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IATA

NOTICE

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Montreal—Geneva

Senior Vice-President Foreword

Gilberto Lopez Meyer
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Dear Colleagues,

The industry's extraordinary safety performance in 2017 set a very high bar that, unfortunately, we were unable to match in 2018. The all accident rate, jet hull loss rate and fatality risk all deteriorated in 2018 compared to 2017. Additionally, the number of fatal accidents and fatalities were the highest since 2014, a year that included the loss of MH 370.

As safety professionals, we know that accidents are so rare that one or two can create an apparent spike in annual results. This is why we focus on long-term trends. Here the news is better. The jet and turboprop hull loss rates, as well as the all accident rate, and fatality risk all improved compared to the performance over the preceding five years.

Another way to look at it is to ask what would have happened last year, if the industry had performed at the same safety levels as in 2013, given the increase in traffic over the intervening five years? The answer is that we would have experienced 109 accidents in 2018, rather than 62, with 38 hull losses instead of the 12 that actually occurred.

We are making progress; but we are not advancing quickly enough when it comes to addressing the kinds of accidents that result in the highest numbers of deaths: Loss of Control–In-flight (LOC-I) and Controlled Flight into Terrain (CFIT). In 2018, these categories accounted for more than 80% of fatalities, even though they represented less than 10% of the accidents.

Turboprop operations present another challenge. The good news is that the hull loss rate improved more than 67% compared to the rate of the preceding five years. Yet, despite turboprops having flown only 18% of sectors last year, they accounted for five of 11 fatal accidents (45%).

Airlines on the IATA Operational Safety Audit (IOSA) continued to outperform airlines that are not on the registry. The accident rate for IOSA carriers in 2018 was more than two times better than the rate for non-IOSA carriers. Over the past five years the rate was more than 2.5 times better.

However, 2018 IOSA calculations are impacted by the fatal accident involving a Global Air aircraft that was leased, along with crew, to Cubana. Because Global Air is not on the IOSA registry, the accident is not considered to have involved an IOSA airline, even though Cubana, as a member of IATA, is required to be on the IOSA registry. This issue is being examined and is expected to be addressed this year.

It is our privilege to offer you this 55th 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 IATA Operations Committee (OPC), the Safety Group (SG), the Cabin Operations Safety Technical Group (COSTG) and all IATA staff involved for their cooperation and expertise, essential for the creation of this report.

“We must constantly endeavor to promote safety, best practices and a strong safety culture, where safety is fully integrated into how we all work”

Chairman Foreword

Stephen Hough
Chairman, IATA Accident Classification Technical Group

One thing that can be said about aviation safety in 2018 is that it was not 2017. What do I mean by that? Well, looking back at 2017, it was a year with a low number of accidents as well as an especially low number of fatal accidents and fatalities. I commented last year that this absolutely does not mean that our aviation safety work is done. It only takes a slightly different set of circumstances in the incidents that we saw for there to have been an accident outcome. And, with 2018's statistics, we have seen an unfortunate rise in accidents and fatalities.

To put this in context, we must look a little farther back. Compared to the past five or 10 years, we can see that 2018 accident rates do continue to be low. It takes only one or two mass casualty hull loses to make headlines about a "bad" year and statistical highs and lows to be highlighted. It could be argued that a "good" year with few accidents is actually a "bad" year for safety. Complacency can set in and the industry's need to be cost effective may see safety activity stagnate. I am not at all suggesting that this was the case in 2018 compared to 2017 or that we need accidents to stay motivated. Rather, I am emphasizing that, as safety professionals operating in an industry where we strive for all passengers, crew and staff to make it to their destination or home safely, we can never stop working. We must constantly endeavor to promote safety, best practices and, what I think is one of the most important influencing factors, a strong safety culture, where safety is fully integrated into how we all work.

We are starting to see the benefits of the proactive thinking inherent in Safety Management Systems reflected in in our current safety levels. We must, however, reactively consider what we can learn from the accidents as we review this report. For example, we saw accidents where poor decision-making was a causal factor. We must equip our crews and the support organizations behind them to be able to make considered, timely and risk-based decisions. This includes the selection, training and competence management of all safety critical staff. Threat and error management techniques prepare crews to plan well in advance in order to not be surprised by events and to mitigate them.

Operational pressure must also be considered in these times of commercial stress. We see this in the number of accidents in 2018 with unnecessary weather penetration as a contributory factor. Reliance on modern systems, navigation aids and aircraft does not replace delaying, avoiding and diverting to avoid hazardous weather. With the benefit of hindsight, there were several accidents last year that could have been avoided if a different decision regarding weather conditions had been made.

As always, the quality of the report that you are reading today would not be possible without the expert members of the Accident Classification Technical Group that I have the privilege to chair. It is their knowledge, reasoned opinions and, above all, dedication to making the skies safer that make this report balanced, assured and respected. My thanks to them all.

Fly safe.

Safety Report 2018 Executive Summary

Of the 62 aircraft accidents and 523 fatalities in 2018, International Air Transport Association (IATA) member airlines had two fatal accidents, which accounted for 67 fatalities. While these are promising statistics, they are not the whole picture and the global view should be considered. Regions with accident rates above the global average as well as certain types of operation, older generation turboprops and, notably, operations that do not adhere to the standards of the IATA Operational Safety Audit (IOSA) are such considerations.

IATA has a **Six-Point Safety Strategy** to continuously drive enhancements in six key areas. The activities related to these points are expanded on in **Section 1** of this report.

Over the last decade, as detailed in **Section 2, Decade Review,** the industry continued its 10-year trend of declining accident rates and fatality risks. All indicators show a 10-year downward trend. IATA and the International Civil Aviation Organization (ICAO) are focused on continuously reducing fatality risks in the industry.

Section 3, 2018 Review, shows accidents in the runway environment persist. There were 15 Runway Excursions, which accounted for 52 fatalities, indicating an area where further improvements can be made. The ICAO Global Runway Safety Action Plan released in November 2017 identifies the stakeholder mitigations that must be actioned to address this issue.

The accident categories with fatalities in 2018 were:

- Loss of Control - In-flight (3) with 372 fatalities
- Runway Excursion (2) with 52 fatalities
- Controlled Flight into Terrain (1) with 66 fatalities
- In-flight Damage (1) with one fatality
- Undershoot (1) with one fatality
- Insufficient data for the IATA Accident Classification Technical Group (ACTG) to assign an end state (3) with 31 fatalities

The number of non-fatal accidents by category in 2018 were:

- Runway Excursion (13)
- Ground Damage (9)
- Gear-up Landing/Gear Collapse (9)
- Tail Strike (8)
- In-flight Damage (6)
- Hard Landing (4)
- Loss of Control - In-flight (1)
- Other end state (1)

In 2018:

- The global accident rate was 1.35 per million sectors, compared to 1.08 for IATA members.
- The all-accident rate for airlines on the IOSA registry was more than two times better than that of non-IOSA airlines (0.98 v 2.16).
- 43% of the world's accidents in 2018 occurred in the Asia-Pacific (ASPAC) and Europe (EUR) regions.
- 26% of the world's accidents in 2018 involved ASPAC-based operators.
- There were 15 accidents in the ASPAC region, 14 involving ASPAC-based operators, including six Runway Excursions.
- The largest number of accidents occurred in Generation 3 jets and Generation 4 jets.[1]
- There were no fatal accidents in Generation 4 jets.[1]
- 76% of the world's accidents involved jets, the remaining 24% involved turboprops. The global turboprop fleet is around one-sixth the size of the jet fleet.
- Nine of the 11 fatal accidents in 2018 were passenger operations, which accounted for 98% of all fatalities.

1 Aircraft Generations, as defined in ICAO Doc 9995, Manual of Evidence–based Training.

- IATA membership and IOSA accreditation for non-IATA members continued a strong correlation with improved safety performance.

The five-year data analysis in **Section 4, 2014-2018 Analysis**, shows that the all-accident rate, hull-loss rate, fatal accident rate and fatality risk are all declining. Not only is the rate of accidents measured against sectors flown reducing, but the total number of accidents is in decline.

Between 2014 and 2018:

- The most common accident category was Runway/Taxiway Excursion, followed by Gear-up Landing/Gear Collapse, with Hard Landings the third most common category.
- The top three latent conditions contributing to accidents were Regulatory Oversight, Safety Management and Flight Operations.
- The top three threats were adverse weather conditions, Aircraft Malfunction and Wind/Wind Shear/Gusts.
- The top three errors were Manual Handling/Flight Controls, Standard Operating Procedures (SOPs) Adherence/Cross-Verification and Callouts.
- The most common undesired aircraft state, from which a recovery was still possible, was Long/Floated/Bounced/Firm/Off-Center/Crabbed Landing, followed by Vertical, Lateral or Speed Deviation, with Unstable Approaches the third most common state.
- The most common countermeasures absent in the accidents were Overall Crew Performance, followed by Monitor/Cross-Check and In-flight Decision-Making/Contingency Management.

Section 5, Regional Analysis, provides analysis of accidents in each IATA region.

Between 2014 and 2018:

- The ASPAC region and ASPAC-based operators had the highest total number of accidents, 79 and 77 respectively, over the past five years. This represents 25% of the total accidents worldwide. In particular, Indonesian operators had 20 accidents in the same period.

In 2018:

- North America NAM, Europe (EUR), Middle East and North Africa (MENA) and Northern Asia (NASIA) operators' accident rates were below the global rate.
- Commonwealth of Independent states (CIS), ASPAC, Africa (AFI) and Latin America (LATAM) operators' accident rates were above the global rate.
- In AFI and ASPAC, the accident rate was below the previous five-year rate (2013-2017).
- In seven out of eight IATA regions, the accident rate increased in 2018 compared to 2017. AFI was the only region to see a decrease in the accident rate in 2018.
- AFI operators had five accidents, including two hull losses.
- ASPAC operators had 16 accidents, including three hull losses. There were three fatal accidents in ASPAC. The ASPAC operator accident rate was 2.01, up from 1.69 in 2017.
- CIS operators had eight accidents, including three hull losses and two fatal accidents. The CIS operator accident rate was 4.41, up from 3.99 in 2017.
- EUR operators had nine accidents, with no hull losses and no fatal accidents. The EUR operator accident rate went up from 0.63 in 2017 to 0.87 in 2018.
- LATAM operators had eight accidents, including two hull losses and two fatal accidents. The LATAM operator accident rate in 2018 was 2.33, up from 1.92 in 2017.
- MENA operators had two accidents resulting in one hull loss and one fatal accident. The MENA operator accident rate went up from 0.50 in 2017 to 0.86 in 2018.
- NAM operators had 12 accidents, with one hull loss and one fatal accident. The NAM operator accident rate went up from 0.61 in 2017 to 1.00 in 2018.
- NASIA operators had two accidents, none of which were hull losses or fatal. The NASIA operator accident rate went up from 0.00 in 2017 to 0.32 in 2018.

Section 6, Cargo Accidents 2018:

- There were nine cargo aircraft accidents, two of which were fatal, resulting in 11 onboard fatalities.
- The most common contributory factors to cargo accidents were very similar to those listed above in the five-year analysis (Section 4).

Section 7, Cabin Safety:

In addition to a review of accidents demonstrating the cabin end states and the actions of the cabin crew following an accident, this report includes selected data from several recent analyses carried out by IATA Cabin Safety in relation to:

- Injuries sustained in the cabin
- Inadvertent slide deployment
- Unruly passengers

Deeper analysis to support this information is available to airlines participating in IATA's Safety Trend Evaluation, Analysis and Data Exchange System (STEADES) program through the Global Aviation Data Management (GADM) website.

Using data from incident reports helps identify incident rates and set objective targets and Safety Performance Indicators (SPIs). By benchmarking against industry rates, an operator can more effectively set safety performance targets and manage their risks to an acceptable level.

In response to its members' feedback, IATA Training has been developing a new training course specifically for airline cabin safety experts, to help them integrate more relevant cabin SPIs within their SMS. Release of this training course is anticipated during 2019.

Further information on SMS within cabin operations is included in the IATA Cabin Operations Best Practices Guide.

IATA strives to help operators manage safe cabin operations by sharing guidance and keeping its members informed of developments in cabin safety. The IATA Cabin Operations Safety Conference has become a world-renowned event for delegates to network, learn of recent updates and initiatives, as well as attend workshops to increase their understanding of regulations and policies.

The ACTG compiled **Section 8, Report Findings and IATA Prevention Strategies**. The ACTG continues to be concerned about the low percentage of accident reports completed. As accidents and serious incidents occur less frequently, the ability to mine critical lessons from the events diminishes. Therefore, it is critical that effective investigations are conducted and high-quality reports produced.

Since raising this issue two years ago, IATA has been actively engaged in exploring how we can help drive greater compliance with the ICAO Annex 13 standards and recommended practices. In addition, in an effort to help our member airlines better understand the Annex 13 process and how they can bring greater value to investigations, IATA is developing an Accident Investigation Support Program. This program will be launched in the second quarter of 2019 and will be available to member airlines.

Section 9, STEADES Analyses focused on updating the hazards presented by two emerging risks: Unmanned Aircraft Systems (UAS) and Incorrect Surface Lineups. In-depth studies done by the STEADES team this year illustrated a sharp increase in global occurrences of aircraft-UAS encounters since 2013-2014. Recommendations from the study include the development of a global standardized reporting system to fully understand the scale of the issue and develop effective risk mitigation.

The IATA GADM and Operational Safety teams carried out an analysis of incorrect landing surface lineups reported in the STEADES database from Q1 2016 to Q3 2017, inclusively. The main conclusions from the analysis were:

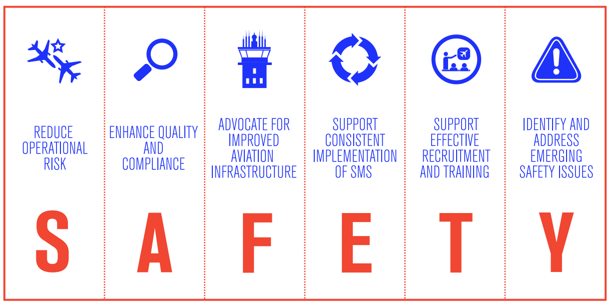
- Parallel runway operations carry the highest risk of lining up with an incorrect surface for landing.
- Visual approaches to parallel runways caused 41% of incorrect lineups in our data set.
- Late runway changes and the associated increase in workload and distraction is a major causal factor of incorrect lineups.

The analysis is reproduced in Section 9.

IATA Safety Strategy

IATA continues to work in support of the Six-Point Safety Strategy. The strategy was developed in consultation with the IATA Safety Group (SG) and is endorsed by IATA's Operations Committee (OPC).

IATA continues to use this safety strategy to define its actions towards an integrated, data-driven approach to managing safety risks to continuously improve aviation safety.



IATA'S SIX-POINT STRATEGY

IATA's Safety Strategy is a holistic approach to identifying organizational and operational safety issues. Its key pillars are:

- Improved technology
- Regulatory harmonization
- Training
- Awareness

IATA works closely with industry stakeholders to ensure each of these pillars is leveraged to address each of the six safety strategies, namely:

1. Reduce operational risk
2. Enhance quality and compliance
3. Advocate for improved aviation infrastructure
4. Support consistent implementation of Safety Management Systems (SMS)
5. Support effective recruitment and training
6. Identify and address emerging safety issues

Each of these six key areas breaks down into several sub-categories to address specific aspects of the strategy.

Aviation security is also key to maintaining operations resilient to threats. Some of the work carried out by IATA in this area is described in this section.

REDUCE OPERATIONAL RISK

IATA remains focused on its top safety priorities, which include Runway Safety, Controlled Flight into Terrain (CFIT), Loss of Control-In-flight (LOC-I) among others, while continuing to promote the implementation of new safety initiatives.

Based on analyses of accident data for commercial air transport operations, IATA has identified high risk accident categories to determine the topics for safety analysis.

Controlled Flight into Terrain

Although CFIT accidents represented only 3% of all commercial aircraft accidents during the last five years, this risk area was the second-highest fatal accident category after LOC-I.

By definition, CFIT can be avoided and it is hoped that the content of the CFIT Accident Analysis Report will help achieve that goal. The report contained the following recommendations for operators to consider:

- Implement Continuous Angle Non-Precision Approaches (CANPA) for a more stable descent profile than traditional "dive and drive" methods used for non-precision approaches.
- Consider replacing circling approaches in favor of using Area Navigation (RNAV) or Required Navigation Performance (RNP) approaches.
- Train flight crews to respond immediately to a hard Enhanced Ground Proximity Warning System (EGPWS) warning, and to respect and respond to EGPWS soft warnings.
- Mandate procedures that ensure EGPWS databases are kept accurate and up-to-date.
- Train and ensure effective implementation of SOPs, flight crew monitoring, cross-checking and pilot-to-pilot communication in all approaches when weather and visibility are factors.
- Use a Flight Operations Quality Assurance (FOQA)/Flight Data Monitoring (FDM) program to monitor compliance and reinforce a policy of go-around from an unstable approach.

As part of its ongoing commitment to mitigating CFIT accidents, IATA is working with Honeywell on a study on the Terrain Awareness and Warning System / Enhanced Ground Proximity Warning System (TAWS/EGPWS) performance.

Manual Handling Skills

IATA has conducted an accident analysis report for commercial air transport operations covering the period from January 2013 through December 2017. This report illustrated that, among the 339 fatal and nonfatal accidents, flight handling errors were contributing factors in 94 accidents (34%). Examples of flight handling errors include:

- Hand flying - vertical, lateral or speed deviations
- Incorrect selection of flaps, speed brake, autobrake, thrust reverser or power settings
- Approach deviations by choice (e.g., flying below the glide slope)
- Ground handling errors - missed runway/taxiway, failure to hold short, taxi above speed limit

In line with this analysis, IATA is carrying out an online survey on manual flying skills to capture a comprehensive understanding of the respondents' perspectives regarding operator training, operator policies for automation, and manual flying during line operations. The survey elicited over 5,000 responses. IATA is reviewing the responses to identify and publish key findings and recommendations.

Loss of Control - In-flight

While the LOC-I category represented 8% of all accidents during the last five years, it resulted in the highest percentage of fatal accidents (54%).

LOC-I Recommendations

- Conduct training on energy management in a variety of scenarios, including, but not limited to: engine failure, thrust loss, and non-normal engine configurations in a variety of scenarios and flight phases.
- Implementation of IOSA Standards in developing nations.
- Monitoring automation and timely manual intervention.
- Training on older generation turboprops.
- Ensure operations are conducted in accordance with SOPs.
- Ensure flight crews have the necessary communication and Crew Resource Management (CRM) skills
- Be mindful of the limitations of simulators to represent conditions outside of the flight envelope and the possibility of providing negative training.
- Lower the weight limit for mandatory flight data monitoring.

Mid-Air Collision

Mid-Air Collision (MAC) is an aviation accident category defined as a collision between aircraft in flight. This accident category is rare, but when it occurs, it is generally catastrophic.

To reduce the risk of MAC, immediate and correct flight crew response to Traffic Alert and Collision Avoidance System (TCAS) Resolution Advisories (RAs) is critical, as any delayed or incorrect flight crew response will diminish the safety margins and subsequent effectiveness of the RA.

With the help of flight data, IATA and EUROCONTROL jointly produced guidance on flight crew compliance with TCAS RAs. This guide, which is based on ICAO provisions and other applicable regulations, recommends that operators establish procedures to enhance flight crew responses, following activation of TCAS RAs. This includes, but it is not limited to:

- Pilot response to RAs
- Pilot compliance with RAs
- Aircraft operations during RAs
- TCAS training
- RA reporting
- Use of FOQA/FDM for monitoring and follow up of TCAS RA events

Runway Safety

The Global Runway Safety Action Plan (GRSAP) was launched at the second Global Runway Safety Symposium in Peru. This GRSAP provides recommended actions for runway stakeholders and is aimed at reducing the global rate of runway excursions and incursions.

IATA continues to work on increasing awareness of the new runway surface Global Reporting Format (GRF) that will become effective in November 2020. The GRF will ensure a harmonized assessment and reporting of runway surface conditions and a correspondingly improved flight crew assessment of takeoff and landing performance. ICAO held a Global Symposium in March 2019 in Montreal to discuss the new GRF, and will also hold further regional symposia. IATA is liaising with ICAO and the industry on the implementation of the GRF.

Incorrect Landing Surface Lineups

The IATA GADM and Operational Safety teams carried out an analysis of incorrect landing surface lineups reported in the STEADES database from Q1 2016 to Q3 2017, inclusively. The analysis is reproduced in Section 9.

IATA Met Project

As of December 2018, IATA has developed a turbulence sharing platform (IATA Turbulence Aware) 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 Turbulence Aware system is to provide airline pilots and airline operation center personnel with real-time, very detailed turbulence awareness and support a global industry shift towards data-driven turbulence mitigation.

This project seeks to achieve two objectives:

1. Develop a global, real-time, objective aircraft-sensed turbulence data sharing platform for airlines operational use to mitigate the impact of turbulence.
2. Improve weather forecasts by expanding the existing World Meteorological Organization (WMO) aircraft-based meteorological data collection program (AMDAR) to airlines from data sparse areas.

Ultimately, the IATA turbulence platform provides an open solution to industry that will enable any operator to share their data within a global turbulence repository. The ultimate aim being that carriers will have access to each other's real-time turbulence data so that greater situational awareness both preflight and in-flight can be achieved.

In summary, the turbulence platform will enable multiple carriers and other aviation industry stakeholders to benefit operationally from having access to global, consolidated near real-time in-situ turbulence data.

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

Ground Operations Safety

IATA Ground Operations is working on trends and in-depth analyses of safety data provided by the IATA Ground Damage Database (GDDB) and other sources provided by industry stakeholders.

The IATA Ground Operations safety agenda is focused on the following areas:

- Ground Damage Reduction
  - Implementation plan for Ground Support Equipment (GSE) proximity sensing and warning systems.
  - Pilot testing of technology for autonomous docking of Passenger Boarding Bridges (PBBs), passenger stairs, high-loaders and other GSE.
- Safety Policies and Operational Procedures
  - Identification and publication of safety critical procedures in the IATA Ground Operations Manual (IGOM Ed. 8).
  - Development of lashing and tie-down procedures in IGOM Ed. 8.
  - GSE pooling and borrowing guidelines.
  - GSE basic minimum maintenance program/schedule.
  - Safety alerts.
  - SMS and SPI guidelines.
- Human Factors (HF)
  - Substance abuse prevention program.
  - Injury and aircraft damage cost models.
  - Enhanced safety training for HF and SMS.
- Standardization
  - New IGOM Adoption Policy, which allows operator and Ground Service Provider (GSP) variations with risk assessment (as applicable) .
  - Implementation of Ground Operations Training Program - Airport Handling Manual (AHM) Chapter 11.
  - Development of GSE Maintenance Training Program (new section in AHM Chapter 9).
- Loading and Load Control Errors
  - Key study on the root causes of loading errors (ongoing project).
  - Digitalization and standardization of aircraft weight and balance data needed for Departure Control System (DCS) setup.
  - Weight & Balance Information Center (ongoing project).
- Occupational Health and Safety
  - Injury cost models.
  - Fatigue management.

Fatigue Management

The traditional regulatory approach to managing crewmember fatigue has been to prescribe limits on maximum flight and duty hours, and require minimum breaks within and between duty periods. It is a one-size-fits-all approach that does not consider operational differences. Despite updated flight time limitations (FTL), fatigue continues to be a contributory factor in many accidents and incidents, and continues to be an identified risk on individual operators' hazard registries.

A Fatigue Risk Management System (FRMS) is an enhancement to FTLs, enabling an operator to customize FTLs to better manage fatigue risk to the operation. There is scientific and operational support that FRMS is a means for effectively mitigating fatigue risks. However, many operators do not know where to start in managing fatigue.

With the support of the IATA Fatigue Management Task Force (FMTF), IATA has developed a series of guidance materials and information papers to support the implementation of fatigue management principles. IATA also participated in the development of standards published in the cobranded IATA/ICAO/IFALPA Fatigue Management Guide for Airline Operators. All of these documents can be downloaded free of charge from www.iata.org.

In late 2018, the IATA FMTF was elevated to a Technical Group (FMTG) by the IATA Operations Committee in recognition of the group's expertise and its ongoing industry work. The governance of this group was also changed from the Flight Operations department to the Safety department. This was to better reflect the current work plan of the group.

The FMTG is currently developing a risk assessment model for safety employees to use to effectively consider fatigue when they are conducting a safety risk assessment. Work is ongoing and it is anticipated that this model will be ready for distribution in late 2019.

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

The IATA Operational Safety Audit (IOSA) program lessens the burden on the industry by representing a global standard that is utilized by numerous regulators to complement their oversight activities on commercial operators. IOSA is an internationally recognized and accepted evaluation system designed to assess the operational management and control systems of an airline. All IATA members are IOSA registered and must remain registered to maintain IATA membership.

