in the number of physically aggressive passengers.

WHY ARE WE SEEING AN INCREASE WHEN PASSENGER NUMBERS ARE CURRENTLY REDUCED?

It was always predicted that there might be an increase in unruly passenger incidents due to mask mandates. The reason is simple: introducing a new rule that is unrelated to existing rules will require passenger education and acceptance, otherwise there will be a number who do not conform. Also, the requirement for wearing masks or other face coverings was not universally adopted at the start of the pandemic for several reasons:

- Medical masks were not widely available, so any mandate had to consider their availability to passengers and the ability of airlines to procure them for their staff.

- States are able to accept/reject any global recommendation, or to formulate their own requirements. Some states mandated masks, and even defined the type to be worn, while others left it to the airline to determine their own policies.

- The issue was heavily politicized. Some considered mask mandates to be a heavy-handed state response affecting their rights, while others accepted that they were sensible precautionary measures to help prevent the spread of infection.

Mask mandates are now an almost standard part of travel with all airlines, although some requirements are reduced on some routes domestically, according to the airline's own risk assessment.

Additional Stress

A journey involving air travel has a considerable number of stressors associated with it. Before the pandemic, these stressors included lineups, unfamiliarity with automated processes such as kiosks, inconsistent security checks (e.g., whether to remove shoes, belts, liquids, etc. or not) alongside operational stressors such as delays. Despite all efforts made by airlines and airports to alleviate these, travel remains for some a stressful experience.

In the pandemic world of travel, a whole new range of additional stressors has been added to the traveler's journey, including in many cases:

- Inconsistent COVID test requirements – before departure and post arrival.

- The need to have an alternative quarantine plan upon arrival in case a test indicates a positive result.

- Proof of vaccination, which may not be universally accepted.

- Frequent changes of rules and requirements, often with very short notice.

- Restrictions at the point of destination may be enforced at any time, negating the purpose of the journey.

- Fear of becoming stranded while away from home.

1 Mann-Kendall Test: Rate Per 100,000 Passengers (p-value < 0.001)

- Inconsistent application and enforcement of rules across the touchpoints on a traveler's journey.

In addition to the stressors identified above, there is, for some passengers, a fear of infection caused by being in close proximity to an infected traveler. While it has been demonstrated that the cabin environment is safer than many other public spaces, passengers may be more vocal in expressing their discontent when witnessing another passenger's noncompliance, adding to the frequency and intensity of such incidents onboard.

Travelers are often confused with ever-changing requirements, and their journey to the aircraft may have been a complicated one. As soon as they set foot onboard the aircraft, they are entering a domain where they have very little control and are in the hands of the cabin crew.

In contrast to incident rates before the pandemic, it is clear that the issue of unruly passengers is no longer limited to specific groups of passengers (e.g., those traveling on holiday, group parties, etc.). Today, any passenger has the potential to become unruly due to the increased number of rules, regulations and stressors added to the journey.

Impact on Cabin Crew

Cabin crew are also undergoing multiple new stressors associated with their role, in addition to those encountered by passengers, including:

- Long periods of isolation from their family and friends
- Being confined to hotel rooms
- Poor variation in diet
- Lack of exercise opportunities

All of these can have an impact on their mental health and wellbeing, which in turn can adversely affect their ability to respond positively during interactions with passengers. Many airlines are making efforts to support their cabin crew throughout the pandemic, including peer support programs, flexible rostering, employee assistance programs as well as mental health first aid courses and support.

WHAT CAN CABIN CREW DO?

Understanding and recognizing that travelers are already stressed when they board, cabin crew should immediately use their skills in de-escalation to alleviate the stress and reassure the passengers that they are in a safe environment.

An immediate and positive connection with any passenger during boarding plays a part in ensuring further positive interactions throughout a flight. A simple and individual acknowledgement, greeting, smile, or reassurance will often help defuse some of the stressors at this point and forge a more positive relationship. Reassuring and positive onboard announcements delivered with an empathetic human tone may also help to maintain compliance within the cabin.

Cabin crew will often have to ask or remind passengers to complete tasks such as fastening seatbelts, correct positioning of masks, storing of baggage, etc. and this can be seen as repetitive, impersonal and robotic unless a personal connection has already been made.

The majority of passengers do not intend to break a rule and become noncompliant. Before responding to an issue, cabin crew should consider whether the passenger might have simply made a mistake, or whether they are consciously making an effort not to comply. The cabin crew response from this point should be appropriate to the circumstances and escalate from gentle persuasion to direct order only if appropriate.

Cabin crew should report all incidents of intentional or continued noncompliance through the airline's reporting system, being sure to focus on the facts of the incident, rather than emotionally.

IS COMPLIANCE WITH A MASK MANDATE A SAFETY ISSUE?

Cabin safety activities are focused on the safe operation of the aircraft and procedures. Processes are usually based on a quantifiable risk rating, so all activities can be prioritized and supported appropriately. For example, the consequences of an overheating or igniting high-energy item, such as a lithium battery, in the cabin are much more immediate and greater than the consequences of a single passenger refusing to wear a mask.

It can be argued that noncompliance with a mask mandate might put others onboard at increased risk of infection, however, when considering that, in many cases, passengers have already tested negative to travel, may be required to be vaccinated, and are in a controlled cabin environment with downward airflow, HEPA filters, and natural cabin dividers such as seatbacks, etc., the resultant risk is low.

Intentional noncompliance with a mask mandate is low-level unruly behavior, generally classified as a Level 1 report, and does not pose any significant safety risk to the aircraft operation. However, it is the accompanying behavior, attitude and intent that needs to be considered and assessed to identify a more accurate picture of unruly passenger incidents onboard aircraft.

WHEN DOES NONCOMPLIANT BEHAVIOR BECOME UNRULY?

Level 1 noncompliance is a frequent occurrence and cabin crew usually manage these situations to a successful conclusion, completing the necessary report for their airline. Whenever a passenger is identified to be in breach of a regulation or policy, cabin crew should identify whether this is intentional or not and address it appropriately. It cannot be assumed that everyone onboard is fully aware of the policies and procedures, as some passengers may not have flown before, and rules vary across airlines.

The following are commonly encountered examples of noncompliance:

- Refusal to fasten a seatbelt during turbulence.
- Refusal to stow larger electronic devices during taxiing, takeoff or landing.
- Occupying a seat that is not assigned to them.
- Standing up to retrieve baggage during taxiing before arrival at the gate.
- Refusal to end mobile telephone communications before departure.

All of these examples are low-level and individually may be nothing more than an annoyance, but often one passenger might not comply with multiple regulations or policies on the same flight. This would require a more robust cabin crew intervention.

When a passenger becomes verbally or physically aggressive in their response to a cabin crew intervention, the report should be escalated to a Level 2, where appropriate. While the report classification might include mask compliance or other low-level behavior, the highest level of their aggressive response should also be documented and recorded.

While assessing risks within the operation, the airline should also consider the volume of low-level incidents on any given route. Multiple and persistent incidents of noncompliance might distract cabin crew members from their primary safety duties, which include constant monitoring of the cabin environment for safety and security hazards. A thorough risk assessment process for these reports and robust SPIs will help to ensure the SMS accurately and objectively reflects the risk status, rather than focusing resources on the topics that cause the greatest emotional response.

INTOXICATION

Intoxication, whether attributed to alcohol or other substances, often plays a part in incidents. Some passengers choose to take readily available medications to help them sleep on long-haul flights. This is never recommended because, not only can they slow a passenger's reaction to an emergency, they can also interact with even small amounts of alcohol. This can result in unusual behaviors that the passenger does not realize they are doing and has no recollection of afterwards. Some of the most bizarre onboard incidents have been attributed to sleeping medications and even a very low alcohol intake.

Airlines will often have a policy that passengers may only consume alcohol served by the cabin crew onboard, so the cabin crew can monitor and manage the amount being consumed by an individual. When a passenger uses their own supply of alcohol, it is not possible to manage their consumption in the same way. There may also be, in some cases, customs implications of opening sealed tax-free items during the journey.

Sometimes a passenger might not know about the requirements, but will comply when challenged. A small number of passengers will intentionally consume their own alcohol and it is these passengers who pose the greater problem for cabin crew and who should be more carefully managed to prevent escalation.

CAN LISTS OF BANNED UNRULY PASSENGERS HELP PREVENT FUTURE INCIDENTS?

An airline ticket is a contract between the passenger and the airline. Within the contract there are likely to be conditions of carriage. These conditions may stipulate that, when unacceptable unruly behavior is demonstrated, the airline may refuse further carriage. Individual airlines often maintain their own lists of passengers whom they will not accept for travel on the basis of their previous misbehavior.

Any operator that determines a passenger has breached the terms of their contract in this way will likely be challenged to prove it. Cabin crew reports are often the main source of information and must, therefore, be accurate and supported by clear examples of what the passenger did and said, so a detailed assessment can be made. The consequences to the passenger may be severe, so any travel ban should be proportionate in duration and extent.

Sharing of passenger information between airlines is more problematic and exposes airlines to breach of data privacy rules. While some states might permit sharing of such information, most will not. A possible approach, where governments and airlines believe bans are useful to protect safety, is for governments to maintain national lists of banned passengers that multiple airlines can access.