In 2018, IOSA celebrated its 15th anniversary. On that occasion, a series of workshops were conducted for airlines, audit organizations, auditors and regulators.

As at 8 November 2018, there were 438 airlines on the IOSA registry, including 145 non-IATA members. During the same year, over 1,400 IOSA Audit Reports were exchanged, which is an increase of 7% from the previous year (over 8,700 have been shared since 2003).

IATA is working to introduce the following changes to the program (among others) to mitigate IOSA's associated risks:

- Allocation of initial audits
- Development of a methodology for auditing effectiveness
- Continuously improving the training of auditors

To meet the changing needs of the airline industry, respond to the increasing involvement of regulatory bodies, and address additional program complexity, IOSA and the IATA Safety Audit for Ground Operations (ISAGO) are undergoing a digital transformation.

IATA Safety Audit for Ground Operations

The ISAGO is a standardized and structured audit program of the GSPs operating at airports. The audits assess a GSP's conformance with standards developed by global industry experts for the management, oversight and implementation of ground operations. The standards aim to improve flight safety and reduce ramp accidents and incidents through safety management and standardization of procedures. The audits are conducted by highly trained and experienced auditors that are members of the IATA Charter of Professional Auditors (CoPA). ISAGO is currently the only global program that requires a GSP to implement a SMS equal to that of air and airport operators.

Analysis of data submitted to the IATA GDDB indicated (with clear and strong statistical evidence) that ISAGO made a positive impact on the safety culture and performance of the GSPs that had been audited and granted an ISAGO Registration. These GSPs exhibited a significantly better safety reporting culture, in that their employees were twice as likely to report damage compared to employees of a non-ISAGO GSP. The damage was also less severe.

IATA Standard Safety Assessment Program

The IATA Standard Safety Assessment Program (ISSA) is a voluntary evaluation program, produced at the request of the industry, to extend the benefits of operational safety and efficiency that emanated from the IOSA program to the operators of smaller aircraft that are not eligible for the IOSA program. Additionally, ISSA introduces elements of a SMS.

Following an in-depth review of this program, some improvements were introduced to make it more effective and suitable for the airline industry.

First, IATA reduced the price of an ISSA Assessment, making it more attractive for airlines.

Second, the scope of ISSA was extended to increase the number of ISSA Registered Operators and promote ISSA globally. The changes in scope were implemented in the new edition of the ISSA program documentation. These changes allow airlines operating both aircraft with a maximum takeoff weight below 5,700 kg as well as aircraft with a maximum takeoff weight over 5,700 kg to stay in ISSA and continue their cooperation with IATA.

Third, the standards and recommended practices of ISSA have been revised and some new safety-related standards were added. The standards and recommended practices of ISSA meet the safety, quality and security requirements of the air transport industry for operators of aircraft with a maximum takeoff weight of 5,700 kg.

IATA Fuel Quality Pool

The IATA Fuel Quality Pool (IFQP) is a group of nearly 200 airlines that work together to assess the implementation of safety and quality standards and procedures at aviation fuel facilities. IFQP-qualified inspectors perform inspections against industry regulations at airports worldwide and the reports are shared among IFQP members.

By providing comprehensive training of inspectors and development of standardized inspection procedures according to airline and regulatory requirements, the IFQP enhances safety and improves quality control standards of fuel facilities at the airport.

De/Anti-icing Quality Control Pool

The IATA De/Anti-icing Quality Control Pool (DAQCP) is a group of more than 120 airlines that audit de/anti-icing providers and share the inspection reports and workload at various locations worldwide. The pool's main goal is to ensure that de/icing/anti-icing safety guidelines, quality control recommendations, standards and procedures are followed at all airports.

IATA Drinking Water Quality Pool

The IATA Drinking Water Quality Pool (IDQP) was created by a number of airlines to safeguard the health of passengers and crew onboard aircraft by using the highest standards to ensure water quality. By sharing inspection reports, airlines avoid multiple audits of the same provider at the same location, thereby enjoying substantial financial savings from reductions of airport inspection workloads and associated costs.

ADVOCATE FOR IMPROVED AVIATION INFRASTRUCTURE

Airline operators from all regions around the world are heavily investing in fleet and network expansion as well as onboard avionics to accommodate double-digit traffic growth. Yet, airlines are still faced with bottlenecks and a lack of infrastructure to cope with the growth. The regulatory framework and Air Traffic Management (ATM) capabilities must evolve in a harmonized context and meet the pace of advancing technologies, to ensure that new entrants and airspace users are safely and efficiently integrated into the airspace.

It is important for the industry to move towards a future vision of ATM, and look at the ATM system gate-to-gate. Key drivers for change and operational improvements are safety, efficiency and cost-effectiveness. Within that context, IATA is working with member airlines, key partners such as ICAO, State regulators and Air Navigation Service Providers (ANSPs), to ensure that ATM operations and infrastructure improve the level of safety, enhance efficiency, reduce CO_2 emissions, and are supported by a positive cost-benefit analysis.

Performance-based Navigation with Vertical Guidance

At their 37th General Assembly in September 2010, ICAO member states agreed to complete a national performance-based navigation (PBN) implementation plan as a matter of urgency. The aim was to achieve PBN approach procedures with vertical guidance for all instrument runway ends by 2016.

Due to a low level of progress, IATA continues to engage States, ANSPs and airlines to accelerate the implementation of Approaches with Vertical Guidance (APV) procedures. The intent is to demonstrate the risks associated with current practices of non-utilization of the published approach procedure, or of Air Traffic Control (ATC) personnel taking flight crews off the procedure and vectoring to the final, in lieu of allowing a crew to follow the procedures as designed. These practices do not inherently increase the risks, but they are contrary to the original goal of discontinuing use of non-precision approaches, and providing a more stabilized and predictable final approach.

Irresponsible Use of Unmanned Aircraft Systems

Unmanned Aircraft Systems (UAS) represent a hazard to civil aviation, particularly in the case of their irresponsible use in the vicinity of airports and manned aircraft. Small UAS are being used by people unfamiliar with the safety risks, or with little awareness of civil aviation and its regulation. As such, it is critical to ensure that the relevant risk assessment models and proper SMS are in place for UAS operations.

Within that context, IATA has been working with industry partners to ensure awareness of the safety risks resulting from the operation of small UAS close to aircraft and airports. All material produced under this campaign can be accessed on the IATA website.

IATA has also published a joint safety statement with Airport Council International (ACI) and International Federation of Air Line Pilots' Associations (IFALPA) on the irresponsible use of UAS.

In 2018, IATA issued a bulletin on anti-UAS technology.

Traffic Management of New Entrants

To ensure the safe integration of new entrants into the non-segregated civil airspace structure, IATA is working with ICAO, key regulatory bodies, and the industry to ensure that the system architecture and safety provisions developed to accommodate these entrants are done in a manner that will ensure their operations are safe in the lower, transitional and upper airspace.

SUPPORT CONSISTENT IMPLEMENTATION OF SAFETY MANAGEMENT SYSTEMS

In 2018, IATA focused on driving effectiveness from the SMS elements that have been put in place, while continuing to drive the achievement of the intent of SMS programs. Numerous initiatives contributed to this overall goal.

IATA Safety Information Exchange Program

IATA strongly believes that State/Industry partnership and collaboration are critical to setting and achieving sustainable and effective safety goals, as intended through SMS programs.

As such, IATA has developed the Safety Information Exchange Program (SIEP) to facilitate the open sharing of information and analysis between States, service providers, and other key stakeholders. The program promotes and establishes a mechanism for participant collaboration in identifying, analyzing and mitigating their aviation system safety risks. Program involvement is voluntary and at the sole discretion of the individual participants.

The program is predicated on the Annex 19 requirements for States to manage safety at a State level and establish safety information-sharing networks, while also assuring that safety data and safety information protections are in place.

IATA will continue to advocate for this concept and work with stakeholders from various States to facilitate the establishment of new State/Industry collaborative safety teams.

Safety Culture – A Key Enabler of Safety Management

The need to understand the organizational climate and its impact on the behavior of frontline personnel is a critical enabler to managing safety effectively. As such, the role of safety culture in operational safety has been identified as an area of focus for IATA.

Recent efforts in this area identified a need for greater awareness and tools necessary for operators to assess where they stand in terms of safety culture. The IATA Aviation Safety Culture (I-ASC) survey has proven very valuable in providing organizations with actionable insight into the daily challenges and perceived risk areas of frontline and management employees. Successfully deployed in 2017, more than 40 specific AOCs have conducted the survey by the end of 2018. Due to this success, IATA is now able to introduce the added benefit of benchmarking capabilities on a global basis. IATA intends to expand this capability to the regional and alliance level, as participation allows.

Annex 19 Amendments – Guidance Material

IATA continues its participation on the ICAO Safety Management Panel (SMP), with a specific focus in 2018 and 2019 to identify and upload practical examples to the ICAO Safety Management Implementation website. The website is geared to all States and service providers, and can be found here.

The SMP also regularly reviews Annex 19 applicability.

IATA Issue Review Meeting and Hazard Identification Technical Group

The IATA Issue Review Meeting (IRM) is held twice every year in the spring and fall. The meeting provides a forum where airlines can freely share their experiences and lessons learned regarding accidents, incidents or safety risks that they dealt with. The intent is that the broader community learn from these experiences and work to prevent similar events or risks at their own airlines. Not only does this demonstrate the willingness of our industry to share in the interest of safety, but this open review of significant industry accidents, incidents, potential incidents and risks spanning the entire global sphere of commercial air transportation allows real issues to be identified and further analyzed by the IATA Hazard Identification Technical Group (HITG) and raised to the IATA SG. This is a key input to the SG's determination of industry risks that need IATA action.

We look forward to welcoming you at an upcoming IRM. For more information, please contact us.

SUPPORT EFFECTIVE TRAINING

Training and Licensing

The IATA Training and Licensing portfolio is a multifaceted portfolio that seeks to improve safety through enhanced pilot training and qualification. Working with the IATA Pilot Training Task Force, IATA participates in the development of new standards and publishes guidance materials and best practices to support operators and training organizations in implementing these standards. Additionally, IATA offers consultancy services to provide practical support for the implementation of new training methodologies (contact: Training-Licensing@iata.org).

IATA supports a consistent approach to flight crew training, from the selection process through initial licensing training and operator training, by promoting Competency-based Training and Assessment (CBTA) programs.

IATA is committed to the Total Systems Approach (TSA), which stands for the application of CBTA across all aviation disciplines in general, and, in particular, to a pilot's entire career. Hence, the defined competencies for pilots and instructors/ evaluators should be consistently applied throughout pilot aptitude testing, initial (*ab-initio*) training, type rating training and testing, command upgrade, recurrent training (including evidence-based training), as well as instructor and examiner selection and training. IATA also addresses specific areas of training, such as Upset Prevention and Recovery Training (UPRT) and flight crew monitoring, by publishing guidance materials.

Pilot Aptitude Testing

Designed to support aviation managers in the field of pilot selection, Pilot Aptitude Testing (PAT) is a structured, science-based candidate selection process. PAT helps prevent disappointed applicants, wasted training capacity, and early drop out due to medical reasons. Proven to be highly effective and efficient, PAT provides enhanced safety, lower overall training costs, higher success rates in training and operations performance, a more positive working environment, and reductions in labor turnover. This becomes particularly important in view of the forecast increased demand for qualified pilots in the coming decades.

The 3rd Edition of the IATA PAT Manual integrates the pilot competencies framework into the testing process.

Competency-based Training and Assessment for Pilots

IATA is part of the ICAO Competency-based Training and Assessment Task Force (CBTA-TF), whose task consists in developing an ICAO aircraft pilot competency framework for all pilot licenses, type ratings, instrument ratings and recurrent training.

IATA has supported the revision of the provisions of Annex 1 - Personnel Licensing, the Procedures for Air Navigation Services - Training (PANS-TRG Doc 9868) and Annex 6 Part 1; as well as the consequential amendments of related guidance materials, including the Manual of Evidence-based Training (Doc 9995) and the Manual on Upset Prevention and Recovery Training (Doc 10011).

These amendments promote the expansion of a harmonized pilot competency set and clarify the role of the competencies in the Threat and Error Management (TEM) model. The competencies of the approved adapted competency model provide the individual and team countermeasures to threats, errors and undesired aircraft states.

Competency-based Training and Assessment for Instructors and Evaluators

Given the essential contribution of instructors and evaluators (IEs) to flight safety, IATA considered it important to propose solutions to enhance globally the level of competency of IEs. Therefore, the 1st Edition of the IATA Guidance Material for Instructor and Evaluator Training introduces and defines a set of IE competencies to be applied from the selection process, across all types of IE training, from licensing to operator recurrent training, by both operators and training organizations. The IATA IE competency set has been endorsed by ICAO.

Competency-based Training and Assessment

IATA supports ICAO by leading the drafting of a CBTA implementation guide. The targeted audience for this guidance material is training organizations, operators and Civil Aviation Authorities (CAA) wishing to develop and implement a CBTA program. This guidance addresses the key elements to be considered by an organization that wants to put in place the CBTA principles (i.e., transition from traditional training to CBTA, training system performance, oversight). The target publication date for this guide is 2020.

Multi-Crew Pilot License

Progress in the design and reliability of modern aircraft, a rapidly changing operational environment, and the need to better address the human factors issue prompted an industry review of pilot training. The traditional hours-based qualification process fails to guarantee competency in all cases. Therefore, the industry saw a need to develop a new paradigm for CBTA of airline pilots: Multi-Crew Pilot License (MPL) training.

MPL was the first license to move from task-based to CBTA, in a multi-crew setting from the initial stages of training.

The 2nd Edition of the co-branded IATA/IFALPA MPL Implementation Guide was published in 2015 to support airlines during their implementation process.

Evidence-based Training

Evidence-based Training (EBT) was the first recurrent training program to apply the principles of CBTA for safe, effective and efficient airline operations, while addressing relevant threats.

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 following documents published by ICAO and IATA allow airlines to develop an effective EBT program:

- ICAO Manual of Evidence-based Training (Doc.9995)
- Updates to ICAO Procedures for Air Navigation Services - Training (PANS-TRG, Doc 9868)
- IATA/ICAO/IFALPA Evidence-based Training Implementation Guide
- IATA Data Report for Evidence-based Training

IATA is currently reviewing the 1st Edition of the Data Report for EBT. Publication of the 2nd Edition is expected by the end of 2019.

Upset Prevention and Recovery Training

Loss of Control - In-flight is one of the leading causes of fatalities in commercial aviation. This has led to a revision of current training practices and the adoption of new regulations to address this phenomenon. The IATA Guidance Material and Best Practices for the Implementation of UPRT manual, published in 2015, serves as guidance material for operators to develop an UPRT program as part of their recurrent training. It can also be considered when including UPRT into other programs, such as conversion, upgrading and type rating training. The document specifically focuses on practical guidance for UPRT instructor training. It also includes recommendations for operators cooperating with approved training organizations (ATOs) providing licensing training for their *ab-initio* cadets. It may be used for both traditional and competency-based training schemes.

The 2nd Edition of Guidance Material and Best Practices for the Implementation of UPRT was published in January 2019.

Flight Crew Monitoring

The need to address flight crew monitoring arose from an aviation community consensus around the importance of enhancing monitoring skills, based on data analysis from various sources. The IATA Guidance Material for Improving Flight Crew Monitoring, published in 2016, provides practical guidance for operators and ATOs for the development of flight crew monitoring training. It also highlights how monitoring is embedded in all pilot competencies and how these competencies serve as countermeasures in the TEM model.

Note: All IATA guidance materials produced under Training and Licensing mentioned above are accessible for free download from our website.

Competency-based Training and Assessment (CBTA) for Technicians

IATA is part of the ICAO Competency-based Training and Assessment Task Force (CBTA-TF) for Maintenance, whose task consists in developing an ICAO framework for technician training.

IATA has supported the revision of the provisions of the Procedures for Air Navigation Services - Training (PANS-TRG Doc 9868) Part III Training and Assessment for Aircraft Maintenance Personnel.

The aim of a CBTA program for technicians is to identify, develop and evaluate the competencies required by commercial aircraft maintenance personnel to operate safely, effectively and efficiently. CBTA in maintenance is geared toward individual student performance. The specification of the competency to be achieved, the evaluation of the student's entry level, the selection of the appropriate training method and training aids, and the assessment of a student's performance are the key factors to the success of such a program.

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 automated analysis 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.

Emerging/evolving risks that will increasingly need to be considered in the conversation of operational risk for aviation service providers include:

- Carriage of lithium battery-powered portable electronic devices (PED) by passengers (see also Section 7, Cabin Safety)
- Lithium batteries in cargo and mail
- Unmanned Aircraft Systems (UAS)
- Cyber security

Carriage of Portable Electronic Devices

Improper carriage by passengers of PED powered by lithium batteries, as well as e-cigarettes, power banks and spare lithium batteries, continue to pose a challenge.

A survey of over 1,500 passengers from Hong Kong, the UK and the US conducted in March 2018 identified that passengers in general, and frequent flyers in particular, responded that they believed that they were well-informed about the regulations on the carriage of PED, e-cigarettes, power banks and lithium batteries. However, approximately one-third of respondents from all three regions advised that they pack e-cigarettes, spare lithium batteries and power banks in their checked baggage, despite these items being forbidden in checked baggage. This would indicate that either the passengers are not as well-informed as they believe or they deliberately disregard the prohibition. In an effort to support members to communicate the requirements on the carriage of PED, e-cigarettes, power banks and spare lithium batteries, an infographic on lithium batteries was developed. The infographic is available in A4, letter and web formats in all UN official languages as well as Korean and Vietnamese. The infographic is available here.

Cargo Safety and Lithium Batteries

The ICAO Flight Operations Panel Cargo Safety Subgroup (FLTOPSP-CSSG) was tasked to develop revisions to Annex 6 – Flight Operations, and associated guidance material, to address the safe carriage of cargo, mail and baggage in aircraft cargo compartments. Subject matter experts from both the IATA Safety and IATA Cargo departments are members of the FLTOPSP-CSSG supporting the development of the changes to Annex 6 and the associated guidance material.

The FLTOPSP-CSSG has completed development of a new Chapter 15 – Cargo Compartment Safety for Annex 6. The proposed amendment to Annex 6 was sent out by State letter in August 2018 with the comment period closing 24 November 2018. There was no indication at the time of publication of this report of the comments that may have been submitted.

The FLTOPSP-CSSG is now working on guidance material to support Chapter 15. The guidance material will be published as a new ICAO Manual, Doc 10102, Guidance for Safe Operations Involving Aeroplane Cargo Compartments.

Separately, 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 in the package, there are no hazardous effects outside the package.

The SAE G-27 Committee convened through conference calls and physical meetings during 2018 to progress the development of the performance standard. At the time of writing, it is expected that the G-27 Committee will complete their work in November 2019 in Barcelona. Assuming that the committee is satisfied with the draft standard, it will then be sent out to the full committee for ballot. If the committee votes to adopt the standard, it will then be submitted to SAE for final approval. Once SAE published the final standard, it will then be considered by the applicable ICAO bodies, likely the Dangerous Goods Panel, Flight Operations Panel and Airworthiness Panel, to determine if the standard is suitable for adoption into the ICAO Technical Instructions.

IATA Safety and IATA Cargo continue to represent the industry in the discussions on the carriage of lithium batteries and participate in the work of the applicable ICAO panels. IATA Cargo continues to promote outreach to industry on dangerous goods and the need for compliance with the Dangerous Goods Regulations. In 2018, there were a total of six one-day dangerous goods workshops conducted, three in Africa in February and three in Asia in November. This was in addition to the 8th annual two-day lithium battery workshop that was held in Bangkok in October.

Unmanned Aircraft Systems

Unmanned Aircraft Systems (UAS) represent a potential hazard to civil aviation, particularly in the case of their irresponsible use in close vicinity to airports and manned aircraft. Small UAS are being used by people unfamiliar with the safety risks, or have little awareness of civil aviation and its regulation. As such, it is critical to ensure that the relevant risk assessment models and proper safety management systems are in place for UAS operations.

IATA works closely with key stakeholders, including: Airlines for Europe (A4E), Airports Council International (ACI), Civil Air Navigation Services Organization (CANSO), European Cockpit Association (ECA), European Helicopter Association (EHA), International Federation of Air Line Pilots' Associations (IFALPA) and International Federation of Air Traffic Controllers' Associations (IFATCA). IATA is instrumental in bringing together different aviation stakeholders to speak with one voice on UAS to ensure that the relevant authorities are fundamentally aware of the airspace users' position regarding requirements for the safe operation of UAS and integration of UAS Joint Safety Statements contained in. This leadership will continue as we navigate through challenging dialogue related to unsegregated operations (manned and unmanned aircraft sharing the same airspace).

ICAO issued a State letter on 20 March 2017 emphasizing State responsibilities to protect civil aircraft from "pilotless" aircraft.

The transition from prescriptive to performance-based regulations for UAS and the establishment of acceptable target levels of safety will set the foundation for the implementation of future safety initiatives. IATA will continue to actively participate in policy and operational concept development of technology to enhance safety. Priority work areas include:

- Dynamic geofencing: adaptable virtual barriers that are created using a combination of GPS and radio frequency connections, such as Wi-Fi or Bluetooth, to keep UAS from entering dangerous, restricted or sensitive airspace.
- Detect and Avoid (DAA) technology.
- Analysis of UAS incidents and accidents to identify trends and support SMS and State Safety Programs (SSP).

Cyber Security

Regarding cyber security, it was recorded that "*IATA…should help airlines identify threats and/or risks via the…systems interfaces from application to application and from platform to platform*". Further, it was reported that IATA should create a list of airline-controlled activities that could be used as an attack vector in one of the following categories: Cyber Security, Aviation Cyber and Cyber Threat, and Risk to Aircraft Correlating to Safety of Flight). Then, IATA should create an aviation cyber forum to foster the exchange of information, ideas and practices, increase knowledge and subject matter awareness, and facilitate the sharing of best practices.

Following from that report and to address the issues above, IATA has proposed the creation of a new task force: the Aviation Cyber Security Task Force (ACSTF), which will report to the IATA Security Group (SEG). The objective of the ACSTF is to assemble industry expertise in this emerging aviation risk area, gather information, scope the threat, and identify best practices for airlines related to the increasing probability of a cyber breach of aircraft systems. It is intended that nominations will include not only security managers, but also airline Information Technology experts, engineers and experts from the original equipment manufacturers (OEMs). It is envisaged that this task force will run for two years, will meet physically twice a year, and will hold bi-monthly teleconferences.

It remains that safety and security are IATA's top priorities. Airlines and OEMs demand the highest safety and security standards and protections for aircraft systems. Connectivity of aircraft systems, through traditional information technologies, aviation-specific protocols and radio-frequency communications, has extended the attack surface to the aircraft itself, both on the ground and in flight. Furthermore, the digital footprint of aircraft has increased and continues to do so. Therefore, the question of digital communication between systems, data validity and information/data security (the protection against intentional interference) has become increasingly relevant. With the increased probability of cybersecurity incidents, safety is a paramount concern.

By taking action on cyber security issues, the new task force can protect member airlines' investment in connectivity and e-enablement, thus reinforcing IATA's mandate of supporting operational efficiency and safety.

SECURITY

ICAO Global Aviation Security Plan

The United Nations Security Council Resolution 2309 (2016) on Aviation Security reaffirmed the obligations for States to ensure the security of their citizens and the people of all nations against terrorist attacks on air services operating within their territories and conducted against international civil aviation, wherever these may occur.

All States have been urged to ensure an effective, risk-based and sustainable implementation of ICAO Annex 17 standards at all airports in their jurisdiction and to urgently address any gaps or vulnerabilities that may be identified. In this regard, it is envisaged that the ICAO Global Aviation Security Plan

(GASeP) will provide the necessary mandate for States to continue to enhance aviation security leading up to the 40th ICAO Assembly in 2019.

IATA is a member of the GASeP Task Force, convened under the ICAO AVSEC Panel. The ICAO GASeP was formally endorsed by the ICAO Council in November 2017 and has five clearly identified priority areas for ICAO, States and Industry to collaborate on the enhancement of aviation security. Going forward, relevant IATA working groups, strategic partners and sponsors will be engaged to contribute to the delivery of the ICAO GASeP.

Conflict Zones

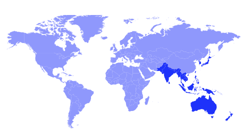
July 2018 marked four years since the tragic events of MH17 over Ukraine. In the time since, militarized hostilities have continued and arguably increased in areas where civil aviation aircraft are known to operate. Awareness of the risks are well-known to industry and member airlines are actively engaged in undertaking risk assessments prior to the dispatch of aircraft based on IOSA standards.

During the ICAO AVSEC Panel 28 in May 2017, a new information-sharing standard for the purposes of enhancing operator risk assessments was supported and included in the proposed Amendment 16 to Annex 17. This new standard was originally proposed by IATA following the recommendations contained in the MH17 Dutch Safety Board report. Moreover, in 2018, ICAO published a Risk Assessment Manual for Civil Aircraft Operations over or near Conflict Zones.

The IATA-hosted Security Forum extranet site is currently being enhanced with a view of promoting qualified links between airlines and vendors for the provision of security information sharing.

REGIONAL INSIGHT

Asia-Pacific Region



The Safety and Flight Operations Asia-Pacific (SFO ASPAC) Safety Strategy mitigates historical risks and aims to discover and prevent future risks.

SFO ASPAC has developed and implemented a risk-based, data-driven safety strategy with reactive, proactive and predictive capabilities that focus on the top regional fatal accident risks: Approach and Landing Accidents (ALAR), Loss of Control - In-flight (LOC-I), and Controlled Flight into Terrain (CFIT). SFO ASPAC has also focused on the emerging Mid-Air Collision (MAC) risk using TCAS-RA information from Flight Data eXchange (FDX) and other sources like ICAO Large Height Deviations.

In SFO ASPAC, GADM is used as a foundational tool for safety analysis, decision-making, and performance monitoring for work with ICAO, individual States, airline members and other system stakeholders. It enables data-driven risk identification and performance monitoring. SFO ASPAC also liaises and collaborates with key partners like the Association of Asia Pacific Airlines (AAPA) and the US Commercial Aviation Safety Team (CAST) on select safety initiatives.

Reactive: with ICAO at Asia-Pacific Regional Aviation Safety Team (APRAST)

- The IATA Annual Safety Report is one of the sources of information used to produce the Asia Pacific Annual Safety Report, which is in turn used to focus regional initiatives on the top risks.
- For focused risk analysis at APRAST, STEADES and FDX are used to correlate safety trends in flight data with pilot reports.
- IATA SFO ASPAC serves as Industry Co-Chair of APRAST, with China as the States' Co-Chair.

Proactive: Asia-Pacific Information-Sharing Demonstration Project

The Asia-Pacific Information-Sharing Demonstration Project (an APRAST initiative with a governance board co-chaired by Singapore and IATA) performed MAC risk analyses on routes approaching and departing airports at participating States during 2018 and developed recommended mitigations. Participating States are Singapore, Japan, China, Indonesia and the Philippines. Japan Airlines, ANA, the Lion Group, Singapore Airlines and Scoot are some of the participating airlines.

Proactive: Promoting IOSA

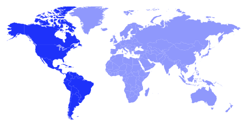
SFO ASPAC organized a joint ICAO/IATA IOSA workshop at the ICAO Regional Office. Attendance included 90 airline participants as well as seven States. After the workshop, the Civil Aviation Authority of Thailand (CAAT) signed a working agreement with IATA to use IOSA as a complement to the CAAT's safety oversight of foreign carriers.

Predictive: Global Safety Predictive Analytics Research Center (SPARC) in Singapore

In 2015, IATA and the Civil Aviation Authority of Singapore (CAAS) jointly initiated a feasibility study for the application of predictive analytics on aircraft data. The technical feasibility of the project was validated during 2016 and 2017. During 2018, three runway-related machine learning algorithms were developed. The first is a safety analysis that enables the model to learn from egregious approaches (i.e., the key feature(s) that would influence the risk of a runway excursion for landing aircraft). The second and third are efficiency-related and measure runway occupancy times for both flight arrivals and departures. In each case, the analysis from applying the algorithms has identified primary causal features of an event and associated confidence levels in the model's prediction of their ongoing effect. While the predictive results varied depending on the prediction point, this predictive confidence well exceeded 90% in some cases. It is expected that, as the algorithms are trained using larger volumes of data, their predictive power will generally improve.

In collaboration with the AAPA and the US CAST, SFO ASPAC shares safety information to focus and align safety initiatives on top regional risks. AAPA and IATA shared common top regional issues with CAST and continued to work on the development of safety enhancement initiatives to mitigate them. A Joint APRAST/CAST/ASIAS LOC-I workshop was conducted at the ICAO Regional Office in Bangkok during the APRAST/12 meeting.

Pan-America Region



Latin America and Caribbean (LATAM/CAR):

Worked with the Regional Aviation Safety Group – Pan-America (RASG–PA) to reduce fatality risk by 50% by 2020 using 2010 statistics as a baseline. Continued with enhanced focus on the top four areas of risk listed below, which have shown a decreasing trend in the region (current five-year rolling average is 0.14 using 2017 data).

- Controlled Flight into Terrain (CFIT)
- Mid-Air Collision (MAC)
- Loss of Control - In-flight (LOC-I)
- Runway Excursion (RE)

This work is supported by the Regional Coordinating Group (RCG) of IATA through review of reactive, proactive and predictive data to drive safety improvements in the region as part of its objectives; inclusive of the need to form Collaborative Safety Teams (CST) in the region with States to achieve continuous improvements of the safety levels within each country. In addition to the objectives of the RCG to ensure regional harmonization of Annex 19, SMS education was provided to airlines in the region.

North Atlantic and North America (NAT/NAM):

The near-term objectives of the Global Aviation Safety Plan (GASP) for the NAT/NAM region have been met. States in the region are working towards their mid-term and long-term objectives, especially in the areas of proactively managing risk through identification and control of existing or emerging safety issues. In addition to the work being done in the NAT/NAM to continuously improve safety in the region, the RCG further supports IATA's objectives of identification of emerging risks with the US CAST group.

Promoting ISSA:

In advocating for the safe transport of passengers, the Americas region partnered with Asociación Latinoamericana y del Caribe de Transporte Aéreo (ALTA) to power the implementation of ISSA with operators whose business model does not conform with IOSA. Further to this partnership, support from the IATA Airline Training Fund (IATF) led to over five airlines accepting sponsorship on ISSA training to assist airlines prepare for certification and improve their standards.

Regional Reactive Analysis:

Accidents in the Pan-America Region showed a decreasing trend across the five-year period analyzed (2014-2018), which was lower than the world average. The analyzed reactive data highlighted LOC-I, RE and CFIT as top categories of interest in the Pan-America Region, inclusive of precursors identified for MAC.

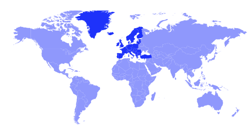
Regional Proactive Analysis:

Use of FDX analysis to drive implementation of CSTs and improvements of safety levels across various airspaces in the region continues to emphasize the need for data-driven decision-making. Working with ICAO, the level of Effective Implementation (EI) of the ICAO Standards and Recommended Practices fell below 60%, decreasing from 10 States to eight in the Pan-America Region, according to the ICAO Universal Safety Oversight Audit Program (USOAP) Continuous Monitoring Approach (CMA).

Regional Predictive Analysis:

Information on Large Height Deviations (LHDs) captured in the regions during 2017 showed that the technical risk estimates satisfy the goal of not exceeding the target level of safety in Reduced Vertical Separation Minimum (RVSM) airspace.

Europe Region



The Europe Region (EUR) is characterized by the existence of two subregions with markedly different safety records and infrastructures; on one hand, the European Union and, on the other hand, the remaining States of the region.

The European Union (EU) subregion is one of the safest in the world, but the growth in air traffic over the coming decades means that action is needed to develop and implement solutions that will make sure the EU improves upon its remarkable safety record. This requires addressing challenges such as the lack of standardization and harmonized regulations, fragmentation of competences between different entities as sources of duplication and unnecessary cost. The introduction of the Data 4 Safety program (the EU ASIAS equivalent) is viewed as one of the main future drivers of risk-based safety management at the European level. IATA is participating in various advisory and collaborative analysis groups at the European Aviation Safety Agency (EASA) to ensure IATA's safety strategy is aligned and consistent with European developments.

Performance-based Regulation/Oversight

One of IATA's priorities in EUR is advocating for the EU Regulatory Environment to adopt a performance/risk-based approach in harmonization with global aviation standards, and so does not represent an undue burden for air operators. To achieve this, IATA is maintaining close cooperation with EASA, attending relevant focused consultations and providing comments to pertinent EASA NPAs. IATA promotes the development of new and revised regulations in the EU as a result of collaborative work with industry instead of being driven by public opinion and media pressure.

As part of cooperation with regulatory and safety oversight authorities, IATA proposes to make use of existing recognized industry programs within SSPs. Now, more and more States in Europe are considering the possibility of using industry audit programs as a complement to their oversight activities (e.g., Finland, Estonia, Poland, Spain). At the end of 2018, IATA and EASA signed a revised memorandum of understanding (MoU) of cooperation on sharing of safety information.

Another initiative that IATA is proposing to assist European States in implementation of their SSPs is IATA's SIEP, which uses deidentified and aggregated safety data as one of the sources of State Safety Information to be used in collaborative risk assessment and mitigation. There is a growing interest in the program and IATA is in discussion with several European States.

In order to raise awareness of its programs, IATA delivered the following workshops in the European Region in 2018:

- 10 April 2018, Istanbul – GADM: The workshop was hosted by Pegasus Airlines and attended by more than 65 participants from eight countries across Europe, Commonwealth of Independent States (CIS) and the Middle East, including a large representation of the Turkish civil aviation industry and Directorate General of Civil Aviation.
- 29-31 May 2018 – IOSA: This was the first in a series of workshops within the IOSA campaign to be conducted in all IATA regions to celebrate 15 years of the IOSA program. Hosting about 60 participants, the workshop was an excellent opportunity to communicate achievements, look back at the history of IOSA and, most importantly, plan for future developments that benefit our registered airlines in the realms of safety and efficiency. During the workshop, EASA presented their view on the use of IOSA.
- 7 September 2018 – IOSA and other IATA audit programs: The goal of the workshop was to brief the relevant stakeholders on the existing IATA audit pools as well as provide more information on the ISAGO New Model and how airlines could benefit from it.

Cooperation with ICAO EUR

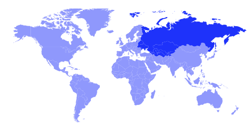
IATA is cooperating closely with ICAO EUR by participating and contributing to several ICAO working groups at various levels, including ICAO Regional Aviation Safety Group (RASG-EUR), RASG Coordination Group (RCOG), ICAO European Regional Expert Team (IE-REST), and ICAO Language Proficiency Requirements Implementation Task Force (LPRI TF).

Regional targets for fatality risk reduction are being developed within RASG-EUR activities. Taking into consideration the GASP objectives as well as reactive safety information from previous years (accident and incident data) and proactive safety information (safety oversight audit and SMS/SSP assessments) from the EUR/NAT regions, the safety priorities for RASG-EUR are:

- Runway safety
- Loss of control - In-flight
- Controlled flight into terrain
- Safety oversight capabilities
- Air navigation deficiencies
- Safety management

A regional overview of the safety enhancement initiatives in the RASG-EUR Region, including contributions from IATA, is published in the RASG-EUR Annual Safety Report, available on the ICAO website.

Commonwealth of Independent States (CIS)



In the CIS, the focus is on ensuring implementation of global standards and improving the oversight capability of the relevant States. To achieve this, IATA cooperated with local stakeholders to ensure enhancement of safety awareness in the region.

One of the major projects that IATA is contributing to in CIS is the ICAO-IAC RER/01/901 Project. Named *"Development of operational safety and continuing airworthiness for contracting states of the international Agreement"*, it has been active for the past 18 years. Within this project, and in cooperation with ICAO, Interstate Aviation Committee (IAC) and Airbus, IATA delivered or contributed to the following workshops in Moscow in 2018:

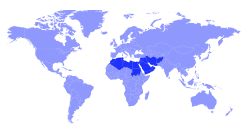
- 26-27 April 2018 – Competence-based Training/Evidence-based Training (CBT/EBT): The workshop was attended by more than 140 aviation professionals from CIS and EUR: Republic of Armenia, Republic of Belarus, Republic of Kazakhstan, Republic of Moldova, Kyrgyz Republic, the Russian Federation, Republic of Tajikistan, the Ukraine, Republic of Uzbekistan, Great Britain, Spain, the Netherlands, France, Canada and Turkey. The speakers shared their experiences on CBT/EBT implementation at different airlines, peculiarities of the training methods' application, perspectives and difficulties of the transition to the new personnel training system as well as other CBT/EBT aspects.
- 20-21 June 2018 – Safety Performance Indicators: About 40 safety experts from the national aviation authorities and airlines of the Republic of Azerbaijan, Republic of Belarus, Canada, Georgia, Kyrgyz Republic and the Russian Federation actively participated in the workshop. IATA presented their best practices and presented the possibilities of using IATA GADM tools for safety performance monitoring, including on the State level, with the IATA SIEP.
- 4-6 September 2018 – IOSA: More than 150 quality/compliance professionals from 17 States, representing national aviation authorities, airlines and airports attended the workshop. Stakeholders appreciated the value of IOSA and other IATA audit programs as significant tools for safety enhancement in the region.

Contribution to ICAO's "No Country Left Behind" Initiative

Kyrghyzstan is the only country in the CIS Region with a significant safety concern (SSC) from ICAO, due to the latest result from ICAO's Universal Safety Oversight Audit Program (USOAP) audit. It is included as a State in the EU Safety List, meaning all of its airlines are banned from flying to Europe. IATA works in close coordination with ICAO to enhance safety in the State, and provide assistance to its airlines to be removed from the EU Safety List.

IATA is focusing on encouraging and helping the local stakeholders to use existing IATA programs and tools, including IOSA, IGOM and ISAGO to enhance safety in the State. One major airline joined the IOSA Registry in 2018, another one has scheduled to be audited in 2019, and one more airline is considering ISSA. Several safety and compliance-related trainings covered by the IATF have been delivered in Kyrgyzstan and attended by representatives from Kyrgyz airlines and the National Aviation Authority.

Middle East and North Africa Region (MENA)



The Regional Aviation Safety Group - Middle East (RASG-MID) was established in September 2011 to develop an integrated, data-driven strategy and implement a work program that supports a regional performance framework for the management of safety.

The RASG-MID consists of three main teams: the Annual Safety Report Team (ASRT), the Regional Aviation Safety Team (RAST), and the Safety Support Team (SST). The ASRT is responsible for collecting and analyzing safety information. The ASRT is also responsible for the identification of the safety focus areas and the production of the RASG-MID Annual Safety Report (ASR).

The MID Region showed stable growth in traffic volumes. Total scheduled commercial departures in 2017 accounted for approximately 1.37 million departures compared to 1.08 million departures in 2013, representing a compound annual growth rate of nearly 5%.

Following the analysis of the reactive and proactive safety information provided by IATA and ICAO for the period 2013-2017, it was concluded that the main focus areas for the MID Region are:

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

The following are identified as emerging risks in the MID region:

- Security risks with impact on safety (SEC)
- Fire/Smoke - non-impact (F-NI)
- Runway incursion (RI)
- Bird strike (BIRD)
- Wake vortex

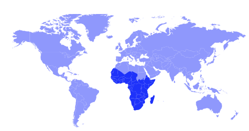
Implementation of a SSP is one of the main challenges faced by States in the MID Region. The RASG-MID addresses the improvement of SSP implementation in the MID Region as one of the top Safety Enhancement Initiatives (SEIs). Currently, States in the MID Region have not reached full implementation of the SSP framework.

Common challenges/difficulties related to SSP implementation include identification of a designated entity, establishment of an initial Acceptable Level of Safety Performance (ALoSP), allocation of resources to enable SSP implementation and lack of qualified and competent technical personnel.

It should be highlighted that reporting of incidents is still low in the MID Region.

MENA was successful in promoting the IOSA and ISAGO audit programs among airlines and State authorities. Four States (Egypt, Jordan, Lebanon and Kuwait) signed a safety MoU with Annex 1 (ISAGO) or Annex 2 (IOSA), recognizing the programs as an acceptable means to complement their oversight obligations.

Africa and Indian Ocean Region (AFI)



The Regional Aviation Safety Group — Africa and Indian Ocean (RASG-AFI) was first established in March 2012 in Kampala, Uganda.

IATA currently holds the vice-chairmanship of the group and is the industry representative. RASG-AFI consists of several safety support teams that focus on high-risk areas, namely:

- Significant Safety Concerns (SSCs)
- Fundamentals of Safety Oversight (FSO)
- Accident Investigation Group (AIG)
- Emerging Safety Concerns (ESI)
- Annual Safety Report Team (ASRT)

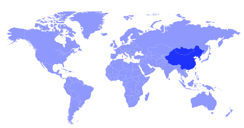
The ASRT is currently chaired by the Assistant Director, Safety & Flight Operations, AME. The ASRT is responsible for collecting and analyzing safety information as well as identifying safety focus areas for the AFI aviation community. 2019 will see production of the 5th Edition of the RASG-AFI Annual Safety Report (ASR).

IATA has been very actively involved as part of the Runway Safety Go Missions, which have seen the establishment of over 20 Runway Safety Teams (RSTs) in AFI.

RASG-AFI has been charged with monitoring the progress of States in implementing/meeting the Abuja Safety Targets, which were set by the Ministerial Meeting of July 2012 with the ultimate goal of driving down the AFI overall accident rate towards the global average.

For the first time, in 2018, IATA launched a Third Country Operator (TCO) awareness project in AFI for the sole purpose of educating primarily member airlines and, in turn, their respective CAA to better understand the application process. The program, which was fully supported by the EASA, mainly targeted those States that were impacted by the EU Safety List. The aim was to leave these operators and/or States in a position where they fully understand the TCO process and associated requirements to the extent they can minimize the chances of being on the List. And, if they are already listed, equip them on how to work towards removal.

North Asia Region (NASIA)



The Safety and Flight Operations North Asia (SFO NASIA) aims to discover and reduce the risk of flight operations and to promote the overall safety level in the region.

IATA China ATFM Liaison Desk

IATA China ATFM Liaison Desk together with the Civil Aviation Administration of China (CAAC) and the Air Traffic Management Bureau (ATMB) supports the flights of member airlines operated in China and assists with related operational issues. The desk started to provide a 24-hour and two-way communication service in August and more than 200 cases have been solved by the end of 2018.

Promoting IOSA and ISAGO

SFO NASIA organized the IOSA 15th Anniversary Workshop in September in Beijing. Attendance included around 60 regulators and operators from six regions and countries. The ISAGO audit program was promoted among regional airlines and State authorities and IATA signed the ISAGO agreement with Xiamen Airlines.

In November, IATA signed the safety MoU with the CAAC and the Civil Aviation Administration of Mongolia (CAAM), which further enhanced the common understanding and cooperation between IATA and the Civil Aviation Authorities.

Beijing Daxing International Airport (PKX)

Beijing Daxing International Airport will be officially operating in September of 2019. To have a safe and efficient operation at the new airport, a one-week training session regarding the design of multiple airport operations and intersection runways was provided to the North China Regional ATMB by the headquarters and SFO NASIA.

Cabin Safety Workshop

SFO NASIA together with the Civil Aviation University of China (CAUC) held the IATA-CAUC Cabin Safety Seminar in Tianjin, China and invited regulators, airlines, safety professionals and cabin crew from the region to discuss current and ongoing issues in the Cabin Operations and Safety environment.

1

IATA Annual Safety Report

Safety is aviation's highest priority. More than 70 years ago, the global airline industry came together 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 55th year of publication. This 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. This document provides the industry with critical information, derived from the analysis of aviation accidents, to understand safety risks in the industry and propose mitigations.

The 2018 Safety Report was produced at the beginning of 2019 and presents trends and statistics based on knowledge of the industry at that time. This report is made available to the industry for free distribution.

The Safety Report is a valuable tool as aviation works tirelessly to improve its already superb safety record.

Image courtesy of Embraer

SAFETY REPORT METHODS AND ASSUMPTIONS

The Safety Report is produced each year and 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. Firstly, that 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. Secondly, that the sectors used to create the accident rates are the most up-to-date available at the time of production. The sector information is updated on a regular basis and takes into account actual and estimated data. As new updates are provided the sector count becomes more accurate for previous years, which in turn allows for increased precision in the calculation of accident rates.

ACCIDENT CLASSIFICATION TECHNICAL GROUP

The IATA Operations Committee (OPC) and its Safety Group (SG) created the Accident Classification Technical Group (ACTG) 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 ACTG are incorporated in the annual IATA Safety Report.

It should be noted that many accident investigations are not complete at the time the ACTG meets to classify the year's events and additional facts may be uncovered during an investigation that could affect the currently assigned classifications.

The ACTG is composed of safety experts from IATA, member airlines, original equipment manufacturers, 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, including FlightGlobal and the accident investigation boards of the States where the accidents occurred. Once assembled, the members of the ACTG validate each accident report using their expertise to develop an accurate assessment of the events.

2018 ACTG members:

Mr. Steve Hough (Chairman)
SAS

Capt. Ruben Morales (Vice-Chairman)
HONG KONG AIRLINES

Dr. Dieter Reisinger (Former Chairman)
AUSTRIAN AIRLINES

Mr. Marcel Comeau
AIR CANADA

Mr. Xavier Barriola
AIRBUS

Capt. Jeff Perin
AIR LINE PILOTS ASSOCIATION (ALPA)

Mrs. Tatyana Morozova
AIR ASTANA

Mr. Nicolas Bornand
AIR FRANCE

Mrs. Alice Calmels
ATR

Capt. Jorge Robles
AVIANCA

Mr. Ivan Carvalho
AZUL BRAZILIAN AIRLINES

Capt. Robert Aaron Jr.
THE BOEING COMPANY

Mr. Richard Mayfield
THE BOEING COMPANY

Mr. Eric Justin East
THE BOEING COMPANY

Mr. David Fisher
BOMBARDIER AEROSPACE

Mr. Luis Savio dos Santos
EMBRAER

Mr. Yasuo Ishihara
HONEYWELL

Mr. Andrea Mulone (Database/Analysis)
IATA

Mr. Robert Holliday (Secretary)
IATA

Mrs. Huanmei Yang
ICAO

Capt. Arnaud Du Bédat
IFALPA

Capt. Takahisa Otsuka
JAPAN AIRLINES

Mr. Martin Plumleigh
JEPPESEN

Capt. Peter Krupa
LUFTHANSA

Capt. Andreas Poehlitz
LUFTHANSA

Capt. Ayedh Almotairy
SAUDI ARABIAN AIRLINES

Capt. NIlesh Patil
SINGAPORE AIRLINES

Capt. HockKeat Ho
SINGAPORE AIRLINES

Capt. Antonio Jose dos Santos Gomes
TAP AIR PORTUGAL

Capt. Peter Kaumanns
VEREINIGUNG COCKPIT

Mr. Greg Brock
WORLD METEOROLOGICAL ORGANISATION

2

Decade in Review

AIRCRAFT ACCIDENTS AND FATALITIES

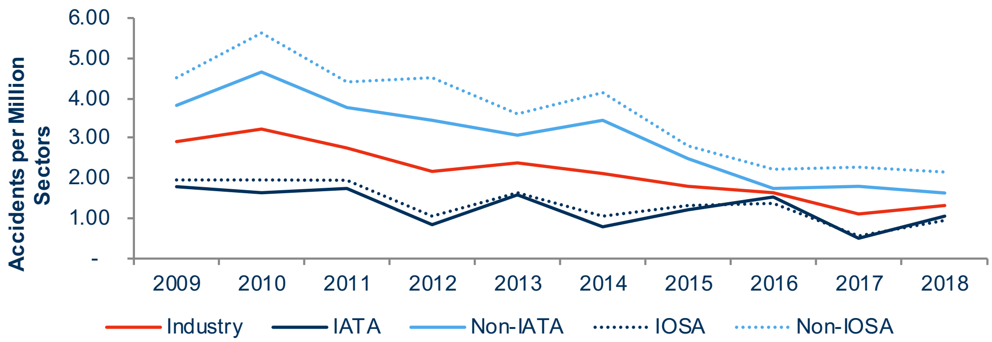
This section presents yearly accident rates for the past 10 years for each of the following accident metrics: all accidents, fatality risk, fatal accidents and hull losses, as well as general statistics on the number of fatalities and accident costs.