CAN AIRLINES ADOPT A ZERO-TOLERANCE POLICY?

Some operators choose to adopt a zero-tolerance policy toward unruly behavior, supported within their terms and conditions of carriage and publicized on their websites and other passenger communications channels. A zero-tolerance policy is aimed to protect an airline's staff members from abuse from passengers. If adopting such a policy, the operator must also consider that a passenger may legitimately become upset or disgruntled with poor service and sometimes a verbal expression of dissatisfaction is the only way for them to demonstrate their frustration.

There is a difference, however, between verbal expression, which may be heated and impassioned, and verbal abuse of the person receiving it. If the person receiving the complaint is trained and experienced in customer service, they should, in most cases, be able to negotiate patiently and de-escalate a complaint. They should also be able to recognize when a complaint becomes an act of aggression.

With any zero-tolerance policy introduction, there is likely to be an initial increase of reports, as often the type of incidents that were previously tolerated and dealt with by cabin crew would be reported. The US FAA launched a zero-tolerance policy during 2021 that was deemed to be successful in reducing the expected increase of reports.

WHAT TRAINING IS RECOMMENDED?

Unruly passenger management is not just a cabin crew issue; it is a combined responsibility of ground staff, cabin crew and flight crew.

Formal training courses may be a requirement for some work groups; however, awareness training can also be accomplished using methods other than a formal training course delivered online or in a classroom. Newsletters can identify recent incidents, how they were handled, and their outcome. Reminders and discussions are also effective.

Ground Staff and Service Providers

Effective management of incidents while on the ground will help to reduce onboard incidents by preventing those already intoxicated or demonstrating unruly behavior from boarding the aircraft. Some ground staff members will be reluctant to remove a passenger from a flight for many different reasons. Where ground staff are not employed directly by the airline, they may be more willing to want to defer the decision to an airline employee. The decision to offload or remove a passenger will likely have consequences for the passenger and airline, so it is important that the airline has a policy in place that supports the decision of the person faced with the situation.

Group	Responsibility	Suggested training	Cabin Ops Safety Best Practices Guide reference	IOSA Standards Manual reference
Ground Staff	Identify unruly behavior before departure and remove from flight, where appropriate.	▪ Recognize unacceptable behavior ▪ De-escalate situations ▪ Deliver appropriate warnings ▪ Remove a passenger from a flight ▪ Effectively communicate issues with the cabin crew	17.6.5.1	GRH 3.1.6
Cabin Crew	De-escalate situations of unruly behavior and report to pilot in command, where appropriate. Take immediate steps to manage safety risks posed by unruly behavior onboard.	▪ Recognize unacceptable behavior ▪ De-escalate situations ▪ Deliver appropriate warnings ▪ Remove a passenger from a flight ▪ Effectively communicate issues with the flight crew ▪ Use of nonlethal protective devices (e.g., passenger restraint) ▪ Reporting of events	17.6.5.3	CAB 2.2.12
Flight Crew	Communicate with cabin crew during incidents. Approve the restraint of a passenger, where appropriate. Take steps to remove a passenger from the flight, where appropriate.	▪ Recognize unacceptable behavior ▪ Remove a passenger from a flight ▪ Effectively communicate issues with the cabin crew ▪ Authority to restrain and/or remove a passenger	17.6.11	FLT 2.2.42

Sometimes a ground staff member may wish to defer the decision to the cabin crew and/or pilot in charge as it is sometimes easier for the pilot to make this decision without repercussions. Where such deferrals are frequent, the airline should look at the reasons for this and determine whether they can do anything to support an earlier decision process, which in turn might improve efficiency.

Cabin Crew

Cabin crew training syllabi are already sufficiently detailed and regulated to help manage incidents onboard the aircraft and typically include de-escalation techniques, identification of unacceptable behaviors, administering warnings, restraint of passengers, and reporting.

Training should include practical application of skills through role play scenarios, which can help build confidence and ensure teamwork is consistent during actual events. While evidence points toward an increase of events, it does not currently highlight any gaps within training programs and content.

Flight Crew

Flight crew should be trained to recognize unacceptable behaviors and to support the cabin crew in their response to any incident when it arises. The authority to restrain a passenger is obtained from the pilot in command and training should be provided to ensure flight crew are fully aware of their responsibility to ensure such measures are necessary to protect the safety of the aircraft, its passengers and crew.

REFERENCES

Unruly Passengers (FAA.gov)

IATA Cabin Operations Safety Best Practices Guide
(IATA members may request a complimentary copy through IATA Safety Connect)

IOSA Standards Manual

11

Global Aviation Data Management (GADM)

INCIDENT DATA EXCHANGE (IDX)

In 2021, the focus was on onboarding airlines, GSPs and airport operators into the revamped IDX program. IDX is a worldwide, aggregated, de-identified database of safety and security occurrence reports in the areas of flight operations, cabin operations, ground operations, maintenance, engineering, and more. Currently, the IDX program has over 110 airlines contributing regularly, which represents more than 15% of worldwide commercial aviation traffic. IDX benefits include the ability for users to:

- Access de-identified safety and security information.
- Benchmark themselves at the regional and global level.
- Anticipate operational challenges and risks at specific airports.
- Identify critical incident trends while setting targets for improvement.

In 2021, GADM released various focus area dashboards that allow users to access safety and security information, while helping them to identify emerging safety trends and risks provoked by the global COVID-19 pandemic.

GADM DATA SCIENCE

Since 2020, the GADM team has been collaborating with the Institute for Data Valorization (IVADO) and several universities to study Machine Learning and Artificial Intelligence technologies to derive fast and cost-effective solutions for safety and security risk identification. In 2021, the following R&D projects were conducted:

- Natural Language Processor Application for Incident Report Analysis (University of Montreal)
- Anomaly Detection in Aviation Safety Data (HEC Montreal)

The developed models will support the processing of massive text datasets and identification of anomalous points automatically, which will save time and manual efforts spent in analyzing datasets; thus, potential safety and security risks could be identified faster, supporting proactive risk identification.

To exchange innovative ideas, common challenges, and success stories in the data valorization and digital intelligence aviation domain, GADM has been taking a leading role in aviation communities of interest with major industry players.

ACCIDENT DATA EXCHANGE (ADX)

The Accident Database also underwent a major transformation in 2020, and a revamped version of the platform is currently available to all GADM participants.

The Accident Data Exchange (ADX) complements the IATA Safety Report by providing easy access to all commercial aviation accidents since 2005 that meet the IATA Accident Inclusion Guidelines.

ADX provides rate-based information, which consists of normalizing accident numbers with global sectors to perform analyses that are statistically relevant. In addition, ADX allows easy extraction of statistics based on many variables, such as airport, aircraft, date, country, phase of flight, accident category, severity, type of operations, and much more.

FLIGHT DATA EXCHANGE (FDX)

Flight Data Exchange (FDX) is IATA's premier global flight data sharing program. The program counted over 140 active member airlines at the close of 2021. The program membership is diverse and covers different regions of the world, thus making the program truly global.

The FDX program offers member airlines access to in-depth analytics in areas of risk as well as the ability to benchmark their operations against other operators in the world from a regional or global perspective. The FDX platform is developed to be easy to navigate by providing member airlines with improved visualizations and refined filter options.

The program offers secure handling of flight data in a confidential and safe manner under strict guidance from IATA governance protocols, ISO data governance standards as well as international data protection standards.

For further information about any of GADM 's programs, email gadm@iata.org or the individual programs via adx@iata.org, fdx@iata.org or idx@iata.org.

For details on the current membership to the IATA GADM programs please click here.

Fatality Risk (cont'd)

Definition

In 2015, IATA added another measure of air carrier safety to its annual Safety Report: **fatality risk.** This measure seeks to answer the following question: what was the exposure of a passenger or crew member to a catastrophic accident, where all people on board perished?

The equation to calculate the fatality risk is **Q = V/N**, where:

- **N** is the number of flights or sectors conducted during the period
- **V** is the total number of "full-loss equivalents" among the N flights or sectors

The full-loss equivalent for a given flight is the proportion of passengers and crew who do not survive an accident. For example:

- If a flight lands safely, the full-loss equivalent is zero.
- If a flight results in an accident in which all passengers and crew are killed, the full-loss equivalent is one.
- If a flight results in an accident in which half of passengers and crew are killed, the full-loss equivalent is 0.5.

V is the sum of all full-loss equivalents calculated for all N flights. In other words, the fatality risk rate (Q) is the sum of the individual accident full-loss equivalents divided by the total number of flights.

Examples

The following tables illustrate two examples:

Case 1: There were a total of four accidents during the period:

Accident	% of People-Onboard Who Perished	Full-Loss Equivalent
#1	0%	0
#2	100%	1
#3	50%	0.5
#4	50%	0.5
Total Full-Loss Equivalent		2
Number of Sectors		3,000,000
Fatality Risk		0.00000067
Fatality Risk (normalized per 1 million sectors)		0.67

In Case 1, there were a total of four accidents out of three million sectors. Of these four accidents, one had no fatalities, one was a complete hull loss with all on board killed, and two in which half on board perished. In total, there were two full-loss equivalents out of three million sectors, which equates to 0.67 full-loss equivalents per million sectors. In other words, the exposure of all passengers and crew who flew on those sectors to a catastrophic accident was 1 in 1.5 million flights.