Image courtesy of Boeing

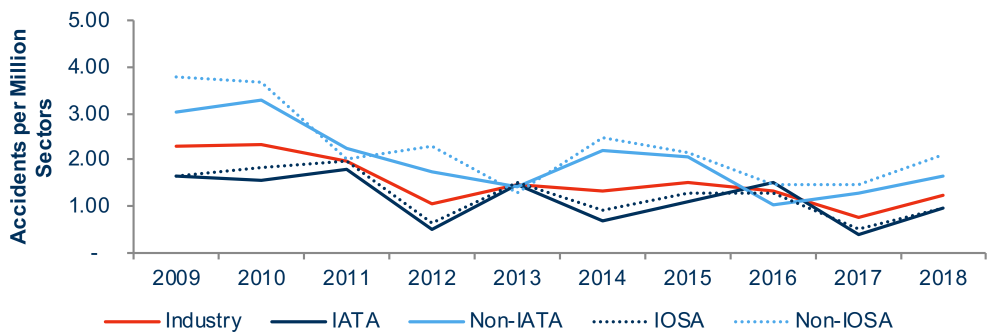
ALL ACCIDENTS

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

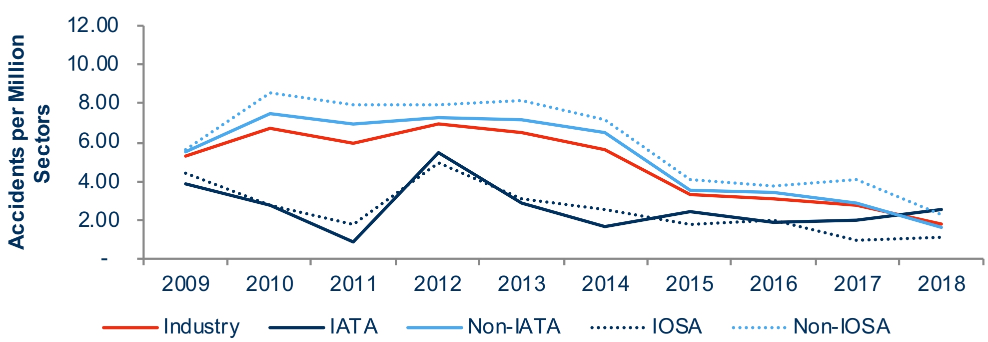
Jet & Turboprop Aircraft



Jet Aircraft



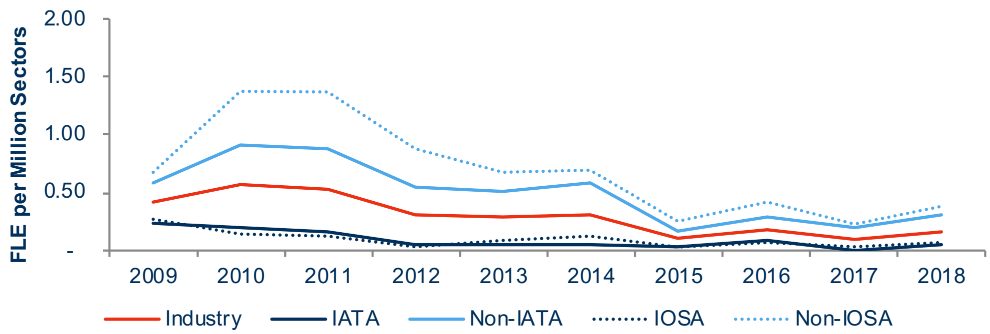
Turboprop Aircraft



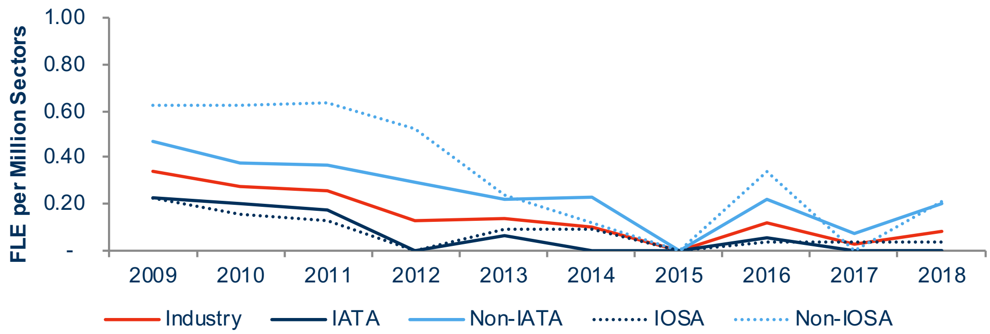
FATALITY RISK

Fatality Risk: Full-Loss Equivalents (FLE) per 1 Million Sectors. For definition of 'full-loss equivalent', please see Annex 1.

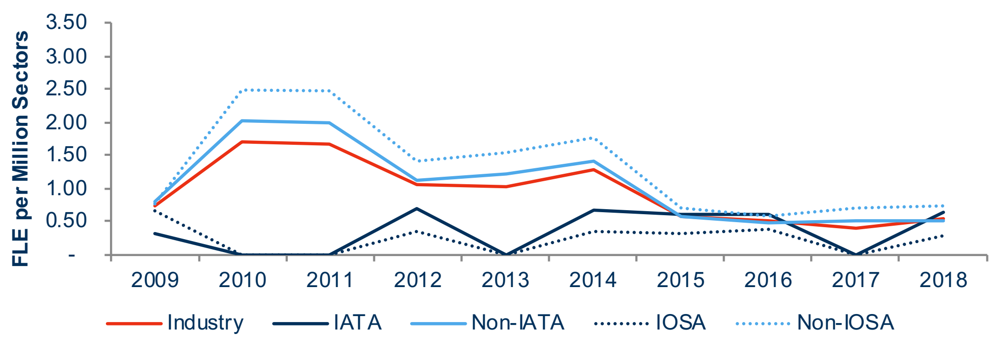
Jet & Turboprop Aircraft



Jet Aircraft



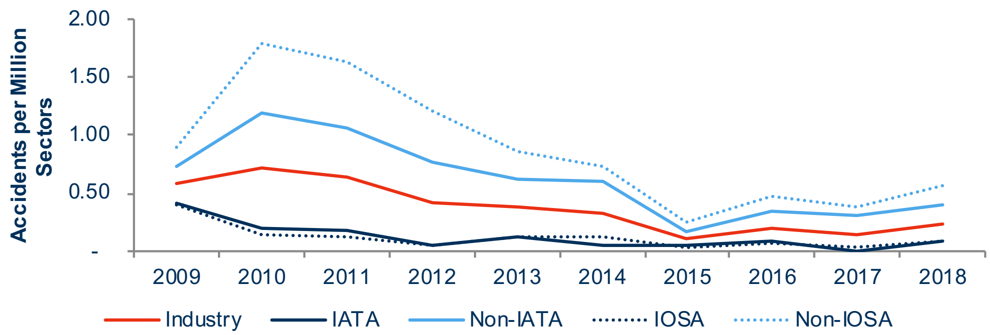
Turboprop Aircraft



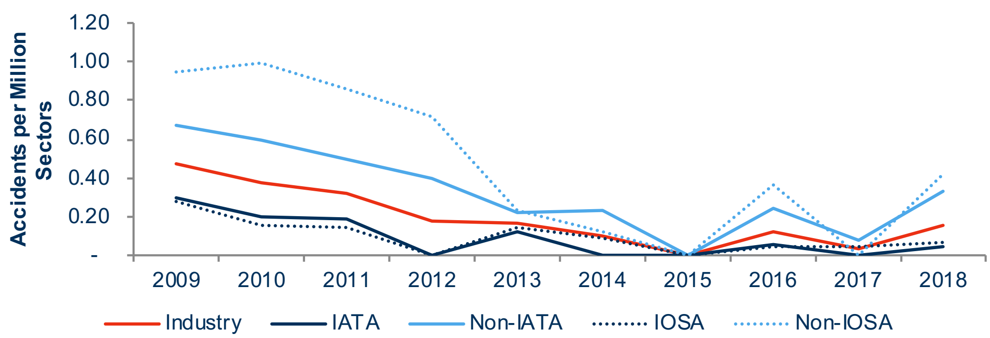
FATAL ACCIDENTS

'Fatal Accidents' refer to accidents with at least one person on board the aircraft perishing as a result of the crash.

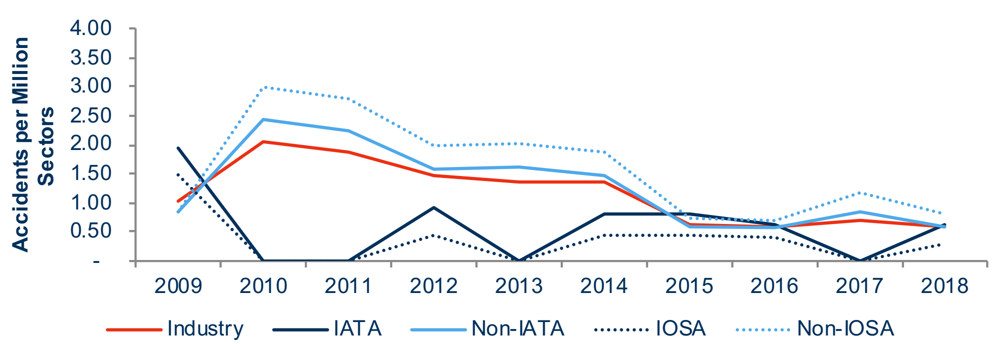
Jet & Turboprop Aircraft



Jet Aircraft



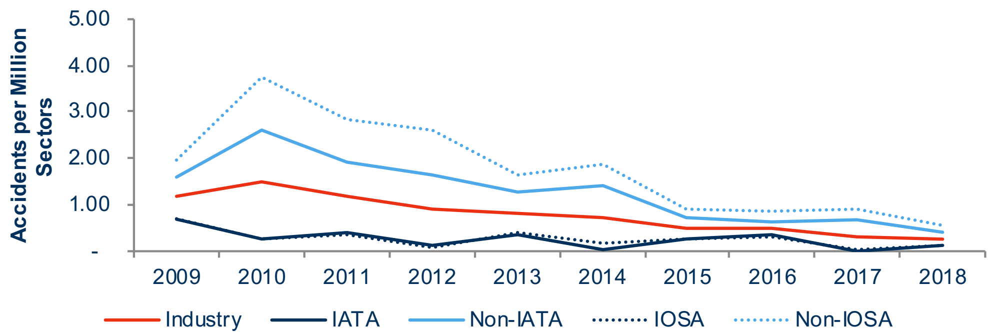
Turboprop Aircraft



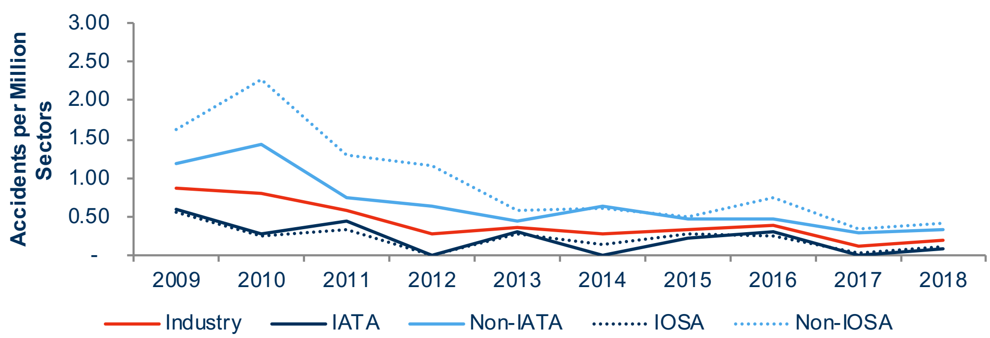
HULL LOSSES

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

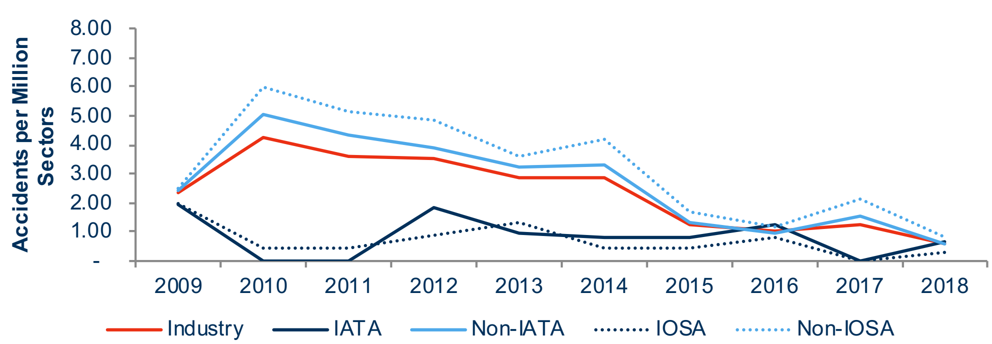
Jet & Turboprop Aircraft



Jet Aircraft



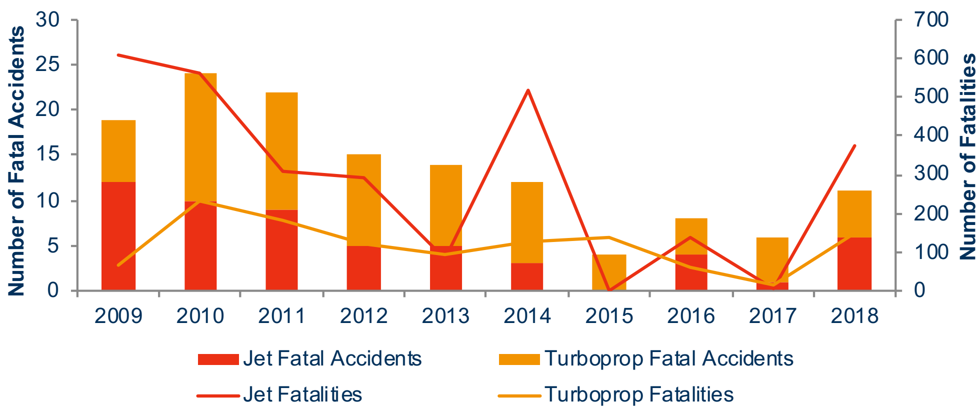
Turboprop Aircraft



FATALITIES

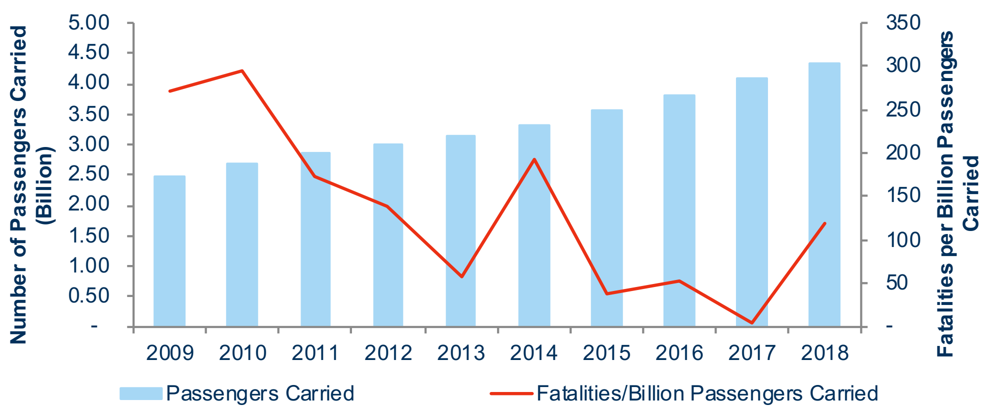
The graph below shows the total number of fatalities (line and vertical right axis) and the number of fatal accidents (stacked bar and vertical left axis) split between aircraft propulsion type. The reader needs to be aware that the data is not normalized by the aircraft flight count, therefore discretion should be used. Interpreting and applying this data should be used in reference to the accident rate graphs presented previously.

Number of Fatalities and Fatal Accidents



The graph below shows the constant increase in the number of passengers carried over the past 10 years as well as a ratio metric related to the number of fatalities by the number of passengers carried in a specific year.

Number of Passengers Carried and Fatality Ratio per Passengers Carried



Passengers Carried Data Source: IATA / Industry Economic Performance

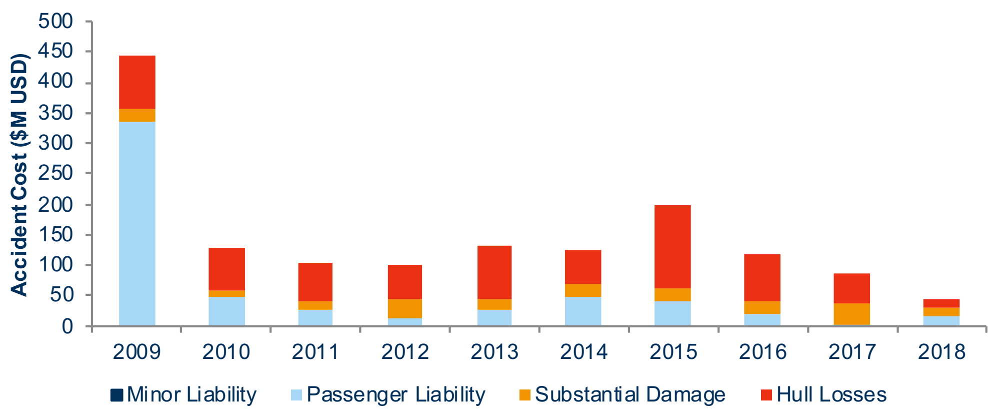
ACCIDENT COSTS

The graphs below show the estimated costs for all losses involving jet and turboprop aircraft over the last 10 years. The figures presented are from operational accidents and exclude security-related events and acts of violence.

Jet Aircraft

Source: Ascend FlightGlobal

Turboprop Aircraft



Source: Ascend FlightGlobal

3

2018 in Review

COMMERCIAL AIRLINES OVERVIEW

FLEET SIZE AND SECTORS FLOWN

	Jet	Turboprop	Total
World Fleet	27,294	5,413	32,707
Sector Landings (Millions)	37.7	8.4	46.1

Source: Ascend - a FlightGlobal Advisory Service
Note: World fleet includes in-service and stored aircraft operated by commercial airlines as at year end.

CARGO OPERATING FLEET

	Jet	Turboprop
Percentage of Operating Fleet in All-Cargo Use	7.5%	20.4%

Source: Ascend - a FlightGlobal Advisory Service
Note: Operating fleet includes in-service and stored aircraft operated by commercial airlines as at year end.

REGIONAL BREAKDOWN

	AFI	ASPAC	CIS	EUR	LATAM/CAR	MENA	NAM	NASIA
Jet - Sector Landings (Millions)	0.79	6.24	1.68	7.89	2.64	2.15	10.08	6.22
Turboprop - Sector Landings (Millions)	1.06	1.74	0.13	2.46	0.80	0.17	1.92	0.12

AIRCRAFT ACCIDENTS

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

NUMBER OF ACCIDENTS

	Jet	Turboprop	Total
Total	47	15	62
Hull Losses	7	5	12
Substantial Damage	40	10	50
Fatal	6	5	11
Full-Loss Equivalents	3.0	4.6	7.6
Fatalities*	375	148	523
Fatalities of people not on board the aircraft	*0*	*0*	*0*

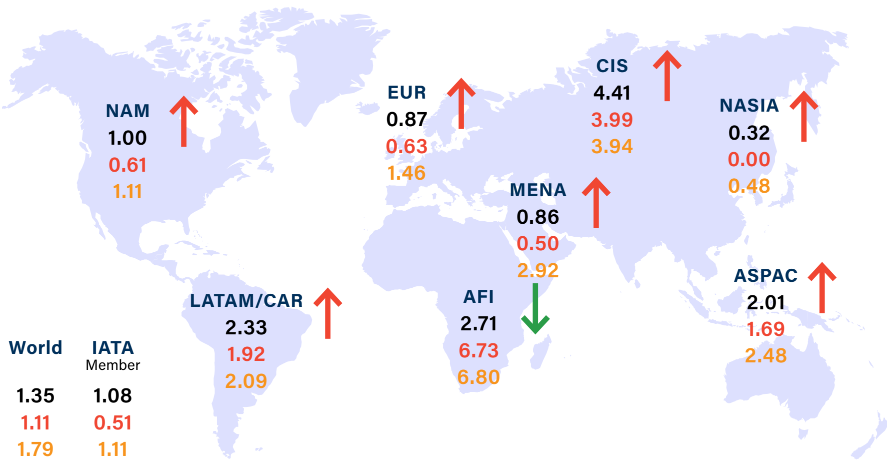
**People on board only*

ACCIDENTS PER OPERATOR REGION

	AFI	ASPAC	CIS	EUR	LATAM/CAR	MENA	NAM	NASIA
Total	5	16	8	9	8	2	12	2
Hull Losses	2	3	3	0	2	1	1	0
Substantial Damage	3	13	5	9	6	1	11	2
Fatal	2	3	2	0	2	1	1	0
Full-Loss Equivalents	2.0	1.7	1.9	0.0	1.0	1.0	0.0	0.0
Fatalities	11	241	91	0	113	66	1	0

ALL ACCIDENTS RATE

Jet & Turboprop Aircraft

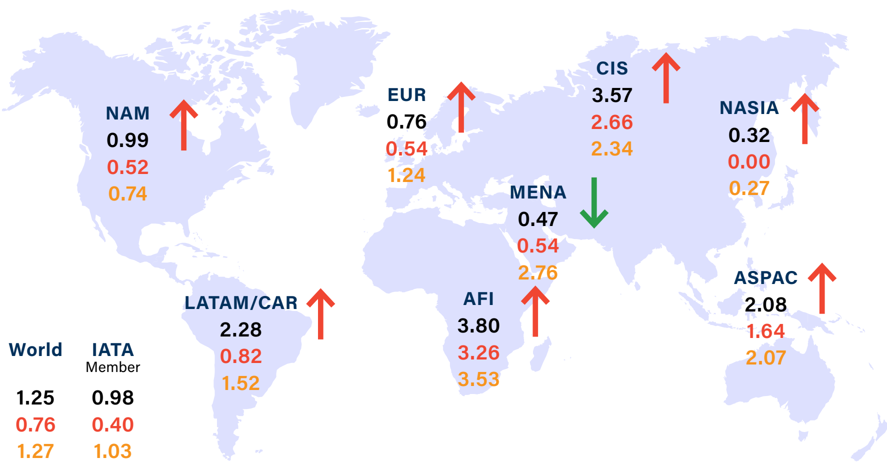


2018 vs 2017 accident rate

2018
2017
'13-'17

In 2018, in 7 of 8 IATA regions, the Accident Rate increased compared to 2017.

Jet Aircraft

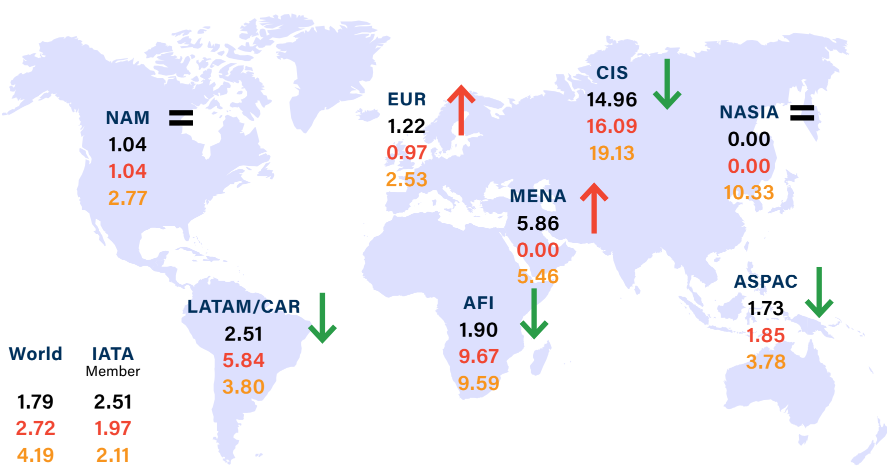


2018 vs 2017 accident rate

2018
2017
'13-'17

In 2018, in 7 of 8 IATA regions, the Jet Accident Rate increased compared to 2017.

Turboprop Aircraft



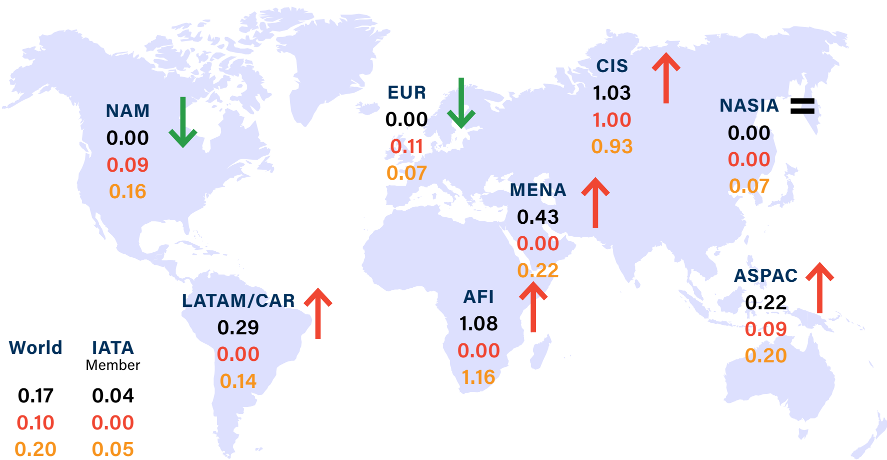
2018 vs 2017 accident rate

2018
2017
'13-'17

In 2018, Turboprop accident rate increased in EUR and MENA compared to 2017.

FATALITY RISK

Jet & Turboprop Aircraft

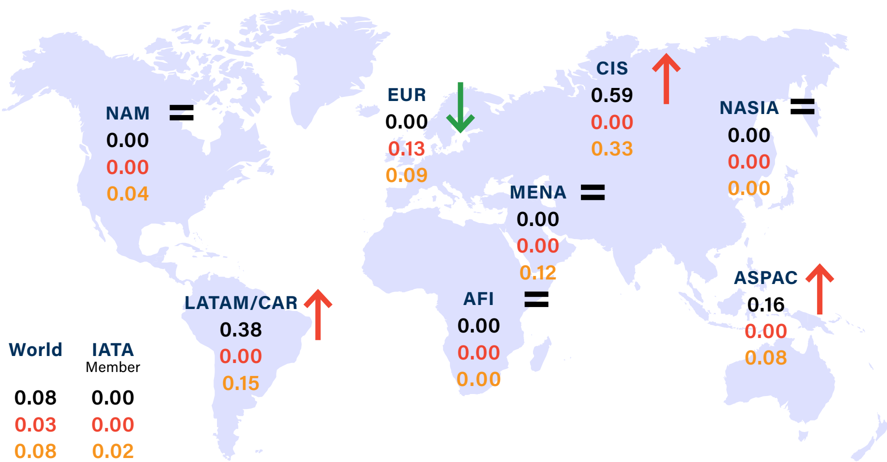


2018 vs 2017 accident rate

2018
2017
'13-'17

In 2018, in 5 of 8 IATA regions, Fatality Risk increased compared to 2017.

Jet Aircraft

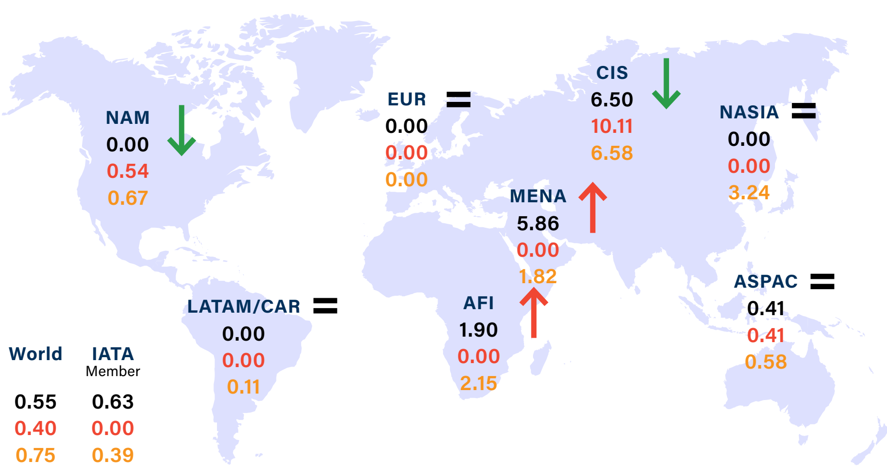


2018 vs 2017 accident rate

2018
2017
'13-'17

In 2018, Jet Fatality Risk increased in CIS, LATAM-CAR and ASPAC compared to 2017.

Turboprop Aircraft



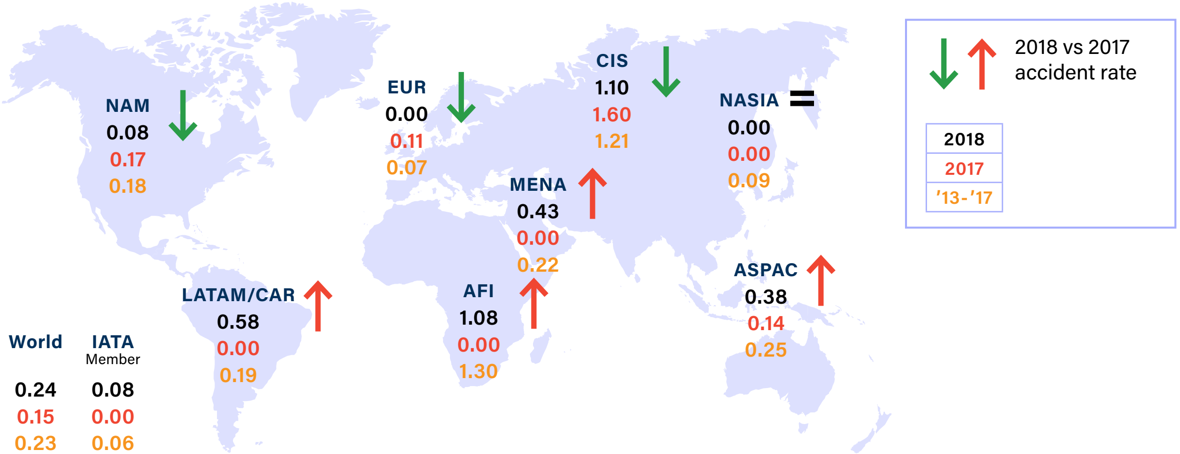
2018 vs 2017 accident rate

2018
2017
'13-'17

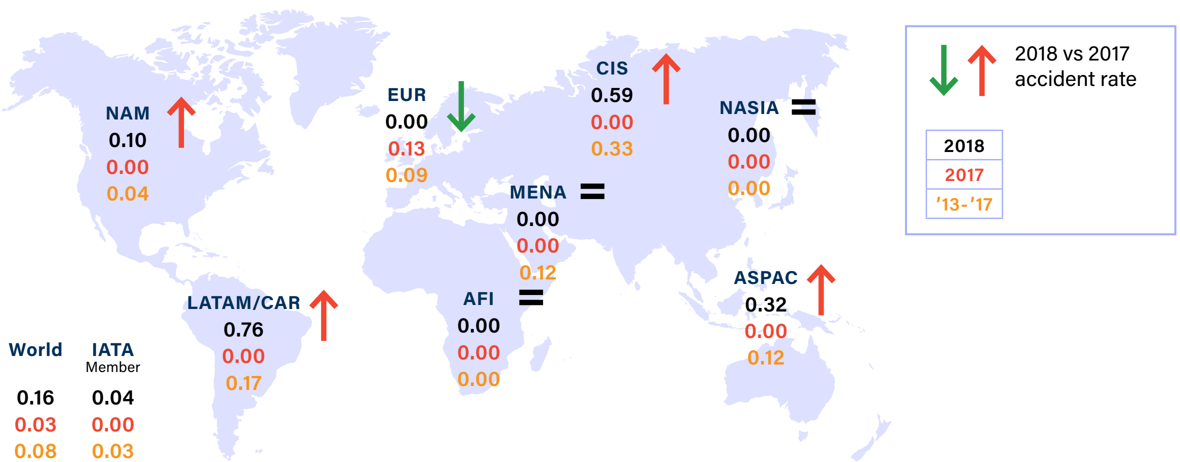
In 2018, Turboprop Fatality Risk increased in MENA and AFI compared to 2017.

FATAL ACCIDENTS RATE

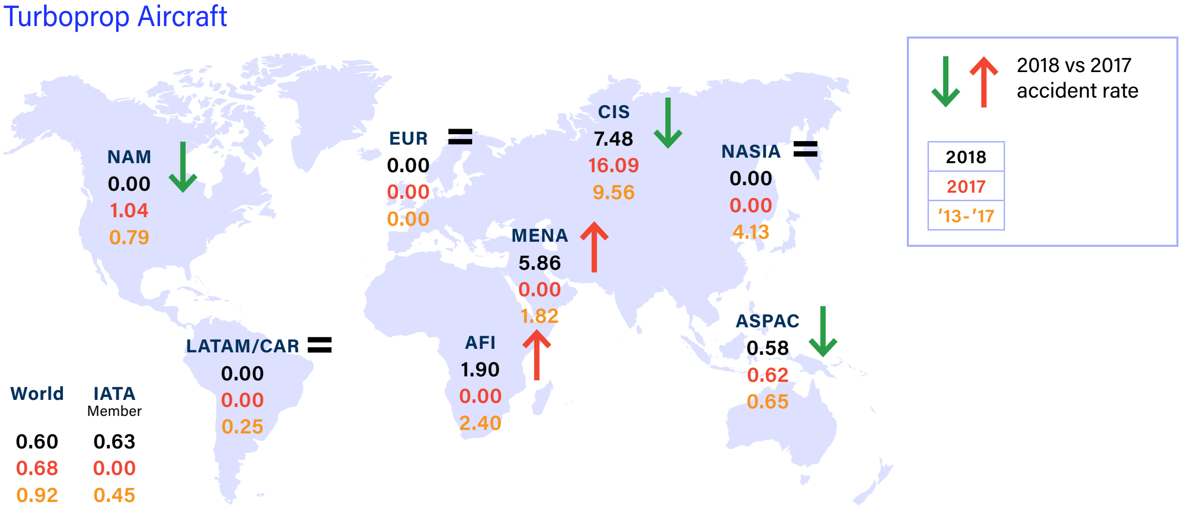
Jet & Turboprop Aircraft



Jet Aircraft

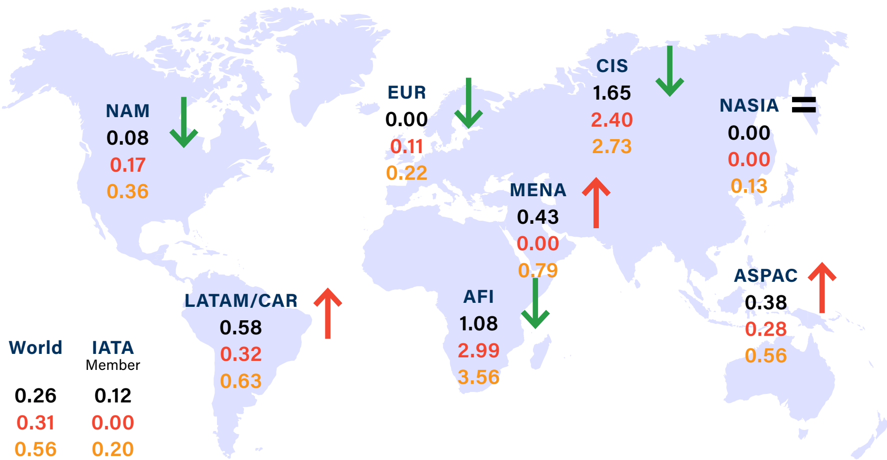


Turboprop Aircraft



HULL LOSS RATE

Jet & Turboprop Aircraft

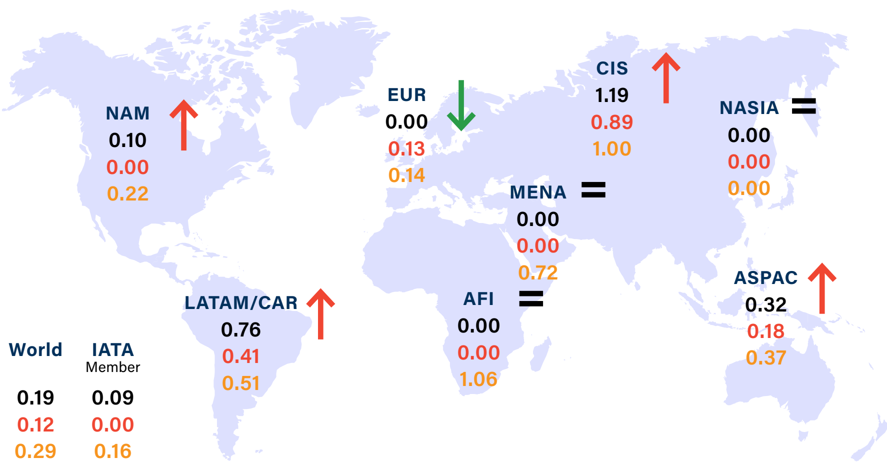


2018 vs 2017 accident rate

2018
2017
'13-'17

In 2018, the Hull Loss accident rate increased in MENA, LATAM-CAR and ASPAC compared to 2017.

Jet Aircraft

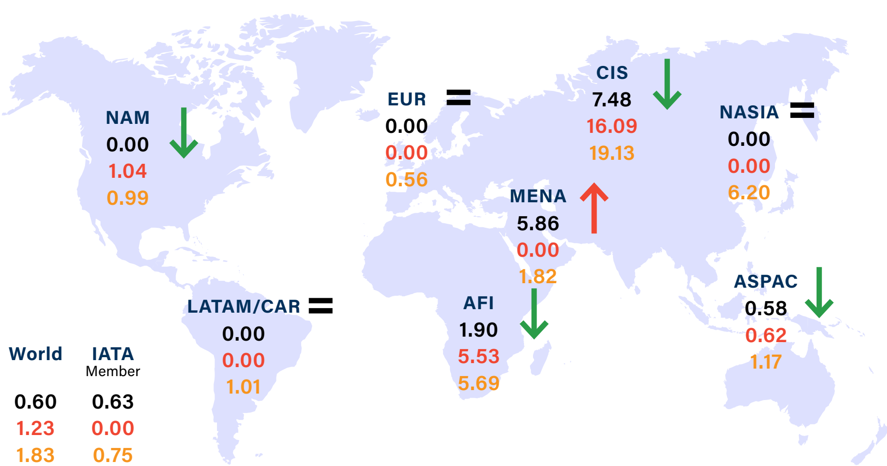


2018 vs 2017 accident rate

2018
2017
'13-'17

In 2018, Jet Hull Loss Rate increased in NAM, LATAM-CAR, CIS and ASPAC compared to 2017.

Turboprop Aircraft



2018 vs 2017 accident rate

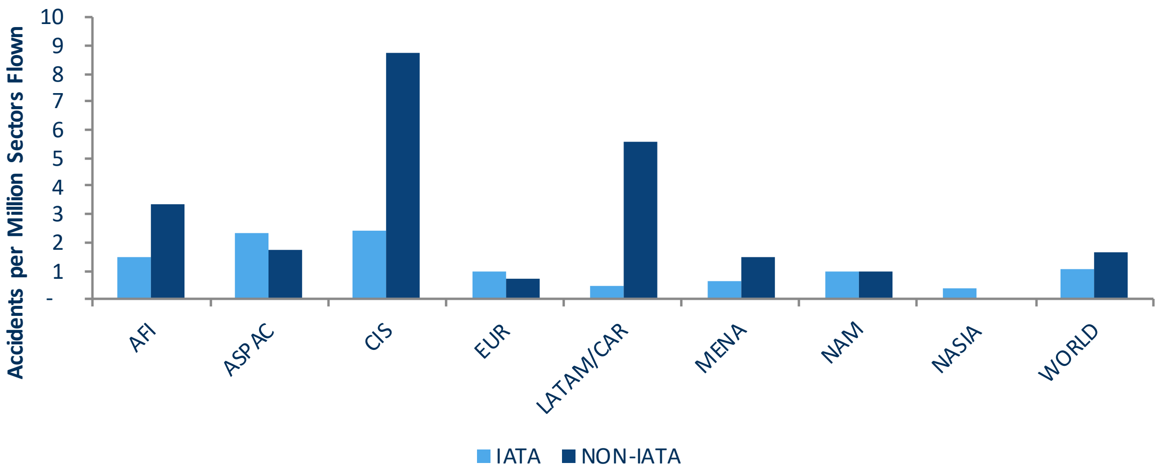
2018
2017
'13-'17

In 2018, Turboprop Hull Loss Rate increased in MENA compared to 2017.

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, CIS, LATAM/CAR and MENA regions.

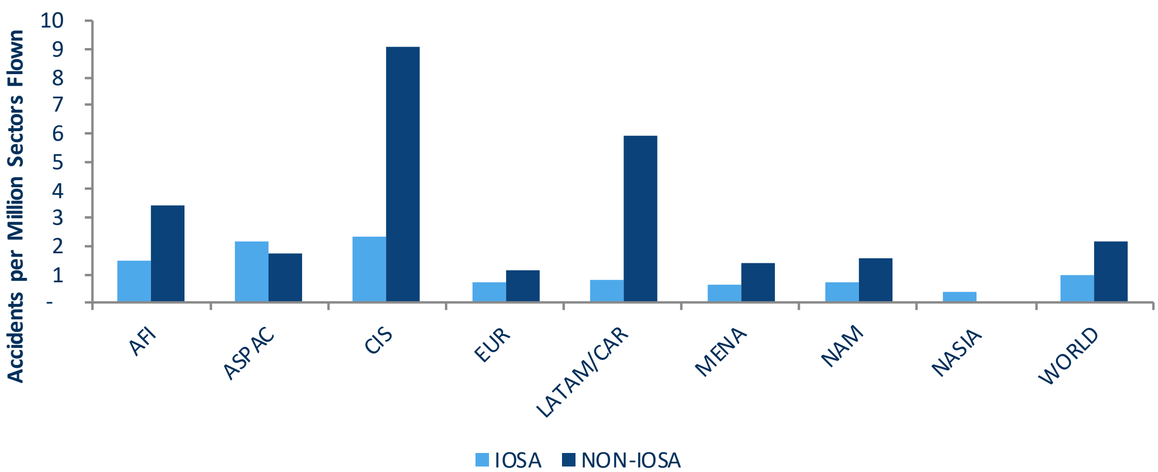
2018 Accident Rate: IATA Member Airlines vs. Nonmembers



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, CIS, EUR, LATAM/CAR, MENA and NAM regions. The non-IOSA-registered airline accident rate was more than two times higher than for IOSA-registered airlines in 2018.

2018 Accident Rate: IOSA-Registered vs. Non-Registered



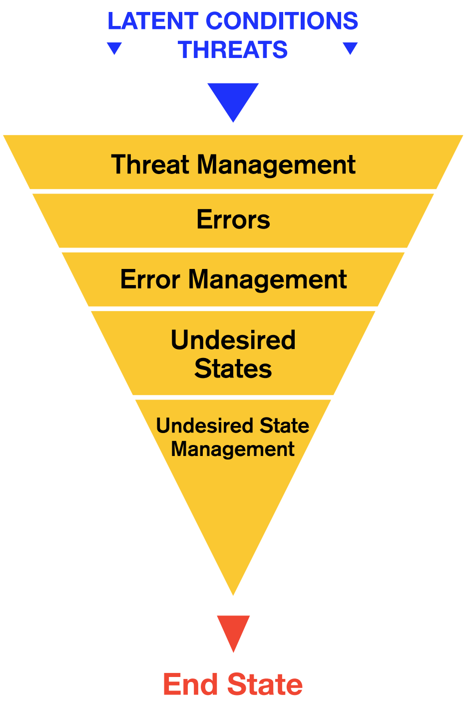
4

In-Depth Accident Analysis 2014 to 2018

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, the International Civil Aviation Organization (ICAO), member airlines and manufacturers 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. An end state is unrecoverable.

Distinction between 'Undesired Aircraft State' and 'End State': An 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).

ACCIDENT CLASSIFICATION SYSTEM

At the request of member airlines, manufacturers and other organizations involved in the 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 Sections 4 through 6, the percentages shown with regards to contributing factors (e.g., % of threats and errors noted) are based on the number of accidents in each category. Accidents classified as "insufficient information" are excluded from this part of the analysis. The number of "insufficient information" accidents is noted at the bottom of each analysis section of contributing factors in Addendums A, B and C. However, accidents classified as "insufficient information" are part of the overall statistics (e.g., % of accidents that were fatal or resulted in a hull loss).

Annex 1 contains definitions and detailed information regarding the types of accidents and aircraft that are included in the Safety Report analysis as well as the breakdown of IATA regions.

The complete IATA TEM-based accident classification system for flight is presented in Annex 2.

ORGANIZATIONAL AND FLIGHT CREW-AIMED COUNTERMEASURES

Every year, the ACTG classifies accidents and, with the benefit of hindsight, determines actions or measures that could have been taken to prevent an accident. These proposed countermeasures are in two categories, systemic countermeasures and last-line-of-defense countermeasures, that frontline personnel could action. Systemic countermeasures can be put in place by operators or state regulators. These countermeasures are based on activities, processes or systemic issues internal to the airline operation or state's oversight activities. Frontline personnel countermeasures are primarily directed towards flight crew, which may have been effective in managing the threat or errors identified in the accident analysis.

Countermeasures for other personnel, such as air traffic controllers, ground crew, cabin crew or maintenance staff are important, but they are not considered in this report at this time.

Each event was coded with potential countermeasures that, with the benefit of hindsight, could have altered the outcome of events. A statistical compilation of the countermeasures is presented in Section 8 of this report.

ANALYSIS BY ACCIDENT CATEGORY AND REGION

This section presents an in-depth analysis of 2014 to 2018 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 – Definitions. An in-depth regional analysis can be found in Section 5.

Referring to these accident categories helps an operator to:

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

2018 Aircraft Accidents – Accident Count

Number of accidents: 62
Number of fatalities: 523

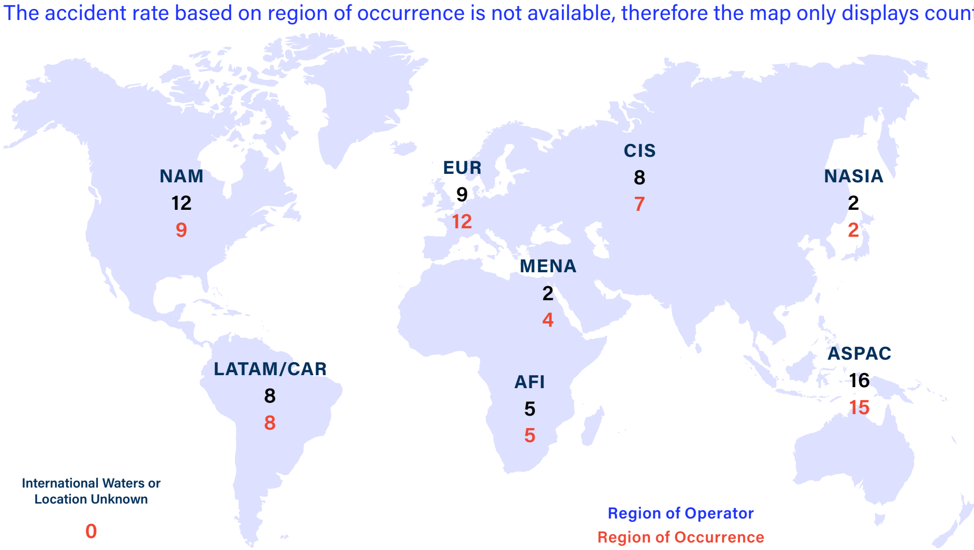
Accident Count % of Total	2018
IATA Member	42%
Full-Loss Equivalents	12%
Fatal	18%
Hull Losses	19%

Passenger	Cargo	Ferry	Jet	Turboprop
85%	15%	0%	76%	24%

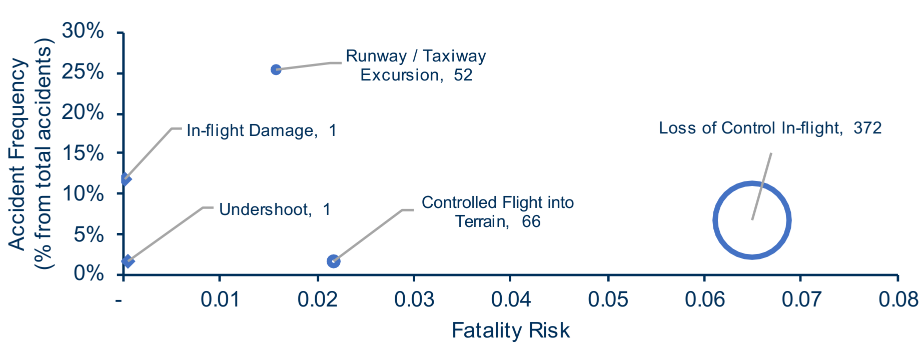
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2018)

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



Accident Category Frequency and Fatality Risk (2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
2%

Threats

Gear/Tire:
6%

Flight Crew Errors

Ground Navigation:
3%

Undesired Aircraft State

Unnecessary Weather Penetration:
3%

Countermeasure

In-flight decision making/ contingency management:
2%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

2018 Aircraft Accidents – Accident Rate*

Accident rate*: 1.35

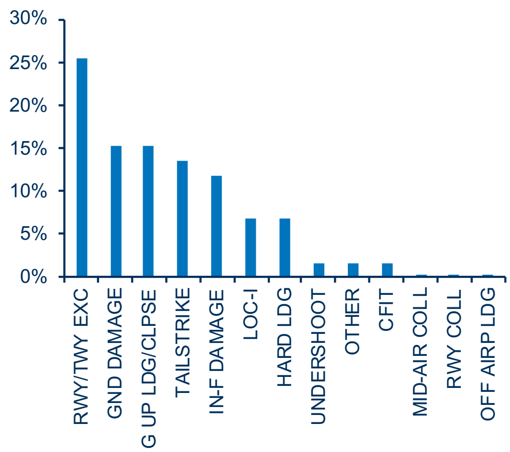
Accident Rate*	2018
IATA Member	1.08
Fatality Risk**	0.17
Fatal	0.24
Hull Losses	0.26

Jet	Turboprop	
1.25*	1.79*	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 (2018)