Case 2: There were a total of six accidents:

Accident	% of People Onboard Who Perished	Full-Loss Equivalent
#1	0%	0
#2	10%	0.1
#3	20%	0.2
#4	50%	0.5
#5	30%	0.3
#6	40%	0.4
Total Full-Loss Equivalent		1.5
Number of Sectors		3,000,000
Fatality Risk		0.0000005
Fatality Risk (normalized per 1 million sectors)		0.50

In Case 2, there were a total of six accidents out of three million sectors. Of these six accidents, five experienced some fatalities, but there was no complete full loss. The total of the full-loss equivalents was 1.5. This equates to a fatality risk of 0.50 per million sectors. The exposure, in this case, was of one catastrophic accident per two million flights.

When comparing the above cases, the risk of perishing on a randomly selected flight is lower in Case 2 even though there were more accidents with fatalities. Case 1 had fewer fatal accidents, but they were more severe. Therefore, the odds of a passenger or crew losing their life on a given flight (fatality risk) is higher in Case 1 than in Case 2.

Considerations

It is important to note that the calculation of fatality risk does not consider the size of the airplane, how many people were on board, or the length of the flight. Rather, what is key is the percentage of people, from the total carried, who perished. It does not consider whether the accident was on a long-haul flight on a large aircraft where 25% of the passengers did not survive, or on a small commuter flight with the same ratio. The likelihood of perishing is the same.

Fatality risk, or full-loss equivalent, can easily be mistaken to represent the number of fatal accidents (or the fatal accident rate). Although fatality risk only exists once there is a fatal accident, they are not the same. While a fatal accident indicates an accident where at least one person perished, the full-loss equivalent indicates the proportion of people on board who perished.

Fatality risk provides a good baseline for comparison between accident categories. For example, Loss of Control — In-flight (LOC-I) is known to have a high fatality risk, but a low frequency of occurrence. Runway Excursion, on the other hand, has a low fatality risk, but a higher frequency of occurrence. It is possible, therefore, for the Runway Excursion category to have the same fatality risk as LOC-I if its frequency of occurrence is high enough so that the generally small full-loss equivalent for each individual accident produces the same total full-loss equivalent number as LOC-I (per million sectors).

Annex 1 – Definitions

Abnormal Disembarkation: Passengers and/or crew exit the aircraft via boarding doors (normally assisted by internal aircraft or exterior stairs) after an aircraft incident or accident and when away from the boarding gates or aircraft stands (e.g., onto a runway or taxiway); only in a non-life-threatening and non-catastrophic event.

Accident: IATA defines an accident as an event where ALL of the following criteria are satisfied:

- Person(s) have boarded the aircraft with the intention of flight (either flight crew or passengers).
- The intention of the flight is limited to normal commercial aviation activities, specifically scheduled/charter passenger or cargo service. Executive jet operations, training, and maintenance/test flights are excluded.
- The aircraft is turbine-powered and has a certificated Maximum Takeoff Weight (MTOW) of at least 5,700 kg (12,540 lb.).
- The aircraft has sustained major structural damage that adversely affects the structural strength, performance or flight characteristics of the aircraft and would normally require major repair or replacement of the affected component exceeding $1 million USD or 10% of the aircraft's hull reserve value, whichever is lower, or the aircraft has been declared a hull loss.

Accident Classification: Process by which actions, omissions, events, conditions, or a combination thereof, that led to an accident are identified and categorized.

Aircraft: Involved aircraft, used interchangeably with airplane(s).

Cabin Safety-related Event: Accident involving cabin operational issues (e.g., passenger evacuation, onboard fire, decompression, ditching) that requires actions by the operating cabin crew.

Captain: Involved pilot responsible for the operation and safety of the aircraft during flight time.

Commander: Involved pilot, in an augmented crew, responsible for the operation and safety of the aircraft during flight time.

Crew member: Anyone on board a flight who has duties connected with the sector of the flight during which the accident happened. It excludes positioning or relief crew, security staff, etc. (see definition of "Passenger" below).

Evacuation (Land): Passengers and/or crew evacuate the aircraft via escape slides/slide rafts, doors, emergency exits or gaps in the fuselage (usually initiated in life-threatening and/or catastrophic events).

Evacuation (Water): Passengers and/or crew evacuate the aircraft via escape slides/slide rafts, doors, emergency exits or gaps in the fuselage and into or onto water.

Fatal Accident: Accident where at least one passenger or crew member is killed or later dies of their injuries, resulting from an operational accident. Events such as slips, trips and falls, food poisoning, or injuries resulting from turbulence or involving onboard equipment, which may involve fatalities, but where the aircraft sustains minor or no damage, are excluded.

Fatality: Passenger or crew member who is killed or later dies of their injuries resulting from an operational accident. Injured persons who die more than 30 days after an accident are excluded.

Fatality Risk: Sum of full-loss equivalents per 1 million sectors, measuring the exposure of a passenger or crew member to a non-survivable accident. A full-loss equivalent is related to the percentage of people on board who perished. Refer to Addendum A for additional information.

Full-Loss Equivalent: Number representing the equivalent of a catastrophic accident where all people onboard died. For an individual accident, the full-loss equivalent is a value between 0 and 1, representing the ratio between the number of people who perished and the number of people on board the aircraft. In a broader context, the full-loss equivalent is the sum of each accident's full-loss equivalent value. Refer to Addendum A for additional information.

Hazard: Condition, object or activity with the potential of causing injuries to persons, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function.

Hull Loss: Accident in which the aircraft is destroyed or substantially damaged and is not subsequently repaired for whatever reason, including a financial decision of the owner.

Hull Loss/Nil Survivors: Accident resulting in a complete hull loss with no survivors (used as a Cabin End State).

IATA Accident Classification System: Refer to Annexes 2 and 3 of this report.

IATA Regions: IATA determines the accident region based on the operator's home country as specified in the operator's Air Operator Certificate (AOC). For example, if a Canadian-registered operator has an accident in Europe, this accident is counted as a 'North American' accident. For a complete list of countries assigned per region, consult the following table:

IATA REGIONS

Region	Country
AFI	Angola
	Benin
	Botswana
	Burkina Faso
	Burundi
	Cameroon
	Cape Verde
	Central African Republic
	Chad
	Comoros
	Congo, Democratic Republic of
	Congo
	Côte d'Ivoire
	Djibouti
	Equatorial Guinea
	Eritrea
	Ethiopia
	Gabon
	Gambia
	Ghana
	Guinea
	Guinea-Bissau
	Kenya
	Lesotho
	Liberia
	Madagascar
	Malawi
	Mali
	Mauritania
	Mauritius
	Mozambique
	Namibia
	Niger
	Nigeria
	Rwanda
	São Tomé and Príncipe
	Senegal
	Seychelles
	Sierra Leone
	Somalia
	South Africa
	South Sudan

Region	Country
	Swaziland
	Tanzania, United Republic of
	Togo
	Uganda
	Zambia
	Zimbabwe
ASPAC	Australia[1]
	Bangladesh
	Bhutan
	Brunei Darussalam
	Cambodia
	Fiji Islands
	India
	Indonesia
	Japan
	Kiribati
	Korea, Republic of
	Lao People's Democratic Republic
	Malaysia
	Maldives
	Marshall Islands
	Micronesia, Federated States of
	Myanmar
	Nauru
	Nepal
	New Zealand[2]
	Pakistan
	Palau
	Papua New Guinea
	Philippines
	Samoa
	Singapore
	Solomon Islands
	Sri Lanka
	Thailand
	Timor-Leste
	Tonga
	Tuvalu
	Vanuatu
	Vietnam

Region	Country
CIS	Armenia
	Azerbaijan
	Belarus
	Georgia
	Kazakhstan
	Kyrgyzstan
	Moldova, Republic of
	Russian Federation
	Tajikistan
	Turkmenistan
	Ukraine
	Uzbekistan
EUR	Albania
	Andorra
	Austria
	Belgium
	Bosnia and Herzegovina
	Bulgaria
	Croatia
	Cyprus
	Czech Republic
	Denmark[3]
	Estonia
	Finland
	France[4]
	Germany
	Greece
	Holy See (Vatican City State)
	Hungary
	Iceland
	Ireland
	Italy
	Israel
	Kosovo
	Latvia
	Liechtenstein
	Lithuania
	Luxembourg
	Macedonia, the former Yugoslav Republic of
	Malta
	Monaco

Region	Country
	Montenegro
	Netherlands[5]
	Norway
	Poland
	Portugal
	Romania
	San Marino
	Serbia
	Slovakia
	Slovenia
	Spain
	Sweden
	Switzerland
	Turkey
	United Kingdom[6]
LATAM/ CAR	Antigua and Barbuda
	Argentina
	Bahamas
	Barbados
	Belize
	Bolivia
	Brazil
	Chile
	Colombia
	Costa Rica
	Cuba
	Dominica
	Dominican Republic
	Ecuador
	El Salvador
	Grenada
	Guatemala
	Guyana
	Haiti
	Honduras
	Jamaica
	Mexico
	Nicaragua
	Panama
	Paraguay
	Peru
	Saint Kitts and Nevis
	Saint Lucia

Region	Country
	Saint Vincent and the Grenadines
	Suriname
	Trinidad and Tobago
	Uruguay
	Venezuela
MENA	Afghanistan
	Algeria
	Bahrain
	Egypt
	Iran, Islamic Republic of
	Iraq
	Jordan
	Kuwait
	Lebanon
	Libya
	Morocco
	Oman
	Palestinian Territories
	Qatar
	Saudi Arabia
	Sudan
	Syrian Arab Republic
	Tunisia
	United Arab Emirates
	Yemen
NAM	Canada
	United States of America[7]
NASIA	China[8]
	Mongolia
	Korea, Democratic People's Republic of

[1]Australia includes:

Christmas Island
Cocos (Keeling) Islands
Norfolk Island
Ashmore and Cartier Islands
Coral Sea Islands
Heard Island and McDonald Islands

[2]New Zealand includes:

Cook Islands
Niue
Tokelau

[3]Denmark includes:

Faroe Islands
Greenland

[4]France includes:

French Guiana
French Polynesia
French Southern Territories
Guadalupe
Martinique
Mayotte
New Caledonia
Saint-Barthélemy
Saint Martin (French part)
Saint Pierre and Miquelon
Reunion
Wallis and Futuna

[5]Netherlands include:

Aruba
Curacao
Sint Maarten

[6]United Kingdom includes:

Akrotiri and Dhekelia
Anguilla
Bermuda
British Indian Ocean Territory
British Virgin Islands
Cayman Islands
Falkland Islands (Malvinas)
Gibraltar
Montserrat
Pitcairn
Saint Helena, Ascension and Tristan da Cunha
South Georgia and the South Sandwich Islands
Turks and Caicos Islands
British Antarctic Territory
Guernsey
Isle of Man
Jersey

[7]United States of America include:

American Samoa
Guam
Northern Mariana Islands
Puerto Rico
Virgin Islands, U.S.
United States Minor Outlying Islands

[8]China includes:

Chinese Taipei
Hong Kong
Macao

Incident: Occurrence, other than an accident, associated with the operation of an aircraft that affects or could affect the safety of operation.

In-flight Security Personnel: Individual who is trained, authorized and armed by the state and is carried on board an aircraft and whose intention is to prevent acts of unlawful interference.

Investigation: Process conducted for accident prevention, which includes the gathering and analysis of information, the drawing of conclusions (including the determination of causes) and, when appropriate, the making of safety recommendations.

Investigator in Charge: Person charged, based on their qualifications, with the responsibility for the organization, conduct and control of an investigation.

Involved: Directly concerned, or designated to be concerned, with an accident or incident.

Level of Safety: How far safety is to be pursued in a given context, assessed with reference to an acceptable risk, based on the current values of society.

Major Repair: A repair that, if improperly done, might appreciably affect the mass, balance, structural strength, performance, power plant operation, flight characteristics, or other qualities affecting the airworthiness of an aircraft.

Non-operational Accident: Includes accidents resulting from acts of deliberate violence (e.g., sabotage, war) and accidents that occur during crew training, demonstrations and test flights. Violence is believed to be a matter of security rather than flight safety. Crew training, demonstrations and test flights are considered to involve special risks inherent with these types of operations. Also included in this category are:

- Non-airline-operated aircraft (e.g., military or government-operated, survey, aerial work or parachuting flights).
- Accidents where there was no intention of flight.

Normal Disembarkation: Passengers and/or crew exit the aircraft via boarding doors during normal operations.

Occurrence: Any unusual or abnormal event involving an aircraft, including, but not limited to, an incident.

Operational Accident: Accident that is believed to represent the risks of normal commercial operation; generally an accident that occurs during normal revenue operations or a positioning flight.

Operator: Person, organization or enterprise engaged in, or offering to engage in, aircraft operations.

Passenger: Anyone on board a flight who, as far as may be determined, is not a crew member. Apart from normal revenue passengers, this includes off-duty staff members, positioning and relief flight crew members, etc., who have no duties connected with the sector of the flight during which the accident happened. Security personnel are included as passengers as their duties are not concerned with the operation of the flight.

Person: Any involved individual, including airport and Air Traffic Service (ATS) personnel.

Phase of Flight: The phase of flight definitions developed and applied by IATA are presented in the table on the following page.

Rapid Deplaning: Passengers and/or crew rapidly exit the aircraft via boarding doors and a jet bridge or stairs, as a precautionary measure.

Risk: Assessment, expressed in terms of predicted probability and severity, of the consequence(s) of a hazard, taking as reference the worst foreseeable situation.

Safety: State in which the risk of harm to persons or property is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management.

Sector: Operation of an aircraft between takeoff at one location and landing at another (other than a diversion).

Serious Injury: Injury sustained by a person in an accident and which meets one of the following:

- Requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received.
- Results in a fracture of any bone (except simple fractures of fingers, toes or nose).
- Involves lacerations that cause severe hemorrhage or nerve, muscle or tendon damage.
- Involves injury to any internal organ.
- Involves second or third-degree burns, or any burns affecting more than 5% of the surface of the body.
- Involves verified exposure to infectious substances or injurious radiation.

Serious Incident: Incident involving circumstances indicating that an accident nearly occurred. *Note:* the difference between an accident and a serious incident lies only in the result.

Substantial Damage: Damage or structural failure, which adversely affects the structural strength, performance or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component.

Notes:

- Bent fairing or cowling, dented skin, small punctured holes in the skin or fabric, minor damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wing tips are not considered "substantial damage" for the purpose of this Safety Report.
- The ICAO Annex 13 definition is unrelated to cost and includes many incidents in which the financial consequences are minimal.

Unstable Approach: Approach where the IATA ACTG has knowledge about vertical, lateral or speed deviations in the portion of the flight close to landing. *Note:* this definition includes the portion immediately prior to touchdown and in this respect the definition might differ from other organizations. However, accident analysis gives evidence that a destabilization just prior to touchdown has contributed to accidents in the past.

PHASE OF FLIGHT DEFINITIONS

Flight Planning (FLP) This phase begins when the flight crew initiates the use of flight planning information facilities and becomes dedicated to a flight based upon a route and airplane; it ends when the crew arrives at the aircraft for the planned flight or the crew initiates a 'Flight Close' phase.

Preflight (PRF) This phase begins with the arrival of the flight crew at an aircraft for the flight; it ends when a decision is made to depart the parking position and/or start the engine(s). It may also end by the crew initiating a 'Post-flight' phase. *Note:* the PRF phase assumes the aircraft is sitting at the point at which the aircraft will be loaded or boarded, with the primary engine(s) not operating. If boarding occurs during this phase, it is done without any engine(s) operating. Boarding with any engine(s) operating is covered under 'Engine Start/Depart'.

Engine Start/Depart (ESD) This phase begins when the flight crew take action to have the aircraft moved from the parked position and/or take switch action to energize the engine(s); it ends when the aircraft begins to move under its own power or the crew initiates an 'Arrival/Engine Shutdown' phase. *Note:* the ESD phase includes the aircraft engine(s) start-up whether assisted or not and whether the aircraft is stationary with more than one engine shutdown prior to 'Taxi-out' (i.e., boarding of persons or baggage with engines running); it includes all actions of power back to position the aircraft for Taxi-out.

Taxi-out (TXO) This phase begins when the crew moves the aircraft forward under its own power; it ends when thrust is increased for 'Takeoff' or the crew initiates a 'Taxi-in' phase. *Note:* this phase includes taxi from the point of moving under the aircraft's own power, up to and including entering the runway and reaching the Takeoff position.

Takeoff (TOF) This phase begins when the crew increases the thrust for lift-off; it ends when an 'Initial Climb' is established or the crew initiates a 'Rejected Takeoff' phase.

Rejected Takeoff (RTO) This phase begins when the crew reduces thrust to stop the aircraft before the end of the Takeoff phase; it ends when the aircraft is taxied off the runway for a 'Taxi-in' phase or when the aircraft is stopped and engines shutdown.

Initial Climb (ICL) This phase begins at 35 feet above the runway elevation; it ends after the speed and configuration are established at a defined maneuvering altitude or to continue the climb for cruising. It may also end by the crew initiating an 'Approach' phase. *Note:* maneuvering altitude is that needed to safely maneuver the aircraft after an engine failure occurs, or predefined as an obstacle clearance altitude. ICL includes such procedures applied to meet the requirements of noise abatement climb or best angle/rate of climb.

En Route Climb (ECL) This phase begins when the crew establishes the aircraft at a defined speed and configuration, enabling the aircraft to increase altitude for cruising; it ends with the aircraft establishing a predetermined constant initial cruise altitude at a defined speed or by the crew initiating a 'Descent' phase.

Cruise (CRZ) This phase begins when the crew establishes the aircraft at a defined speed and predetermined constant initial cruise altitude and proceeds in the direction of a destination; it ends with the beginning of the 'Descent' phase for an approach or by the crew initiating an ECL phase.