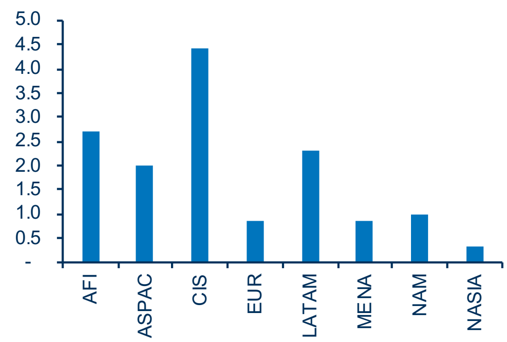
Distribution of accidents as percentage of total



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

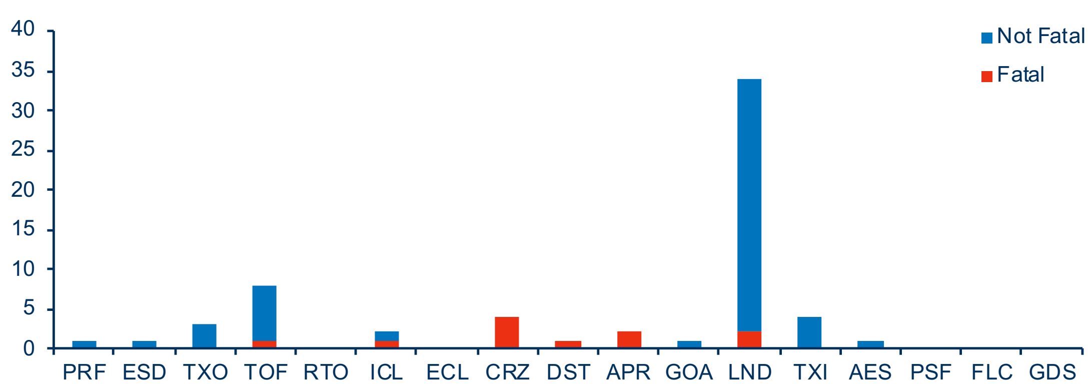
Regional Accident Rate (2018)

Accidents per Million Sectors



Accidents per Phase of Flight (2018)

Total Number of Accidents (Fatal vs. Nonfatal)



Refer to List of Phase of Flight definitions for full names

2014-2018 Aircraft Accidents – Accident Count

Number of accidents: 316
Number of fatalities: 1517

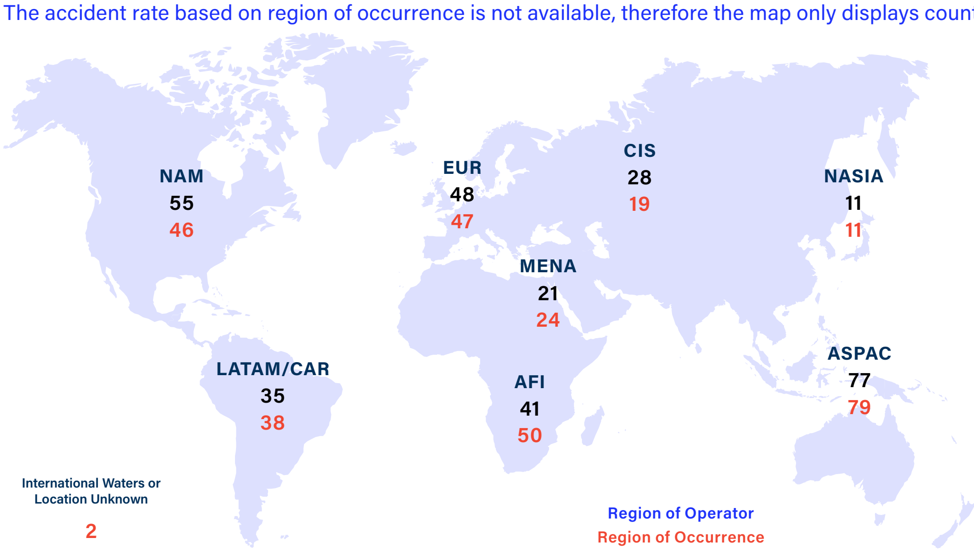
Accident Count % of Total	2014-2018
IATA Member	34%
Full-Loss Equivalents	11%
Fatal	13%
Hull Losses	28%

Passenger	Cargo	Ferry	Jet	Turboprop
78%	21%	2%	64%	36%

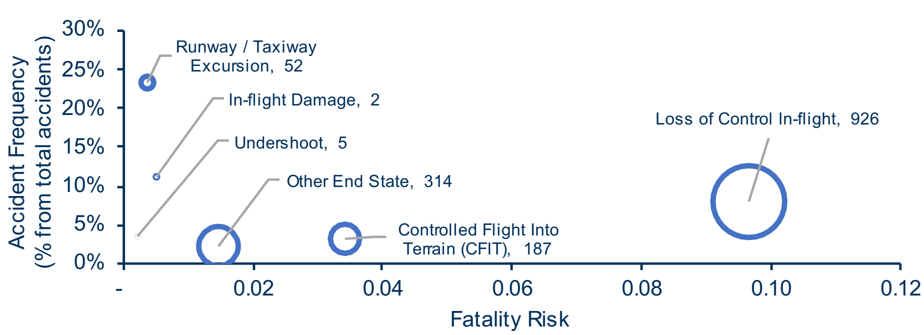
Note: the sum may not add to 100% due to rounding.
Statistics include a propeller accident that happened in 2016.

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
31%

Threats

Meteorology:
33%

Flight Crew Errors

Manual Handling/Flight Controls:
37%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
24%

Countermeasure

Overall Crew Performance:
26%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

2014-2018 Aircraft Accidents – Accident Rate*

Accident rate*: 1.58

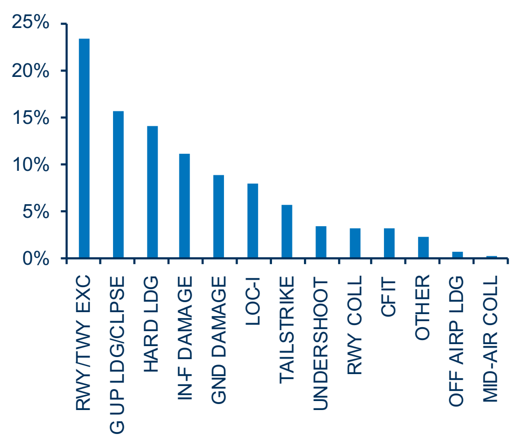
Accident Rate*	2014-2018
IATA Member	1.03
Fatality Risk**	0.17
Fatal	0.21
Hull Losses	0.45

Jet	Turboprop	
1.23	3.20	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 (2014-2018)

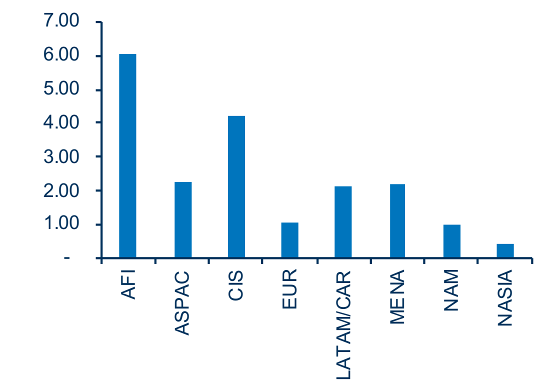
Distribution of accidents as percentage of total



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

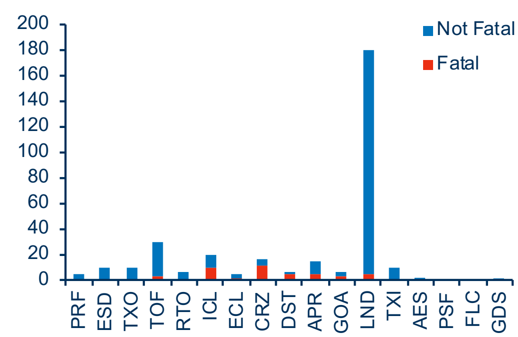
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



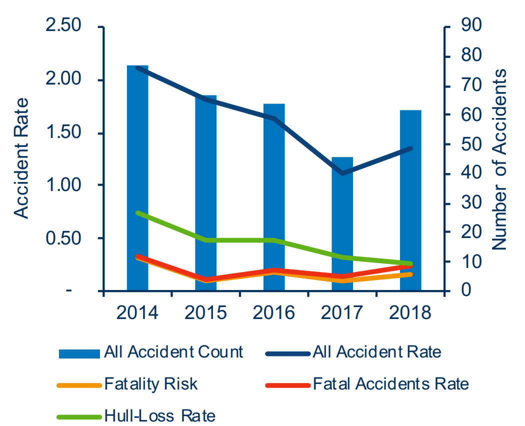
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



2014-2018 Fatal Aircraft Accidents – Accident Count

Number of accidents: 41

Number of fatalities: 1517

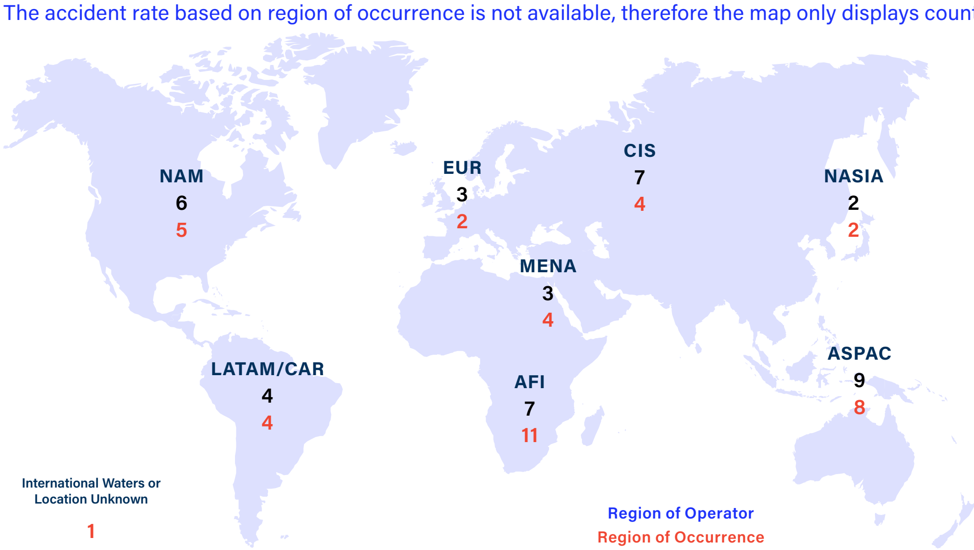
Accident Count % of Total	2014-2018
IATA Member	15%
Full-Loss Equivalents	83%
Fatal	100%
Hull Losses	95%

Passenger	Cargo	Ferry	Jet	Turboprop
51%	46%	2%	34%	66%

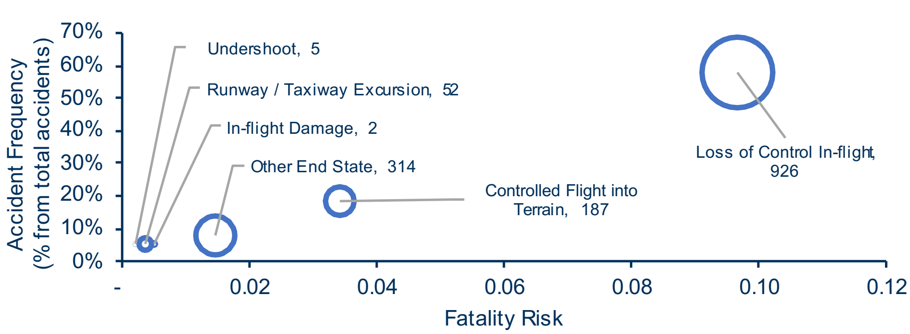
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Safety Management:
54%

Threats

Meteorology:
46%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
61%

Undesired Aircraft State

Operation Outside Aircraft Limitations:
32%

Countermeasure

Overall Crew Performance:
46%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

2014-2018 Fatal Aircraft Accidents – Accident Rate*

Accident rate*: 0.21

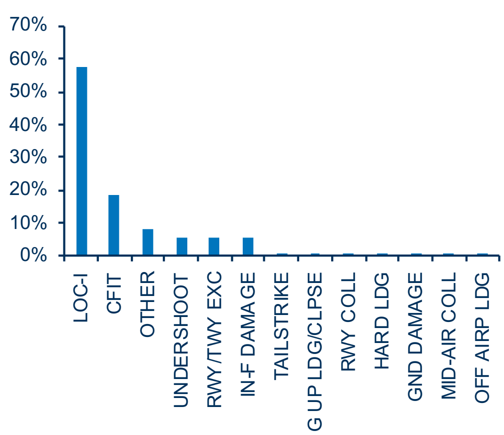
Accident Rate*	2014-2018
IATA Member	0.06
Fatality Risk**	0.17
Fatal	0.21
Hull Losses	0.20

Jet	Turboprop	
0.09	0.76	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 (2014-2018)

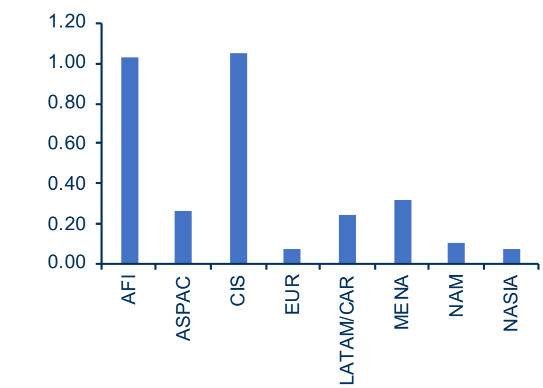
Distribution of accidents as percentage of total



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

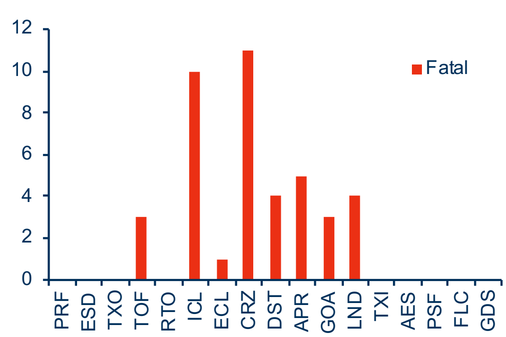
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



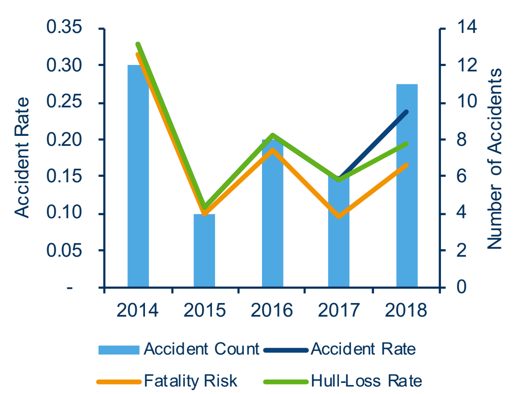
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



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

2014-2018 Nonfatal Aircraft Accidents – Accident Count

Number of accidents: 275
Number of fatalities: 0

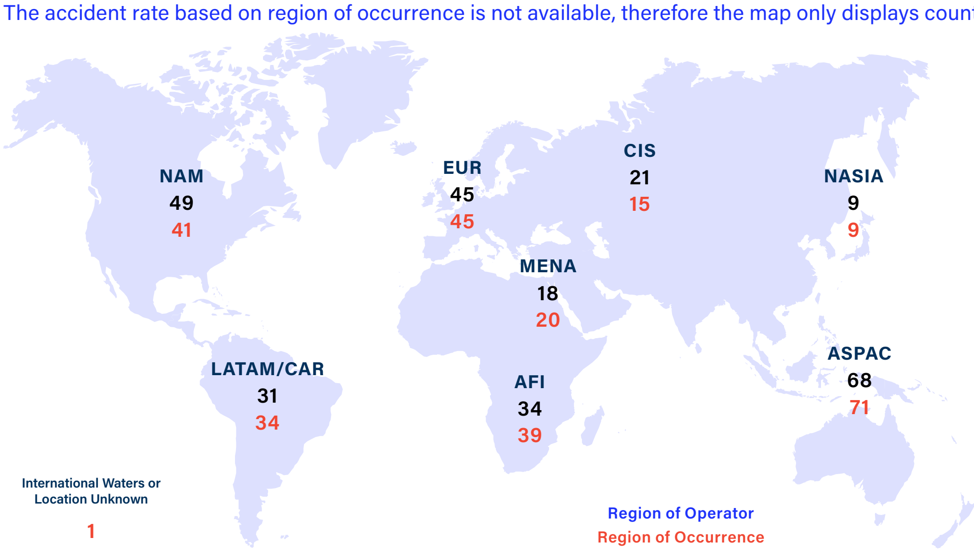
Accident Count % of Total	2014-2018
IATA Member	37%
Full-Loss Equivalents	0%
Fatal	0%
Hull Losses	18%

Passenger	Cargo	Ferry	Jet	Turboprop
81%	17%	2%	68%	32%

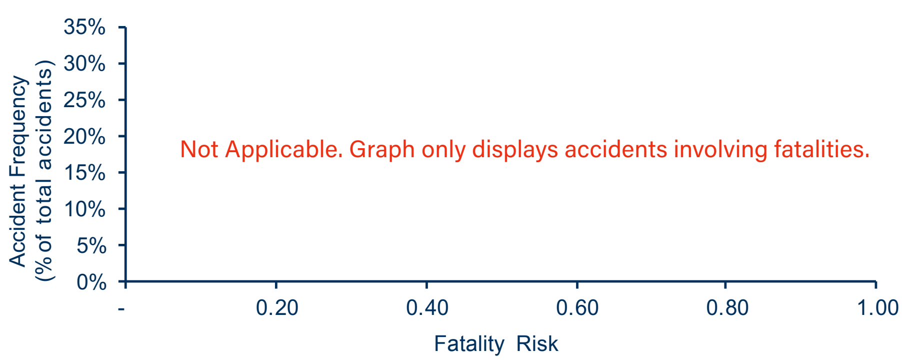
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
29%

Threats

Meteorology:
32%

Flight Crew Errors

Manual Handling/Flight Controls:
36%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
26%

Countermeasure

Overall Crew Performance:
23%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

2014-2018 Nonfatal Aircraft Accidents – Accident Rate*

Accident rate*: 1.38

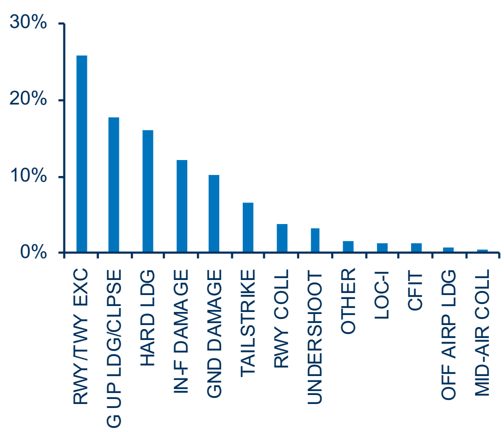
Accident Rate*	2014-2018
IATA Member	0.97
Fatality Risk**	-
Fatal	-
Hull Losses	0.25

Jet	Turboprop	
1.14	2.44	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 (2014-2018)

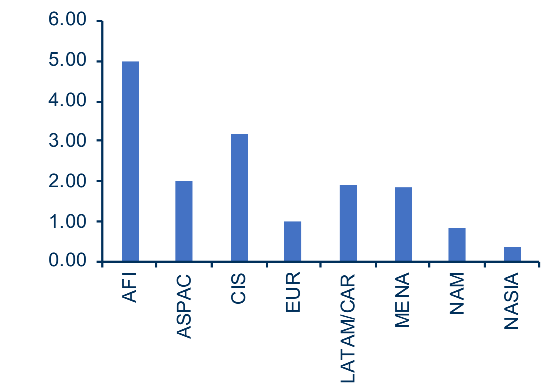
Distribution of accidents as percentage of total



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

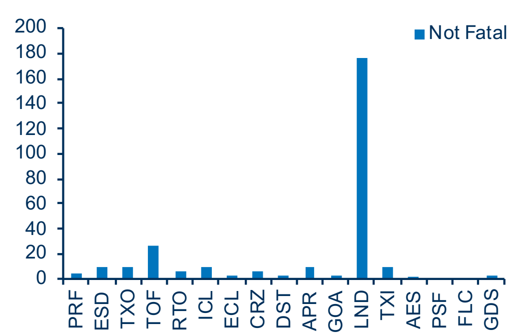
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



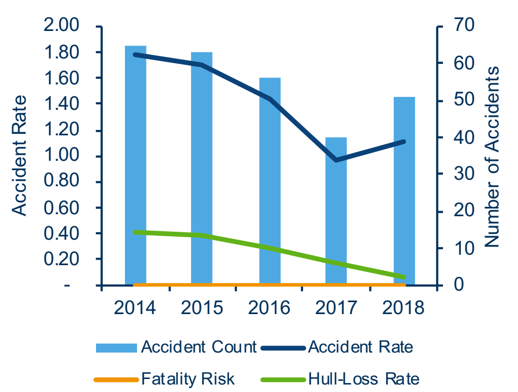
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



2014-2018 IOSA Aircraft Accidents – Accident Count

Number of accidents: 142
Number of fatalities: 815

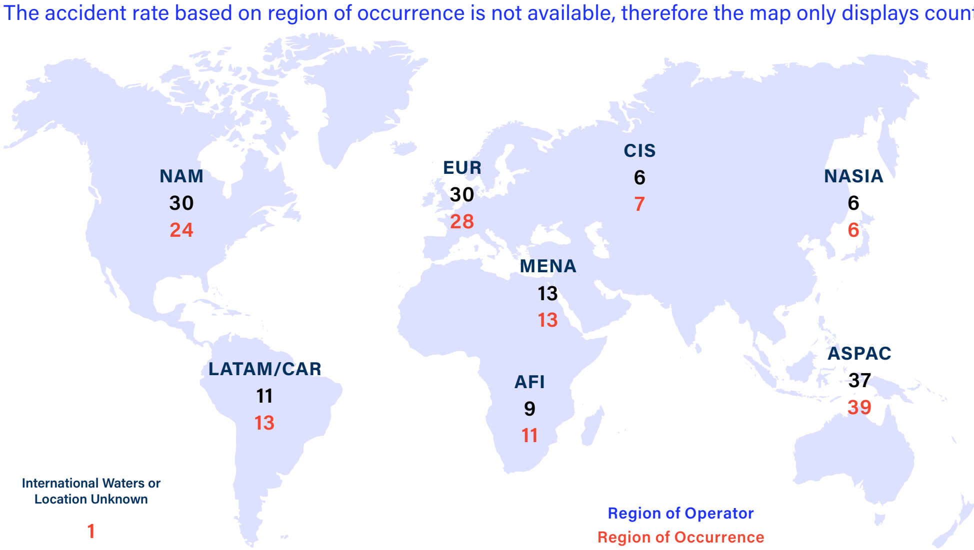
Accident Count % of Total	2014-2018
IATA Member	75%
Full-Loss Equivalents	6%
Fatal	7%
Hull Losses	17%

Passenger	Cargo	Ferry	Jet	Turboprop
95%	5%	0%	85%	15%

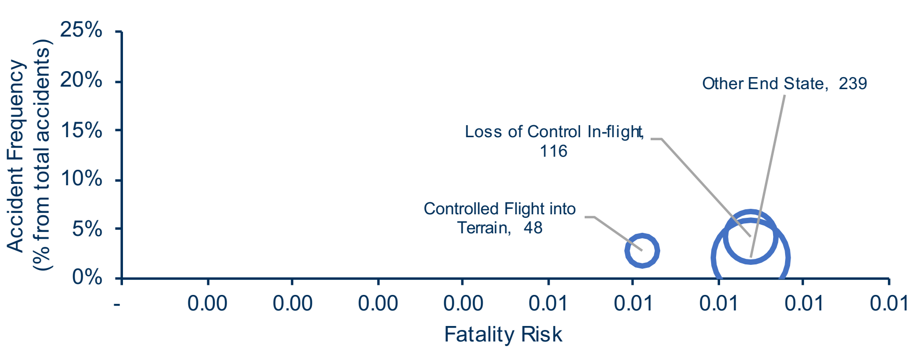
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
23%

Threats

Meteorology:
30%

Flight Crew Errors

Manual Handling/Flight Controls:
35%

Undesired Aircraft State

Vertical/Lateral/Speed Deviation:
23%

Countermeasure

Overall Crew Performance:
26%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