Descent (DST) This phase begins when the crew departs the cruise altitude for an approach at a destination; it ends when the crew initiates changes in aircraft configuration and/or speeds to facilitate a landing on a specific runway. It may also end by the crew initiating an ECL or CRZ phase.

Approach (APR) This phase begins when the crew initiates changes in aircraft configuration and/or speeds enabling the aircraft to maneuver to land on a specific runway; it ends when the aircraft is in the landing configuration and the crew is dedicated to land on a specific runway. It may also end by the crew initiating a 'Go-around' phase.

Go-around (GOA) This phase begins when the crew aborts the descent to the planned landing runway during the APR phase; it ends after speed and configuration are established at a defined maneuvering altitude or to continue the climb for the purpose of cruise (same as the end of ICL).

Landing (LND) This phase begins when the aircraft is in the landing configuration and the crew is dedicated to touch down on a specific runway; it ends when the speed permits the aircraft to be maneuvered by means of taxiing for arrival at a parking area. It may also end by the crew initiating a GOA phase.

Taxi-in (TXI) This phase begins when the crew begins to maneuver the aircraft under its own power to an arrival area for parking; it ends when the aircraft ceases moving under its own power with a commitment to shut down the engine(s). It may also end by the crew initiating a TXO phase.

Arrival/Engine Shutdown (AES) This phase begins when the crew ceases to move the aircraft under its own power and a commitment is made to shut down the engine(s); it ends with a decision to shut down ancillary systems to secure the aircraft. It may also end by the crew initiating an ESD phase. *Note:* the AES phase includes actions required during a time when the aircraft is stationary with one or more engines operating while ground servicing may be taking place (i.e., deplaning persons or baggage with engine(s) running and/or refueling with engine(s) running).

Post-flight (PSF) This phase begins when the crew commences the shutdown of ancillary systems of the aircraft to leave the flight deck; it ends when the flight and cabin crew leave the aircraft. It may also end by the crew initiating a PRF phase.

Flight Close (FLC) This phase begins when the crew initiates a message to the flight-following authorities that the aircraft is secure and the crew is finished with the duties of the past flight; it ends when the crew has completed these duties or begins to plan for another flight by initiating a FLP phase.

Ground Servicing (GDS) This phase begins when the aircraft is stopped and available to be safely approached by ground personnel for the purpose of securing the aircraft and performing the duties applicable to the arrival of the aircraft (i.e., aircraft maintenance); it ends with completion of the duties applicable to the departure of the aircraft or when the aircraft is no longer safe to approach for the purpose of ground servicing (e.g., prior to crew initiating the TXO phase). *Note:* the GDS phase was identified by the need for information that may not directly require the input of flight or cabin crew. It is acknowledged as an entity to allow placement of the tasks required of personnel assigned to service the aircraft.

Annex 2
Accident Classification Taxonomy

1. LATENT CONDITIONS

Definition: Conditions present in the system before the accident and triggered by various possible factors.

Latent Conditions (deficiencies in...)	Examples
Design	↗ Design shortcomings ↗ Manufacturing defects
Regulatory Oversight	↗ Deficient regulatory oversight by the state or lack thereof
Management Decisions	↗ Cost cutting ↗ Stringent fuel policy ↗ Outsourcing and other decisions, which can impact operational safety
Safety Management	Absent or deficient: ↗ Safety policy and objectives ↗ Safety risk management (including hazard identification process) ↗ Safety assurance (including Quality Management) ↗ Safety promotion
Change Management	↗ Deficiencies in monitoring change; in addressing operational needs created by, for example, expansion or downsizing ↗ Deficiencies in the evaluation to integrate and/or monitor changes to establish organizational practices or procedures ↗ Consequences of mergers or acquisitions
Selection Systems	↗ Deficient or absent selection standards
Operations Planning and Scheduling	↗ Deficiencies in crew rostering and staffing practices ↗ Issues with flight and duty time limitations ↗ Health and welfare issues
Technology and Equipment	↗ Available safety equipment not installed (EGPWS, predictive wind shear, TCAS/ACAS, etc.)

1. LATENT CONDITIONS (CONT'D)

Flight Operations	See the following breakdown
Flight Operations: Standard Operating Procedures and Checking	↗ Deficient or absent: 1. Standard operating procedures (SOPs) 2. Operational instructions and/or policies 3. Company regulations 4. Controls to assess compliance with regulations and SOPs
Flight Operations: Training Systems	↗ Omitted training, language skills deficiencies, qualifications and experience of flight crews, operational needs leading to training reductions, deficiencies in assessment of training or training resources such as manuals or CBT devices
Cabin Operations	See the following breakdown
Cabin Operations: Standard Operating Procedures and Checking	↗ Deficient or absent: 1. SOPs 2. Operational instructions and/or policies 3. Company regulations 4. Controls to assess compliance with regulations and SOPs
Cabin Operations: Training Systems	↗ Omitted training, language skills deficiencies, qualifications and experience of cabin crews, operational needs leading to training reductions, deficiencies in assessment of training or training resources such as manuals or CBT devices
Ground Operations	See the following breakdown
Ground Operations: SOPs and Checking	↗ Deficient or absent: 1. SOPs 2. Operational instructions and/or policies 3. Company regulations 4. Controls to assess compliance with regulations and SOPs
Ground Operations: Training Systems	↗ Omitted training, language skills deficiencies, qualifications and experience of ground crews, operational needs leading to training reductions, deficiencies in assessment of training or training resources such as manuals or CBT devices

1. LATENT CONDITIONS (CONT'D)

Maintenance Operations	See the following breakdown
Maintenance Operations: SOPs and Checking	↗ Deficient or absent: 1. SOPs 2. Operational instructions and/or policies 3. Company regulations 4. Controls to assess compliance with regulations and SOPs ↗ Includes deficiencies in technical documentation, unrecorded maintenance and the use of bogus parts/unapproved modifications
Maintenance Operations: Training Systems	↗ Omitted training, language skills deficiencies, qualifications and experience of maintenance crews, operational needs leading to training reductions, deficiencies in assessment of training or training resources such as manuals or CBT devices
Dispatch	See the following breakdown
Dispatch: Standard Operating Procedures and Checking	↗ Deficient or absent: 1. SOPs 2. Operational instructions and/or policies 3. Company regulations 4. Controls to assess compliance with regulations and SOPs
Dispatch: Training Systems	↗ Omitted training, language skills deficiencies, qualifications and experience of dispatchers, operational needs leading to training reductions, deficiencies in assessment of training or training resources such as manuals or CBT devices
Flight Watch	↗ Flight Watch/ Flight Following
Other	↗ Not clearly falling within the other latent conditions

Note: All areas such as Training, Ground Operations or Maintenance include outsourced functions for which the operator has oversight responsibility.

2. THREATS

Definition: An event or error that occurs outside the influence of the flight crew, but which requires crew attention and management if safety margins are to be maintained.

Mismanaged threat: A threat that is linked to or induces a flight crew error.

Environmental Threats	Examples
Meteorology	See the following breakdown
	↗ Thunderstorms
	↗ Poor visibility/Instrument Meteorological Conditions (IMC)
	↗ Wind/wind shear/gusty wind
	↗ Icing conditions
	↗ Hail
Lack of visual reference	↗ Darkness/black hole effect ↗ Environmental situation, which can lead to spatial disorientation
Air Traffic Services	↗ Tough-to-meet clearances/restrictions ↗ Reroutes ↗ Language difficulties ↗ Controller errors ↗ Failure to provide separation (air/ground)
Wildlife/ Birds/Foreign Objects	↗ Self-explanatory
Airport Facilities	See the following breakdown
	↗ Poor signage, faint markings ↗ Runway/taxiway closures
	↗ Contaminated runways/taxiways ↗ Poor braking action
	↗ Trenches/ditches ↗ Inadequate overrun area ↗ Structures in close proximity to runway/taxiway
	↗ Inadequate airport perimeter control/fencing ↗ Inadequate wildlife control

2. THREATS (CONT'D)

Navigational Aids	See the following breakdown
	↗ Ground navigation aid malfunction ↗ Lack or unavailability (e.g., Instrument Landing System)
	↗ NAV aids not calibrated – unknown to flight crew
Terrain/Obstacles	↗ Self-explanatory
Traffic	↗ Aircraft striking other aircraft (e.g., during runway incursion) ↗ Ground vehicles hitting aircraft
Runway Surface Incursion	↗ Aircraft ↗ Vehicle ↗ Wildlife ↗ Other
Other	↗ Not clearly falling within the other environmental threats
Airline Threats	Examples
Aircraft Malfunction	See breakdown (on the next page)
MEL Item	↗ Minimum Equipment List (MEL) items with operational implications
Operational Pressure	↗ Operational time pressure ↗ Missed approach/diversion ↗ Other non-normal operations
Cabin Events	↗ Cabin events (e.g., unruly passenger) ↗ Cabin crew errors ↗ Distractions/interruptions
Ground Events	↗ Aircraft loading events ↗ Fueling errors ↗ Agent interruptions ↗ Improper ground support ↗ Improper deicing/anti-icing
Dispatch/Paperwork	↗ Load sheet errors ↗ Crew scheduling events ↗ Late paperwork changes or errors
Maintenance Events	↗ Aircraft repairs on ground ↗ Maintenance log problems ↗ Maintenance errors
Dangerous Goods	↗ Carriage of articles or substances capable of posing a significant risk to health, safety or property when transported by air
Manuals/ Charts/Checklists	↗ Incorrect/unclear chart pages or operating manuals ↗ Checklist layout/design issues
Other	↗ Not clearly falling within the other airline threats