2014-2018 IOSA Aircraft Accidents – Accident Rate*

Accident rate*: 1.05

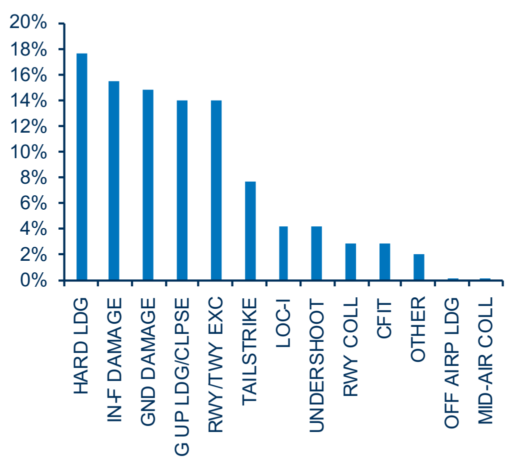
Accident Rate*	2014-2018
IATA Member	1.03
Fatality Risk**	0.06
Fatal	0.07
Hull Losses	0.18

Jet	Turboprop	
0.98	1.59	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 (2014-2018)

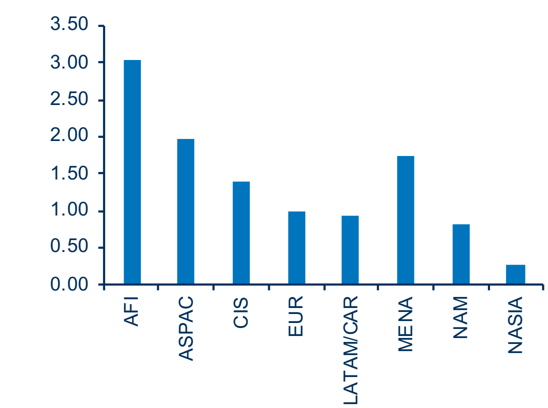
Distribution of accidents as percentage of total



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

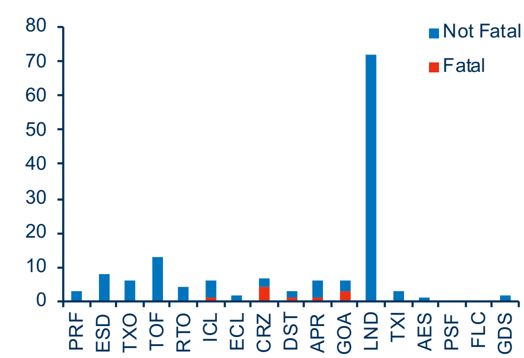
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



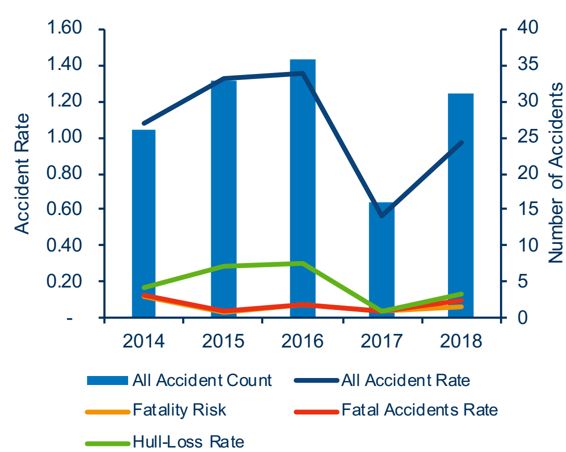
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



2014-2018 Non-IOSA Aircraft Accidents – Accident Count

Number of accidents: 174
Number of fatalities: 702

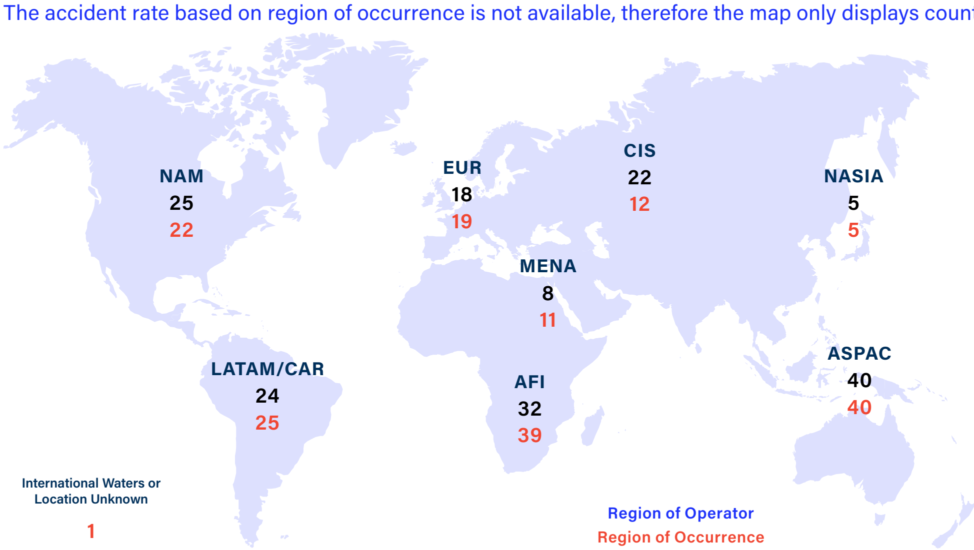
Accident Count % of Total	2014-2018
IATA Member	0%
Full-Loss Equivalents	15%
Fatal	18%
Hull Losses	37%

Passenger	Cargo	Ferry	Jet	Turboprop
63%	33%	3%	47%	53%

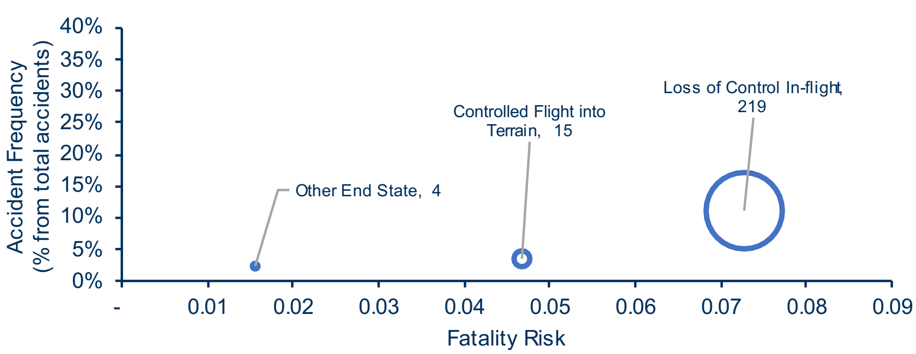
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
39%

Threats

Meteorology:
37%

Flight Crew Errors

Manual Handling/Flight Controls:
38%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
26%

Countermeasure

Overall Crew Performance:
26%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

2014-2018 Non-IOSA Aircraft Accidents – Accident Rate*

Accident rate*: 2.71

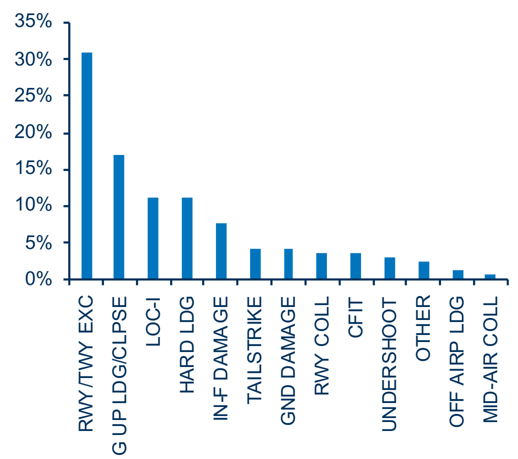
Accident Rate*	2014-2018
IATA Member	-
Fatality Risk**	0.40
Fatal	0.48
Hull Losses	1.01

Jet	Turboprop	
1.93	4.22	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 (2014-2018)

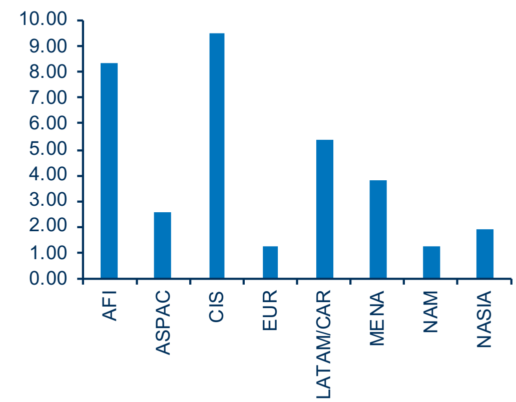
Distribution of accidents as percentage of total



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

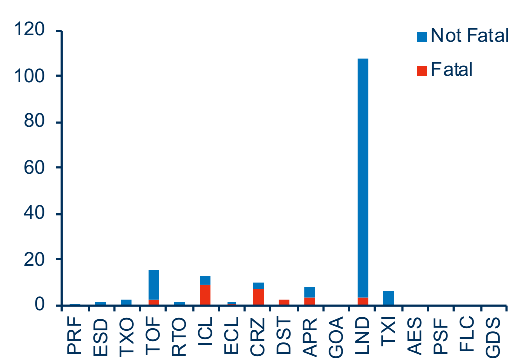
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



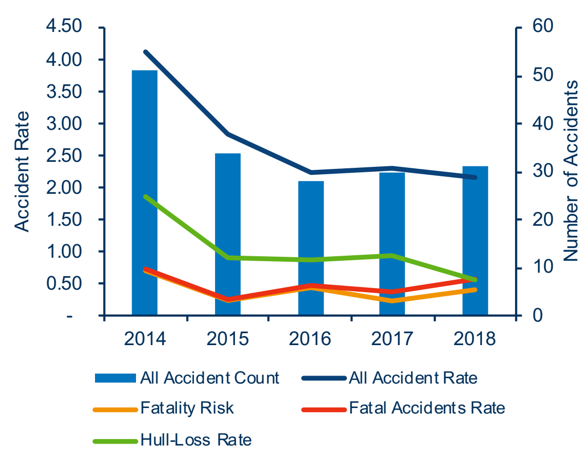
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Controlled Flight into Terrain – Accident Count

2018	Number of accidents: 1	Number of fatalities: 66
2014-2018	Number of accidents: 10	Number of fatalities: 187

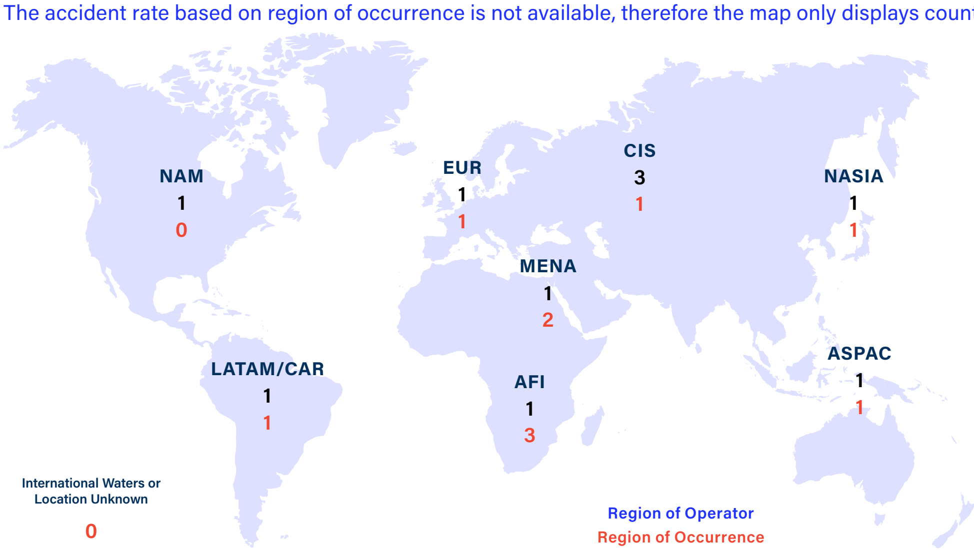
Accident Count % of Total	2018	'14-'18
IATA Member	100%	20%
Full-Loss Equivalents	100%	68%
Fatal	100%	70%
Hull Losses	100%	90%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	100%	0%	0%	0%	100%
2014-2018	40%	50%	10%	10%	90%

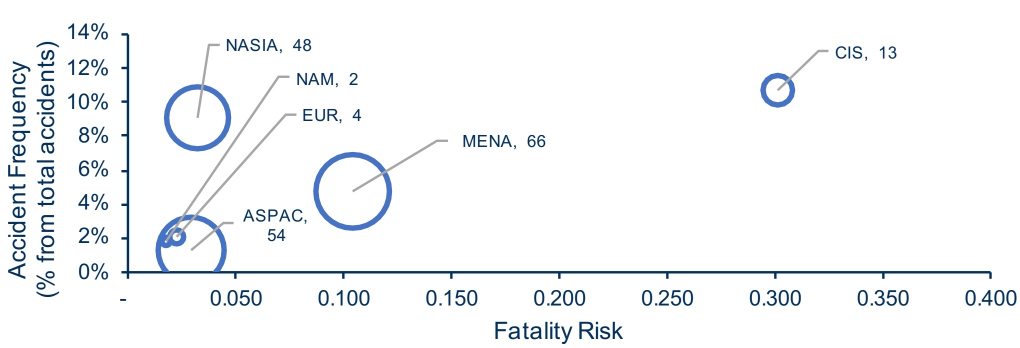
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Flight Operations:
83%

Threats

Poor visibility / IMC:
67%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
100%

Undesired Aircraft State

Unnecessary Weather Penetration:
50%

Countermeasure

Monitor / Cross-check:
83%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Controlled Flight into Terrain – Accident Rate*

2018 Accident rate: 0.02
2014-2018 Accident rate: 0.05

Accident Rate*	2018	'14-'18
IATA Member	0.04	0.02
Fatality Risk**	0.02	0.03
Fatal	0.02	0.04
Hull Losses	0.02	0.05

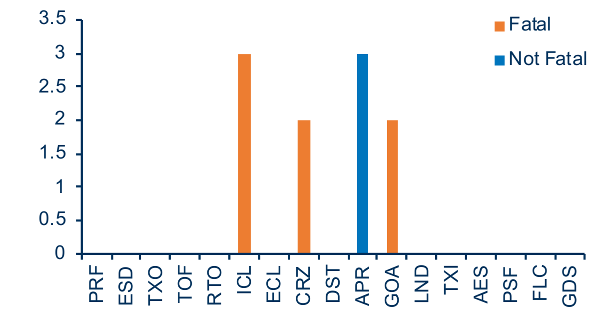
	Jet	Turboprop
2018	–	0.12
2014-2018	0.01	0.25

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

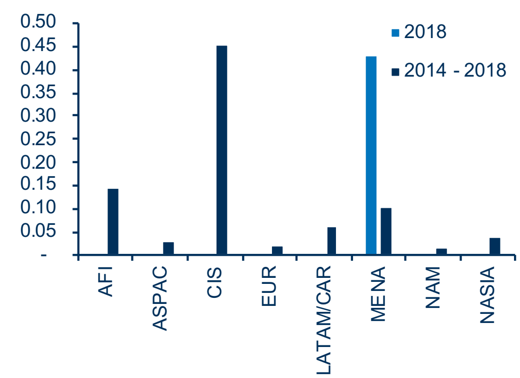
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



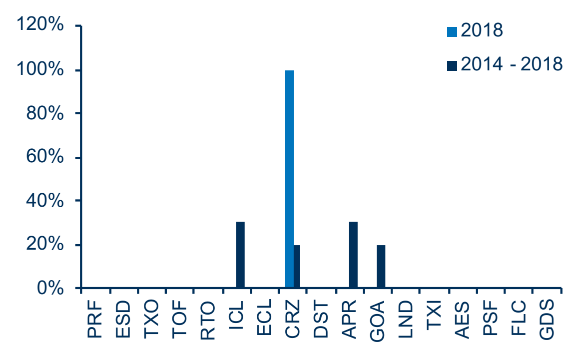
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



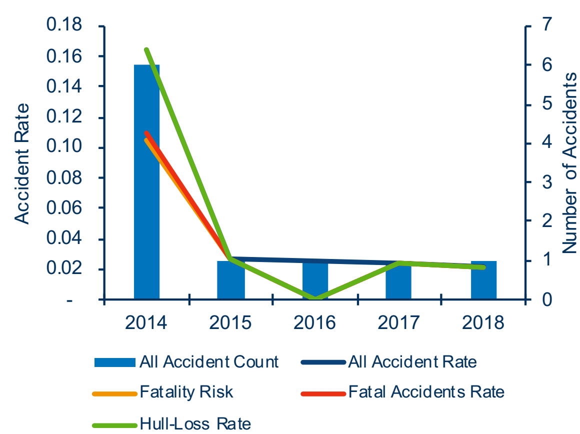
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Loss of Control – In-flight – Accident Count

2018	Number of accidents: 4	Number of fatalities: 372
2014-2018	Number of accidents: 25	Number of fatalities: 926

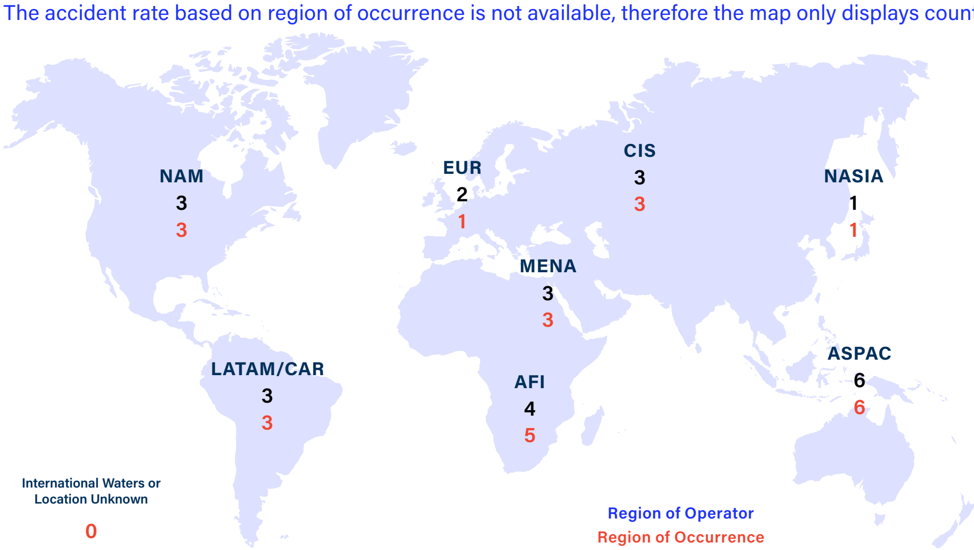
Accident Count % of Total	2018	'14-'18
IATA Member	0%	16%
Full-Loss Equivalents	75%	77%
Fatal	75%	88%
Hull Losses	100%	96%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	10%	0%	0%	100%	0%
2014-2018	56%	40%	4%	40%	60%

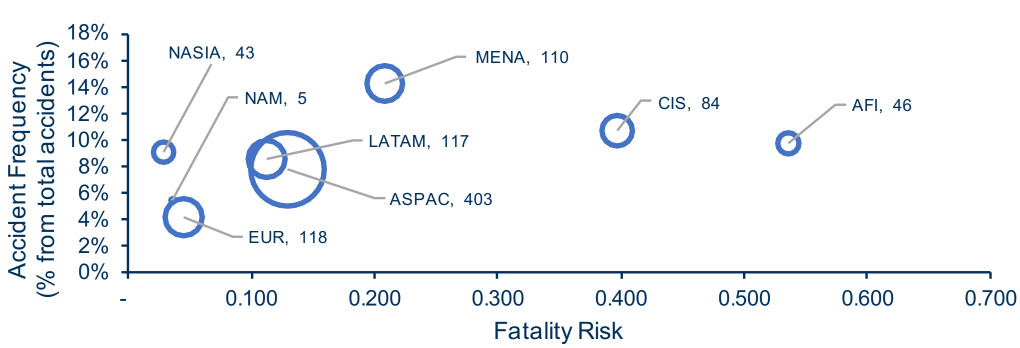
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Flight Operations:
47%

Threats

Aircraft Malfunction:
53%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
53%

Undesired Aircraft State

Operation Outside Aircraft Limitations:
37%

Countermeasure

Overall Crew Performance:
47%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Loss of Control – In-flight – Accident Rate*

2018 Accident rate: 0.09
2014-2018 Accident rate: 0.13

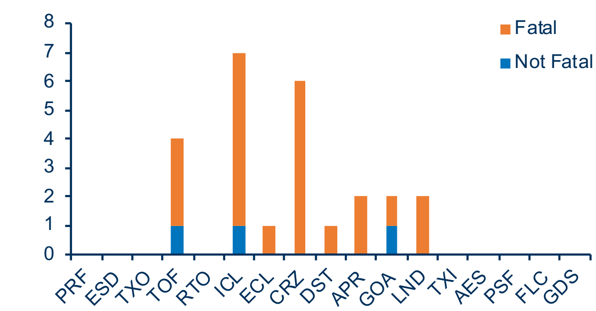
Accident Rate*	2018	'14-'18
IATA Member	–	0.04
Fatality Risk**	0.06	0.10
Fatal	0.07	0.11
Hull Losses	0.09	0.12

	Jet	Turboprop	
2018	0.11	–	Accident rates for Passenger, Cargo and Ferry are not available.
2014-2018	0.06	0.42	

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

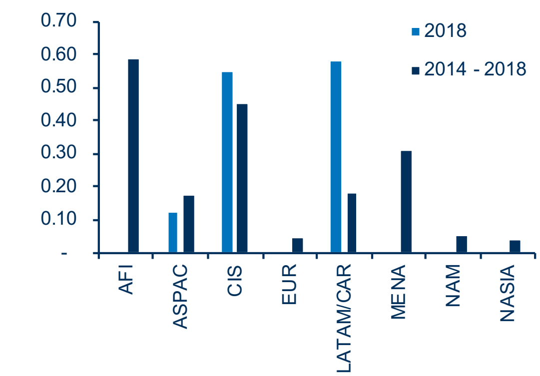
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



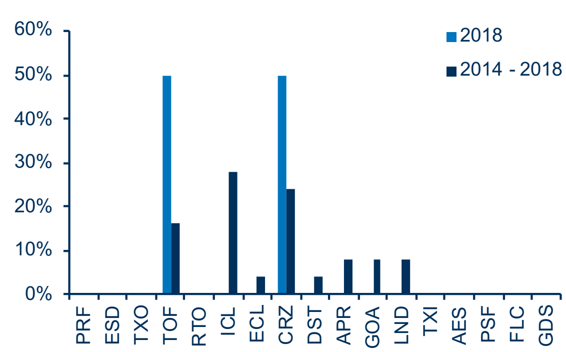
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



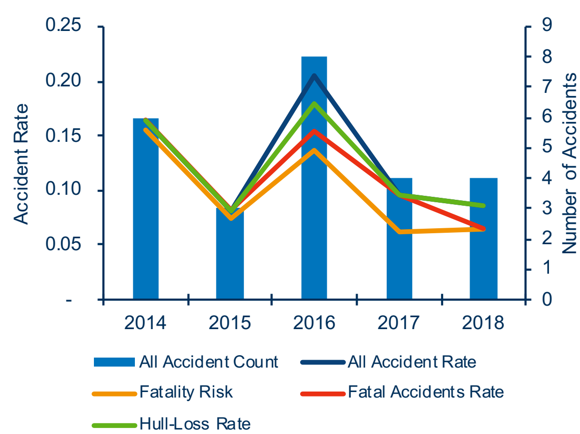
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



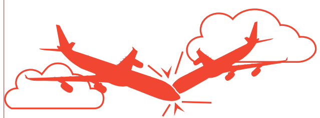
Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Mid-Air Collision – Accident Count

2018	Number of accidents: 0	Number of fatalities: 0
2014-2018	Number of accidents: 1	Number of fatalities: 0



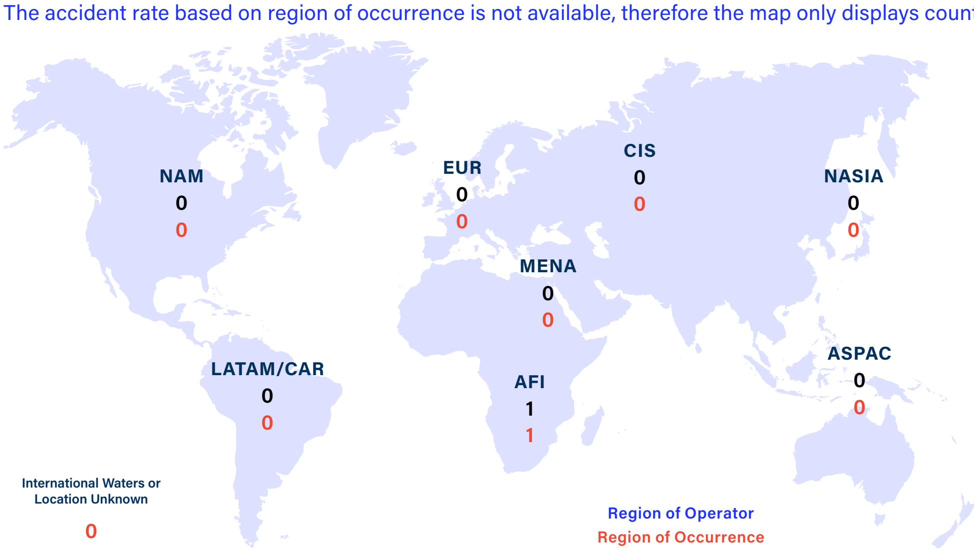
Accident Count % of Total	2018	'14-'18
IATA Member	0%	0%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	0%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	0%	0%	0%	0%	0%
2014-2018	100%	0%	0%	100%	0%

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

Number of Accidents per Region (2014-2018)

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



Note: This report only considers fatalities on board of commercial revenue flights. However, it is important to highlight that in 2016 a mid-air collision involving a commercial jet and a noncommercial aircraft (HS-125 ambulance configuration) resulted in the crash and death of all on board of the HS-125. The B737 suffered substantial damage.