2. THREATS (CONT'D)

Aircraft Malfunction Breakdown (Technical Threats)	Examples
Extensive/Uncontained Engine Failure	↗ Damage due to non-containment
Contained Engine Failure / Power plant Malfunction	↗ Engine overheat ↗ Propeller failure ↗ Failure affecting power plant components
Gear/Tire	↗ Failure affecting parking, taxi, takeoff or landing
Brakes	↗ Failure affecting parking, taxi, takeoff or landing
Flight Controls	See the following breakdown
Primary Flight Controls	↗ Failure affecting aircraft controllability
Secondary Flight Controls	↗ Failure affecting flaps, spoilers
Structural Failure	↗ Failure due to flutter, overload ↗ Corrosion/fatigue ↗ Engine separation
Fire/Smoke in Cockpit/Cabin/Cargo	↗ Fire due to aircraft systems ↗ Other fire causes
Avionics, Flight Instruments	↗ All avionics except autopilot and the Flight Management System (FMS) ↗ Instrumentation, including standby instruments
Autopilot/FMS	↗ Self-explanatory
Hydraulic System Failure	↗ Self-explanatory
Electrical Power Generation Failure	↗ Loss of all electrical power, including battery power
Other	↗ Not clearly falling within the other aircraft malfunction threats

3. FLIGHT CREW ERRORS

Definition: An observed flight crew deviation from organizational expectations or crew intentions.
Mismanaged error: An error that is linked to or induces additional error or an undesired aircraft state.

Aircraft Handling Errors	Examples
Manual Handling/Flight Controls	↗ Hand flying vertical, lateral, or speed deviations ↗ Approach deviations by choice (e.g., flying below the glide slope) ↗ Missed runway/taxiway, failure to hold short, taxi above speed limit ↗ Incorrect flaps, speed brake, autobrake, thrust reverser or power settings
Ground Navigation	↗ Attempting to turn down wrong taxiway/runway ↗ Missed taxiway/runway/gate
Automation	↗ Incorrect altitude, speed, heading, autothrottle settings, mode executed, or entries
Systems/ Radios/Instruments	↗ Incorrect packs, altimeter, fuel switch settings, or radio frequency dialed
Other	↗ Not clearly falling within the other errors
Procedural Errors	Examples
Standard Operating Procedures Adherence / Standard Operating Procedures Cross-verification	↗ Intentional or unintentional failure to cross-verify (automation) inputs ↗ Intentional or unintentional failure to follow SOPs ↗ Pilot flying makes own automation changes ↗ Sterile cockpit violations
Checklist	See the following breakdown
Normal Checklist	↗ Checklist performed from memory or omitted ↗ Wrong challenge and response ↗ Checklist performed late or at wrong time ↗ Checklist items missed
Abnormal Checklist	↗ Checklist performed from memory or omitted ↗ Wrong challenge and response ↗ Checklist performed late or at wrong time ↗ Checklist items missed
Callouts	↗ Omitted takeoff, descent, or approach callouts
Briefings	↗ Omitted departure, takeoff, approach, or handover briefing; items missed ↗ Briefing does not address expected situation

3. FLIGHT CREW ERRORS (CONT'D)

Documentation	See the following breakdown
	↗ Wrong weight and balance information, wrong fuel information
	↗ Wrong Automatic Terminal Information Service (ATIS), or clearance recorded
	↗ Misinterpreted items on paperwork
	↗ Incorrect or missing log book entries
Failure to Go Around	↗ Failure to go around after destabilization on approach ↗ Failure to go around after a bounced landing
Other Procedural	↗ Administrative duties performed after top of descent or before leaving active runway ↗ Incorrect application of MEL
Communication Errors	Examples
Crew to External Communication	See breakdown
With Air Traffic Control	↗ Flight crew to ATC – missed calls, misinterpretation of instructions, or incorrect read-backs ↗ Wrong clearance, taxiway, gate or runway communicated
With Cabin Crew	↗ Errors in Flight to Cabin Crew communication ↗ Lack of communication
With Ground Crew	↗ Errors in Flight to Ground Crew communication ↗ Lack of communication
With Dispatch	↗ Errors in Flight Crew to Dispatch communication ↗ Lack of communication
With Maintenance	↗ Errors in Flight to Maintenance Crew communication ↗ Lack of communication
Pilot-to-Pilot Communication	↗ Within Flight Crew miscommunication ↗ Misinterpretation ↗ Lack of communication

4. UNDESIRED AIRCRAFT STATES (UAS)

Definition: A flight-crew-induced aircraft state that clearly reduces safety margins; a safety-compromising situation that results from ineffective error management. A UAS is **recoverable**.

Mismanaged UAS: A UAS that is linked to or induces additional flight crew errors.

Undesired Aircraft States	Breakdown
Aircraft Handling	↗ Abrupt aircraft control
	↗ Vertical, lateral or speed deviations
	↗ Unnecessary weather penetration
	↗ Unauthorized airspace penetration
	↗ Operation outside aircraft limitations
	↗ Unstable approach
	↗ Continued landing after unstable approach
	↗ Long, floated, bounced, firm, porpoised, off-center landing ↗ Landing with excessive crab angle
	↗ Rejected takeoff after V_1
	↗ Controlled flight toward terrain
	↗ Other
Ground Navigation	↗ Proceeding toward wrong taxiway/runway
	↗ Wrong taxiway, ramp, gate or hold spot
	↗ Runway/Taxiway incursion
	↗ Ramp movements, including when under marshalling
	↗ Loss of aircraft control while on the ground
	↗ Other

4. UNDESIRED AIRCRAFT STATES (UAS) (CONT'D)

Incorrect Aircraft Configurations	↗ Brakes, thrust reversers, ground spoilers
	↗ Systems (fuel, electrical, hydraulics, pneumatics, air conditioning, pressurization/ instrumentation)
	↗ Landing gear
	↗ Flight controls/automation
	↗ Engine
	↗ Weight and balance
	↗ Other

5. END STATES

Definition: An end state is a reportable event. It is **unrecoverable**.

End States	Definitions
Controlled Flight into Terrain	↗ In-flight collision with terrain, water, or obstacle without indication of loss of control
Loss of Control — In-flight	↗ Loss of aircraft control while in flight
Runway Collision	↗ Any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, person or wildlife on the protected area of a surface designated for the landing and takeoff of aircraft and resulting in a collision
Mid-Air Collision	↗ Collision between aircraft in flight
Runway/Taxiway Excursion	↗ A veer off or overrun off the runway or taxiway surface
In-flight Damage	Damage occurring while airborne, including: ↗ Weather-related events, technical failures, bird strikes and fire/smoke/fumes
Ground Damage	Damage occurring while on the ground, including: ↗ Occurrences during (or as a result of) ground handling operations ↗ Collision while taxiing to or from a runway in use (excluding a runway collision) ↗ Foreign object damage ↗ Fire/smoke/fumes

5. END STATES (CONT'D)

Undershoot	↗ A touchdown off the runway surface
Hard Landing	↗ Any hard landing resulting in substantial damage
Gear-up Landing/ Gear Collapse	↗ Any gear-up landing/collapse resulting in substantial damage (without a runway excursion)
Tail Strike	↗ Tail strike resulting in substantial damage
Off-Airport Landing/ Ditching	↗ Any controlled landing outside of the airport area

6. FLIGHT CREW COUNTERMEASURES

The following list includes countermeasures that the flight crew can take. Countermeasures from other areas, such as ATC, ground operations personnel and maintenance staff, are not considered at this time.

Team Climate		
Countermeasure	Definition	Example Performance
Communication Environment	Environment for open communication is established and maintained	Good cross-talk – flow of information is fluid, clear, and direct No social or cultural disharmonies; right amount of hierarchy gradient Flight crew member reacts to assertive callout of other crew member(s)
Leadership	See the following breakdown	
	Captain Should Show Leadership and coordinate flight deck activities	In command, decisive, and encourages crew participation
	First Officer (FO) is assertive when necessary and is able to take over as the leader	FO speaks up and raises concerns
Overall Crew Performance	Overall, crew members should perform well as risk managers	Includes Flight, Cabin, Ground crew as well as their interactions with ATC
Other	Not clearly falling within the other categories	

6. FLIGHT CREW COUNTERMEASURES (CONT'D)

Planning		
SOP Briefing	The required briefing should be interactive and operationally thorough	Concise and not rushed – bottom lines are established
Plans Stated	Operational plans and decisions should be communicated and acknowledged	Shared understanding about plans – "Everybody on the same page"
Contingency Management	Crew members should develop effective strategies to manage threats to safety: ▪ Proactive: In-flight decision-making ▪ Reactive: Contingency management	↗ Threats and their consequences are anticipated ↗ Use all available resources to manage threats
Other	Not clearly falling within the other categories	
Execution		
Monitor/ Cross-check	Crew members should actively monitor and cross-check flight path, aircraft performance, systems and other crew members	Aircraft position, settings, and crew actions are verified
Workload Management	Operational tasks should be prioritized and properly managed to handle primary flight duties	↗ Avoid task fixation ↗ Do not allow work overload
Automation Management	Automation should be properly managed to balance situational and/or workload requirements	↗ Brief automation setup ↗ Effective recovery techniques from anomalies
Taxiway/Runway Management	Crew members use caution and keep watch outside when navigating taxiways and runways	Clearances are verbalized and understood – airport and taxiway charts or aircraft cockpit moving map displays are used when needed
Other	Not clearly falling within the other categories	
Review/Modify		
Evaluation of Plans	Existing plans should be reviewed and modified when necessary	Crew decisions and actions are openly analyzed to make sure the existing plan is the best plan
Inquiry	Crew members should not be afraid to ask questions to investigate and/or clarify current plans of action	"Nothing taken for granted" attitude – crew members speak up without hesitation
Other	Not clearly falling within the other categories	

7. ADDITIONAL CLASSIFICATIONS

Additional Classification	Breakdown
Insufficient Data	Accident does not contain sufficient data to be classified
Incapacitation	Crew member unable to perform duties due to physical or psychological impairment
Fatigue	Crew member unable to perform duties due to fatigue
Spatial Disorientation and Spatial/ Somatogravic Illusion (SGI)	SGI is a form of spatial disorientation that occurs when a shift in the resultant gravitoinertial force vector created by a sustained linear acceleration is misinterpreted as a change in pitch or bank attitude

The COVID-19 pandemic has demonstrated yet again that, during a crisis, aviation remains focused on safety. It's critical to understand, and effectively manage, change during these times to maintain safe operations.

Mark Searle,
Director Safety, IATA OSS

Annex 3 – Accidents Summary

DATE	MANUFAC-TURER	AIRCRAFT	REGIS-TRATION	OPERATOR	LOCATION	PHASE	SERVICE	PROPUL-SION	SEVERITY	SUMMARY
21-01-09	Boeing	B737-500	PK-CLC	Sriwijaya Air	19 km (11.9 mls) NE of Jakarta-Soekarno-Hatta International Airport, Indonesia	ICL	Passenger	Jet	Hull Loss	The aircraft lost height and impacted Java Sea
21-03-02	Aircraft Industries (LET)	Let L-410	HK-4274	South Sudan Supreme Airlines	Pieri, South Sudan	ICL	Passenger	Turboprop	Hull Loss	The aircraft crashed on emergency return after both engines failed
21-01-19	Boeing	B737-400	G-JMCY	West Atlantic	Exeter Airport, UK	LND	Cargo	Jet	Hull Loss	The aircraft suffered a hard touchdown
21-02-01	Boeing	B747-8	JA13KZ	Nippon Cargo Airlines	Tokyo-Narita Airport, Japan	LND	Cargo	Jet	Substantial Damage	The aircraft sufered a tail strike upon landing
21-03-01	ATR	ATR 72	7T-VUK	Air Algerie	Ghardaïa-Noumérat Airport, Algeria	LND	Passenger	Turboprop	Substantial Damage	Nose gear collapse upon landing
21-03-06	Embraer	EMB120 Brasilia	N233SW	Berry Aviation	Detroit-Willow Run Airport, USA	ICL	Passenger	Turboprop	Substantial Damage	Gear problem on departure, lands back gear up
21-03-18	Airbus	A320	XA-VAZ	VivaAerobus	Puerto Vallarta-Gustavo D. Ordaz Airport, Mexico	ESD	Passenger	Jet	Substantial Damage	Nose gear collapse during backtrack for departure
21-03-20	Boeing	B737-400	PK-YSF	Trigana Air	Jakarta-Halim Perdana Kusuma Airport, Indonesia	LND	Cargo	Jet	Substantial Damage	Right main gear failure causes runway excursion on landing
21-04-25	Boeing	B737-300	FPK-316	Air Falcon	United Arab Emirates	UNK	Cargo	Jet	Substantial Damage	Unknown object collided with horizontal stabilizer
21-05-10	ATR	ATR 72	B-17010	UNI Air	Matsu Nangan Airport	APR	Passenger	Turboprop	Substantial Damage	The aircraft suffered a damage to the right main landing gear and tire assembly during go-around
21-06-14	ATR	ATR 72	VT-IYX	IndiGo	Hubli Airport, India	LND	Passenger	Turboprop	Substantial Damage	The aircraft suffered two burst tyres upon landing
21-06-16	Aircraft Industries (LET)	Let L-410	9S-GRJ	Kin Avia	Bukavu-Kavumu Airport, Democratic Republic of the Congo	ICL	Cargo	Turboprop	Hull Loss	The aircraft lost height after departure due to load shift
21-07-02	Boeing	B737-200	N810TA	Trans Air (Honolulu, HI)	9 km WSW off Honolulu-Daniel K. Inouye International Airport, USA	ICL	Cargo	Jet	Hull Loss	The aircraft ditched about 2nm out of Honolulu
21-07-06	Antonov	An-26	RA-26085	Petropavlovsk-Kamchatsk Air Enterprise	3,8 km (2.4 mls) NW of Palana Airport, Russia	APR	Passenger	Turboprop	Hull Loss	The aircraft went missing and impacted the edge of the coast
21-07-10	Airbus	A320	D-AICP	Condor Flugdienst GmbH	Kavala-Megas Alexandros Airport, Greece	ICL	Passenger	Jet	Substantial Damage	Rejected takeoff at Heraklion Airport

DATE	MANUFAC-TURER	AIRCRAFT	REGIS-TRATION	OPERATOR	LOCATION	PHASE	SERVICE	PROPUL-SION	SEVERITY	SUMMARY
21-07-16	Antonov	An-28	RA-28728	SILA Siberian Light Aviation	52 km (32.5 mls) SE of Kedrovo Airport, Russia	CRZ	Passenger	Turboprop	Substantial Damage	Radar contact was lost, ELT activated
21-07-21	De Havilland (Bombardier)	Dash 8-400	5Y-GRS	Skyward Express	Burahache Airstrip, Somalia	LND	Passenger	Turboprop	Substantial Damage	The aircraft suffered a main gear collapse and runway excursion on landing
21-08-11	Boeing (Douglas)	MD-11	N296UP	UPS	Phoenix-Sky Harbor International Airport, USA	GOA	Cargo	Jet	Substantial Damage	The aircraft suffered a tail strike on go around
21-08-20	Shorts	Shorts 360	N4476F	Trans Air (Honolulu, HI)	Honolulu-Daniel K. Inouye International Airport, USA	LND	Cargo	Turboprop	Substantial Damage	The aircraft suffered a gear up landing
21-09-12	Aircraft Industries (LET)	Let L-410	RA-67042	Aeroservice LLC	3 km (1.9 mls) N of Kazachinskoye Airport, India	APR	Passenger	Turboprop	Hull Loss	The aircraft collided with trees on approach
21-09-23	Airbus	Airbus A321	N208HA	Hawaiian Airlines, Inc.	Honolulu-Daniel K. Inouye International Airport, USA	LND	Passenger	Jet	Substantial Damage	Tailstrike Landing
21-09-27	Boeing	Boeing 757	N12125	United Airlines, Inc.	Denver International Airport, USA	TOF	Passenger	Jet	Substantial Damage	Tail Strike on takeoff
21-10-02	Airbus	Airbus A320-200N	N922NK	Spirit Airlines	Atlantic City International Airport, USA	TOF	Passenger	Jet	Substantial Damage	Rejected takeoff as a result of bird strike, right engine fire
21-11-03	Antonov	Antonov An-12	EW-518TI	Aircompany Grodno	Irkutsk Airport, Russia	GOA	Cargo	Turboprop	Hull Loss	Bad Weather Go Around Crash
21-11-29	Boeing	Boeing 747-400	N705CK	Kalitta Air	Miami International Airport, USA	UNK	Cargo	Jet	Substantial Damage	Post flight inspection revealed missing panel
21-12-23	Short Brothers	Short 360	9S-GPS	Malu Aviation	14,8 km (9.3 mls) NW of Shabunda (Democratic Republic of the Congo)	LND	Passenger	Turboprop	Substantial Damage	Ground impact in bad weather

LIST OF ACRONYMS/ABBREVIATIONS

Accident Category Abbreviation

Abbreviation	Full Name
CFIT	Controlled Flight into Terrain
G UP LDG/CLPSE	Gear-up Landing/Gear Collapse
GND DAMAGE	Ground Damage
HARD LDG	Hard Landing
IN-F DAMAGE	In-Flight Damage
LOC-I	Loss of Control — In-flight
MID-AIR COLL	Mid-Air Collision
OFF AIRP LDG	Off-Airport Landing
OTHER	Other End State
RWY COLL	Runway Collision
RWY/TWY EXC	Runway/Taxiway Excursion
TAILSTRIKE	Tail Strike
UNDERSHOOT	Undershoot

List of Acronyms

Acronym	Meaning
ACAS	Airborne Collision Avoidance System
AACA	Alaska Air Carriers Association
ACI	Airports Council International
ACTF	Accident Classification Task Force
ADS-B	Automatic Dependent Surveillance-Broadcast
ADX	Accident Data Exchange
AFGCS	Automatic Flight Guidance and Control Systems
AFI	Africa
AGL	Above Ground Level
AGM	Aircraft Ground Movement
AHM	Airport Handling Manual
AIAG	AFI Incident Analysis Group
ALTA	Asociación Latinoamericana y del Caribe de Transporte Aéreo
AMDAR	Aircraft-based Meteorological Data Relay

List of Acronyms (Cont'd)

Acronym	Meaning
AME	Africa and Middle East
AMP	Aircraft Maintenance Personnel
ANSPs	Air Navigation Service Providers
AOC	Air Operator Certificate
AOV	Areas of Vulnerability
APRAST	Asia-Pacific Regional Aviation Safety Team
APV	Approaches with Vertical Guidance
ARC	Abnormal Runway Contact
ASPAC	Asia-Pacific
ATAC	Air Transport Association of Canada
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATS	Air Traffic Services
AUPRTA	Airplane Upset Prevention and Recovery Training Aid
AVSEC	Aviation Security
CAA	Civil Aviation Authority
CAAC	Civil Aviation Administration of China
CAB	Cabin Operations
CANSO	Civil Air Navigation Services Organization
CAST	Commercial Aviation Safety Team
CBTA	Competency-based Training and Assessment
CCT	Contingency Coordination Team
CDFA	Continuous Descent Final Approach
CEs	Critical Elements
CGO	Cargo Operations
CIS	Commonwealth of Independent States
CMA	Continuous Monitoring Approach
CNS	Communications, Navigation, Surveillance
CoPA	IATA Charter of Professional Auditors
COSCAP-SEA	Cooperative Development of Operational Safety and Continuing Airworthiness Programme South-East Asia
COSTF	Cabin Operations Safety Task Force

List of Acronyms (Cont'd)

Acronym	Meaning
CPDLC	Controller-Pilot Data Link Communications
CRM	Crew Resource Management
CSTs	Collaborative Safety Teams
D-ATIS	Digital Automatic Terminal Information System
DCSs	Departure Control Systems
DH	Decision Height
DIP	Detailed Implementation Plan
DSP	Operational Control and Flight Dispatch
EADI	Electronic Attitude Director Indicator
EAP	Employee Assistance Programs
EASA	European Union Aviation Safety Agency
EB	Electronic Bulletin
EBT	Evidence-based Training
ECAM	Electronic Centralized Aircraft Monitoring
EGPWS	Enhanced Ground Proximity Warning System
EI	Effective Implementation
EICAS	Engine-Indicating and Crew-Alerting System
ERA	Equipment Restraint Area
ERP	Emergency Response Planning
ESAF	Eastern and Southern Africa
EU	European Union
EUR	Europe
FAA	Federal Aviation Administration
FAPFH	Fatal Accidents per Flight Hour
FDA	Flight Data Analysis
FDM	Flight Data Monitoring
FDX	Flight Data Exchange
FFS	Full-Flight Simulator
FIR	Flight Information Region
FLE	Full-Loss Equivalents
FLT	Flight Operations
FMA	Flight Modes Annunciator
FOD	Foreign Object Damage
FOQA	Flight Operational Quality Assurance

List of Acronyms (Cont'd)

Acronym	Meaning
FRMS	Fatigue Risk Management Systems
FSF	Flight Safety Foundation
FSTD	Flight Simulation Training Devices
GADM	Global Aviation Data Management
GAPPRE	Global Action Plan for the Prevention of Runway Excursions
GASP	Global Aviation Safety Plan
GM	Guidance Material
GNSS	Global Navigation Satellite Systems
GOSARPs	Ground Operations Standards and Recommended Practices
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GRF	Global Reporting Format
GRH	Ground Handling Operations
GRSAP	Global Runway Safety Action Plan
GSE	Ground Support Equipment
GSPs	Ground Service Providers
GSRMF	Global Safety Risk Management Framework
HDL	Handling and Loading
HLA	High-Level Airspace
HLCC	High Level Conference on COVID-19 (ICAO)
HRC	High Risk Category
HSE	Health and Safety Executive
I-ASC	IATA Aviation Safety Culture
IAH	IOSA Auditor Handbook
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IDX	Incident Data Exchange
IEs	Instructors and Evaluators
IFALPA	International Federation of Air Line Pilots' Associations
IFATCA	International Federation of Air Traffic Controllers' Association
IGOM	IATA Ground Operations Manual
IMC	Instrument Meteorological Conditions
INACA	Indonesia National Air Carriers Association
IOSA	IATA Operational Safety Audit

List of Acronyms (Cont'd)

Acronym	Meaning
IPM	IOSA Program Manual
ISAGO	IATA Safety Audit for Ground Operations
ISARPs	IOSA Standards and Recommended Practices
ISM	IOSA Standards Manual
ISPM	ISSA Program Manual
ISSA	IATA Standard Safety Assessment
ISSM	ISSA Standards Manual
ITA	IATA Turbulence Aware
ITOP	IATA Tactical Operations Portal
ITU	International Telecommunication Union
IVADO	Institute for Data Valorization
KPIs	Key Performance Indicators
LATAM/CAR	Latin American and Caribbean
LoS	Loss of Separation
MAC	Mid-Air Collision
MEL	Minimum Equipment List
MENA	Middle East and North Africa
MHIRJ	Mitsubishi Heavy Industries Regional Jet
MNT	Engineering and Maintenance
MoU	Memorandum of Understanding
MSA	Minimum Safe Altitude
MTOW	Maximum Takeoff Weight
NAA	National Aviation Authority
NAAs	National Aviation Authorities
NAM	North America
NASIA	North Asia
NAT	North Atlantic
NM	Nautical Mile
NOTAM	Notice to Airmen
OEMs	Original Equipment Manufacturers
OIPR	Opposite Initial Pilot Response
OPS	Operations
ORG	Organization and Management System
OSS	Operations, Safety & Security

List of Acronyms (Cont'd)

Acronym	Meaning
PA	Pan-America
PBN	Performance based Navigation
PF	Pilot Flying
PFD	Primary Flight Display
PIC	Pilot in Command
PLM	Pilot Professionalism Lifecycle Management System
PLoC	Prolonged Loss of Communication
PM	Pilot Monitoring
PSCRM	Passenger Services Conference Resolution Manual
PSFs	Performance Shaping Factors
PTLP	Personnel Training and Licensing Panel
PTLTF	Pilot Training and Licensing Task Force
PWS	Predictive Wind Shear
QA	Quality Assurance
QC	Quality Control
RA	Resolution Advisory
RADALTS	Radar Altimeters
RASG-AFI	African Regional Aviation Safety Group
RASG-MID	Middle East Regional Aviation Safety Group
RASG-PA	Regional Aviation Safety Group – Pan American
RASMAG	Regional Airspace Safety Monitoring Advisory Group
RCG	Regional Coordination Group
RE	Runway Excursions
RI	Runway Incursions
RPTF	Regional Recovery Planning Task Force
RPTF	Regional Recovery Planning Task Force
RVSM	Reduced Vertical Separation Minimum
SAFA	Safety Assessment of Foreign Aircraft
SASCT	Somalia Airspace Special Coordination Team
SAT	South Atlantic
SCAA	Somalia Civil Aviation Authority
SEARAST	South East Asia Regional Aviation Safety Team
SEC	Security Management
SEIs	Safety Enhancement Initiatives

List of Acronyms (Cont'd)

Acronym	Meaning
SeMS	Security Management System
SEs	Safety Enhancements
SFGOAC	Safety, Flight and Ground Operations Advisory Council
SG	Safety Group
SGHA	Standard Ground Handling Agreement
SID	Standard Instrument Departure
SIRM	Safety Issue Review Meeting
SLOP	Strategic Lateral Offset Procedure
SME	Subject Matter Expert
SMS	Safety Management System
SOPs	Standard Operating Procedure
SPG	Systems Planning Group
SPI	Safety Performance Indicators
SPT	Safety Performance Targets
SRA	Safety Risk Assessment
SSP	State Safety Program
TAWS	Terrain Awareness Warning System
TCAS	Traffic Collision Avoidance System
TCC	Temperature-Controlled Containers
TCO	Third Country Operators
TEM	Threat and Error Management
TLS	Target Level of Safety
TSA	Total Systems Approach
UA	Unstable Approach
UAVs	Unmanned Air Vehicles
ULDs	Unit Load Devices
UPRT	Upset Prevention and Recovery Training
USOAP	Universal Safety Oversight Audit Program
VASIS	Visual Approach Slope Indicator System
VGSI	Visual Glideslope Indicator
WICAP	WMO IATA Collaborative AMDAR Program
WMO	World Meteorological Organization
WS	Workstream

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