Accident Category Frequency and Fatality Risk (2014-2018)

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.

Top Primary Contributing factors

Latent Conditions

At least three accidents required to display classification

Threats

At least three accidents required to display classification

Flight Crew Errors

At least three accidents required to display classification

Undesired Aircraft State

At least three accidents required to display classification

Countermeasure

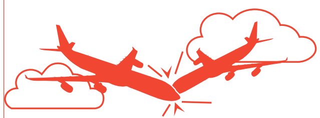
At least three accidents required to display classification

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Mid-Air Collision – Accident Rate*

2018 Accident rate: –
2014-2018 Accident rate: 0.01



Accident Rate*	2018	'14-'18
IATA Member	–	–
Fatality Risk**	–	–
Fatal	–	–
Hull Losses	–	–

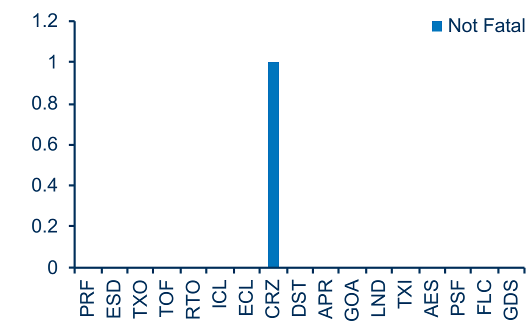
	Jet	Turboprop
2018	–	–
2014-2018	0.01	–

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

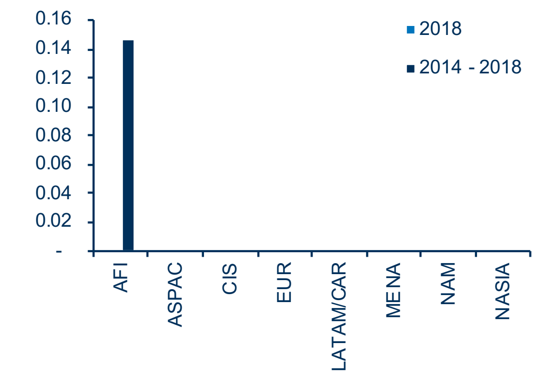
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



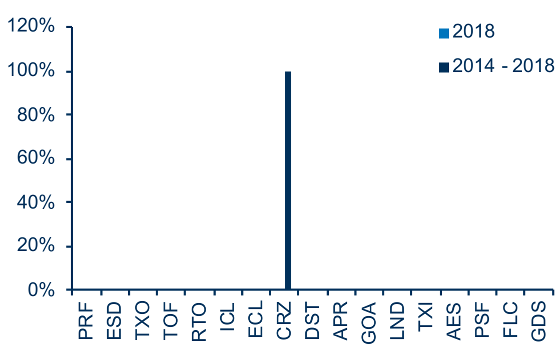
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



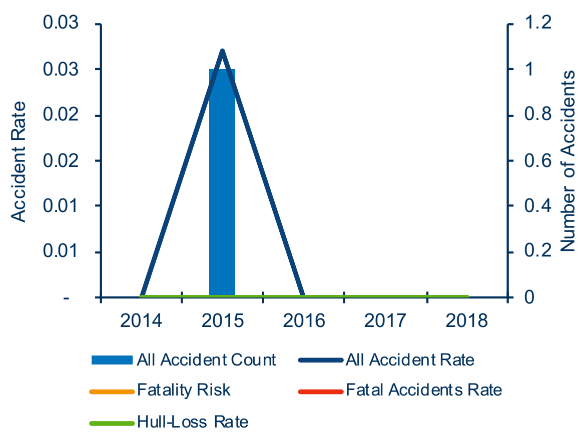
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Runway/Taxiway Excursion – Accident Count

2018	Number of accidents: 15	Number of fatalities: 52
2014-2018	Number of accidents: 73	Number of fatalities: 52

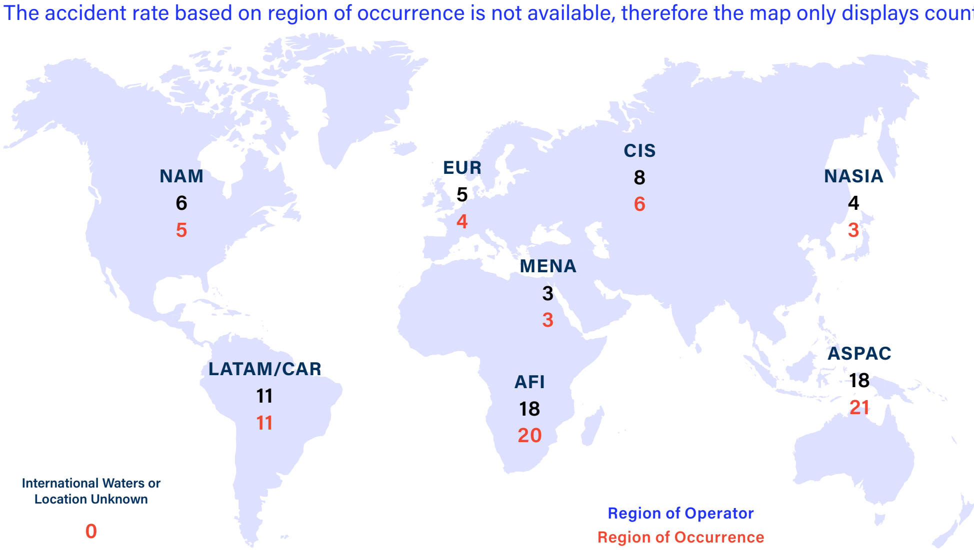
Accident Count % of Total	2018	'14-'18
IATA Member	27%	22%
Full-Loss Equivalents	5%	1%
Fatal	13%	3%
Hull Losses	20%	32%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	87%	13%	0%	73%	27%
2014-2018	74%	26%	0%	64%	36%

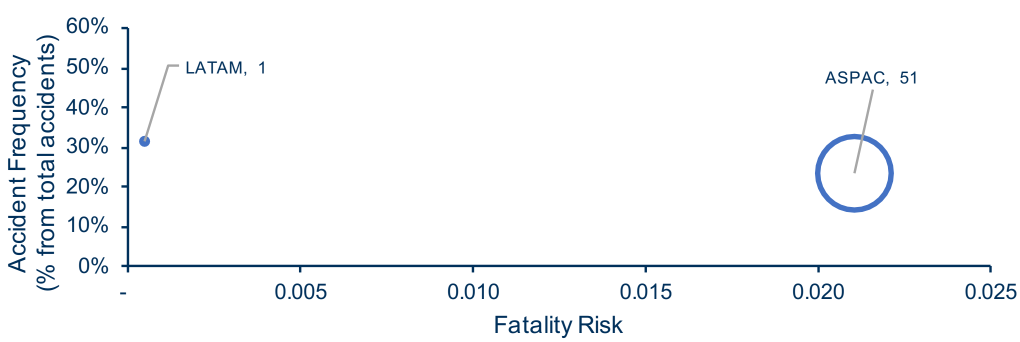
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
43%

Threats

Meteorology:
59%

Flight Crew Errors

Manual Handling/Flight Controls:
45%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
43%

Countermeasure

Overall Crew Performance:
39%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Runway/Taxiway Excursion – Accident Rate*

2018 Accident rate: 0.33
2014-2018 Accident rate: 0.37

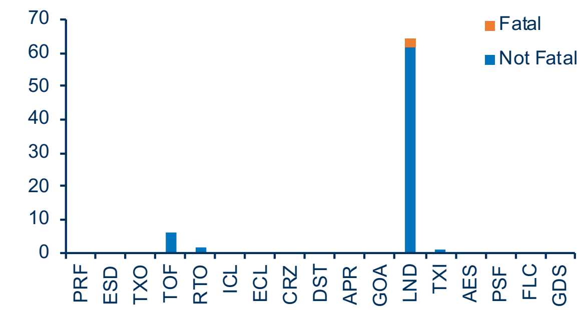
Accident Rate*	2018	'14-'18
IATA Member	0.17	0.15
Fatality Risk**	0.02	0.00
Fatal	0.04	0.01
Hull Losses	0.07	0.12

	Jet	Turboprop	
2018	0.29	0.48	Accident rates for Passenger, Cargo and Ferry are not available.
2014-2018	0.29	0.73	

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

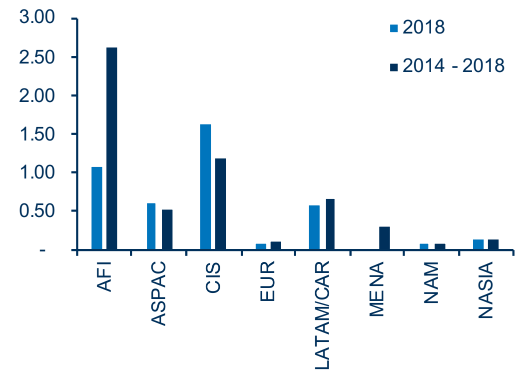
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



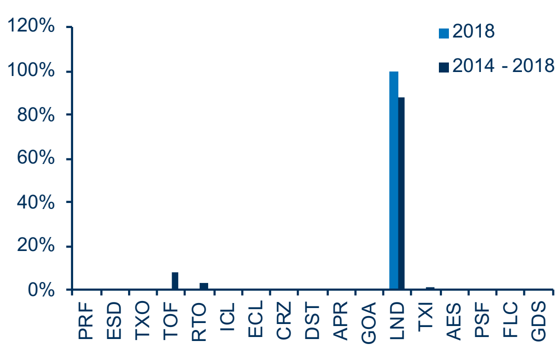
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



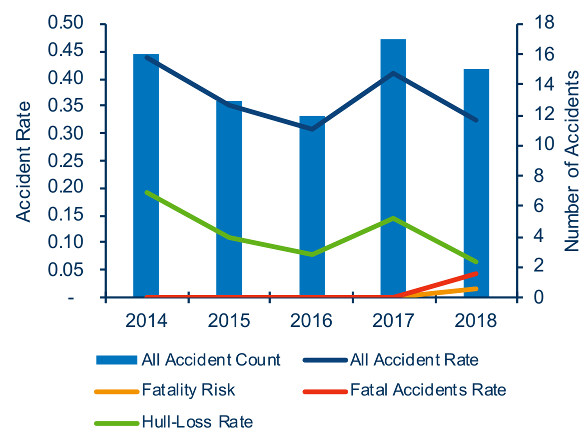
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



In-flight Damage – Accident Count

2018	Number of accidents: 7	Number of fatalities: 1
2014-2018	Number of accidents: 35	Number of fatalities: 2

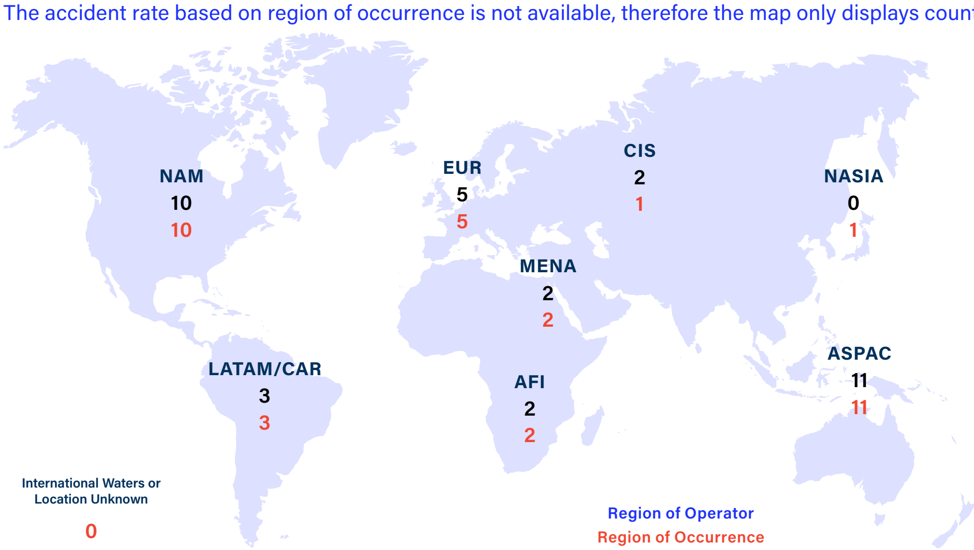
Accident Count % of Total	2018	'14-'18
IATA Member	43%	54%
Full-Loss Equivalents	0%	3%
Fatal	14%	6%
Hull Losses	0%	9%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	71%	29%	0%	86%	14%
2014-2018	86%	14%	0%	86%	14%

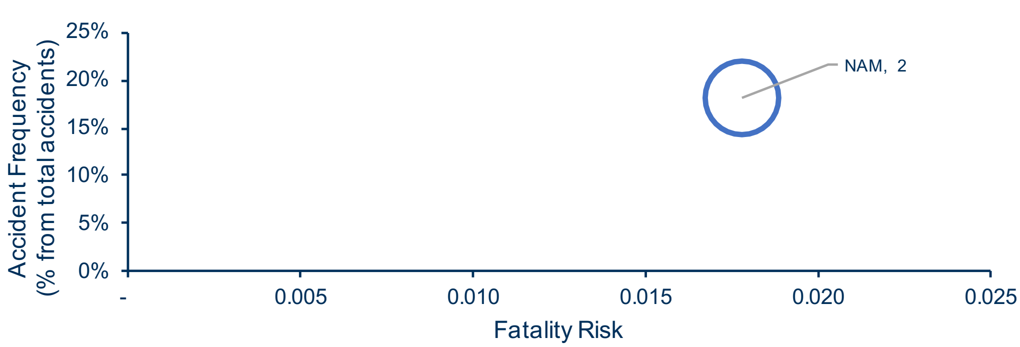
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
16%

Threats

Aircraft Malfunction:
47%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
13%

Undesired Aircraft State

Unnecessary Weather Penetration:
9%

Countermeasure

Leadership:
3%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

In-flight Damage – Accident Rate*

2018 Accident rate: 0.15
2014-2018 Accident rate: 0.18

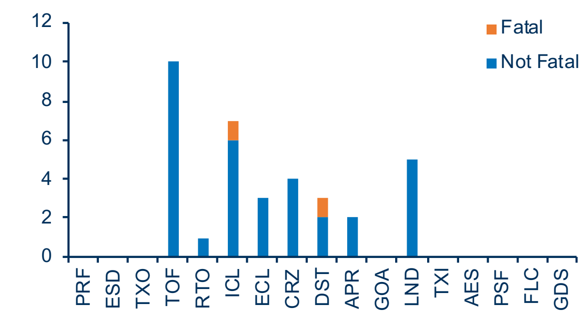
Accident Rate*	2018	'14-'18
IATA Member	0.12	0.18
Fatality Risk**	0.00	0.01
Fatal	0.02	0.01
Hull Losses	-	0.02

	Jet	Turboprop	
2018	0.16	0.12	Accident rates for Passenger, Cargo and Ferry are not available.
2014-2018	0.18	0.14	

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

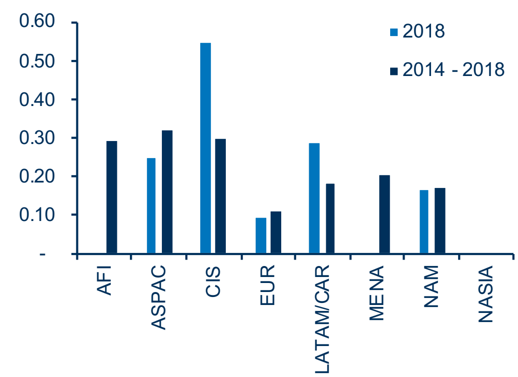
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



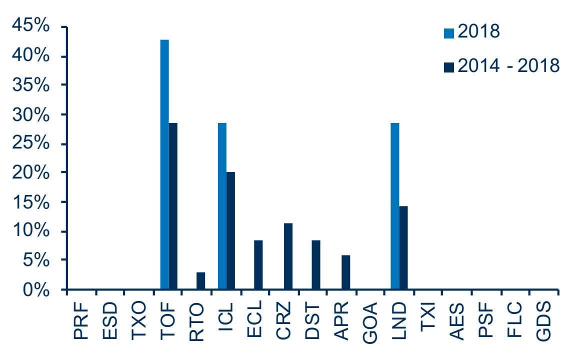
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



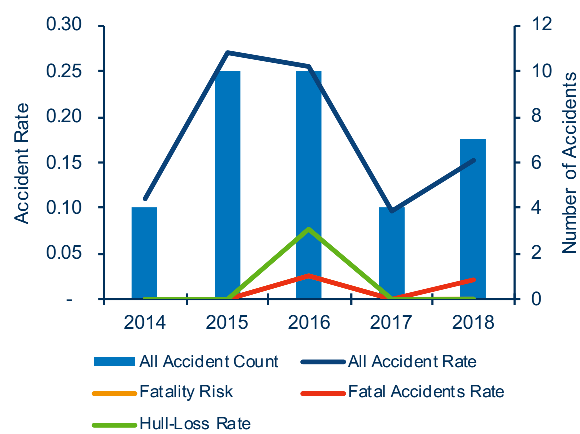
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



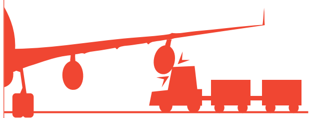
Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Ground Damage – Accident Count

2018	Number of accidents: 9	Number of fatalities: 0
2014-2018	Number of accidents: 28	Number of fatalities: 0



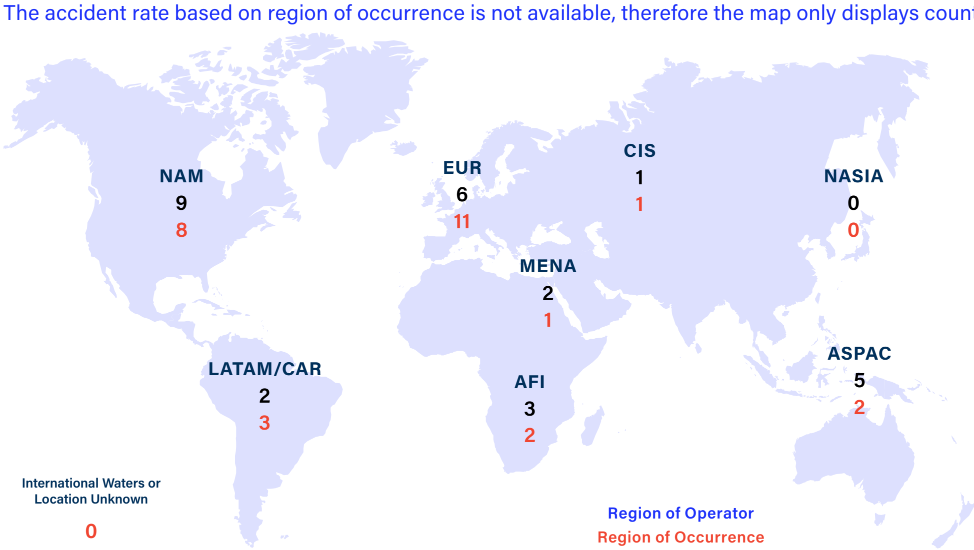
Accident Count % of Total	2018	'14-'18
IATA Member	67%	61%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	11%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	89%	11%	0%	89%	11%
2014-2018	93%	7%	0%	96%	4%

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

Number of Accidents per Region (2014-2018)

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



Top Primary Contributing factors

Latent Conditions

Ground Operations:
26%

Threats

Ground Events:
52%

Flight Crew Errors

Ground Navigation:
17%

Undesired Aircraft State

Ramp Movements:
26%

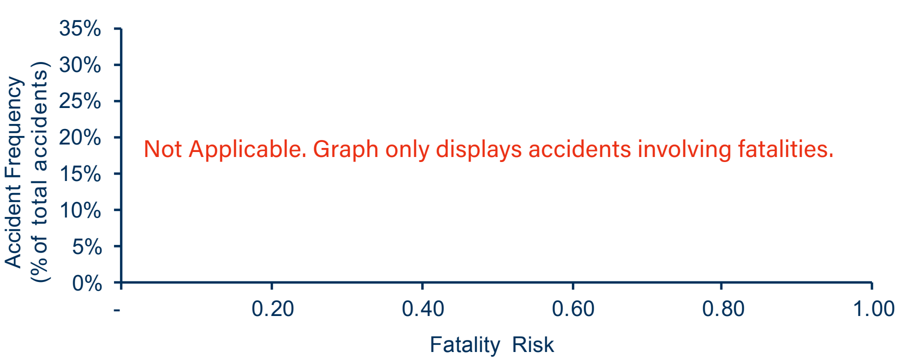
Countermeasure

Overall Crew Performance:
17%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

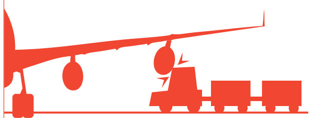
Accident Category Frequency and Fatality Risk (2014-2018)



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*

2018	Accident rate: 0.20
2014-2018	Accident rate: 0.14



Accident Rate*	2018	'14-'18
IATA Member	0.25	0.16
Fatality Risk**	–	–
Fatal	–	–
Hull Losses	–	0.02

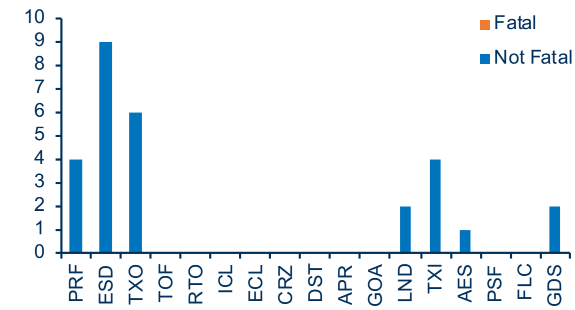
	Jet	Turboprop
2018	0.21	0.12
2014-2018	0.16	0.03

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

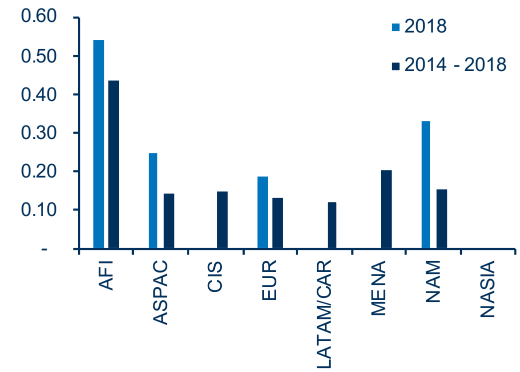
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



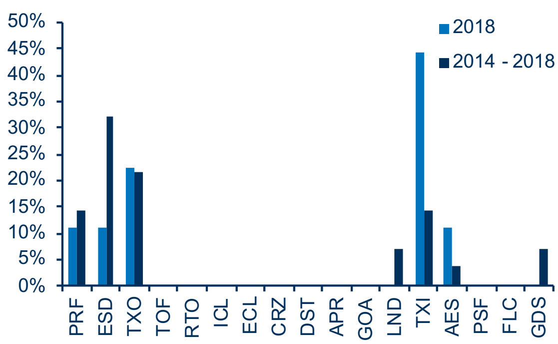
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



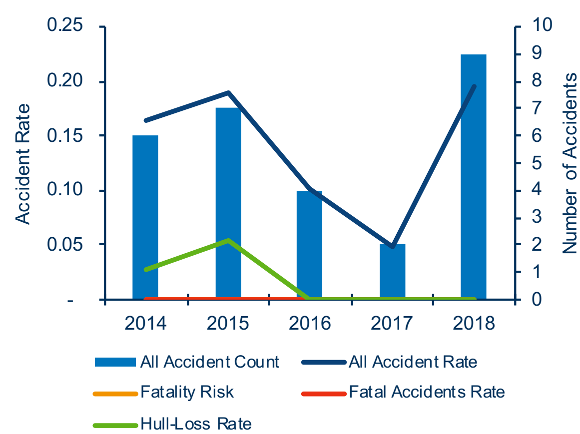
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Undershoot – Accident Count

2018	Number of accidents: 1	Number of fatalities: 1
2014-2018	Number of accidents: 11	Number of fatalities: 5

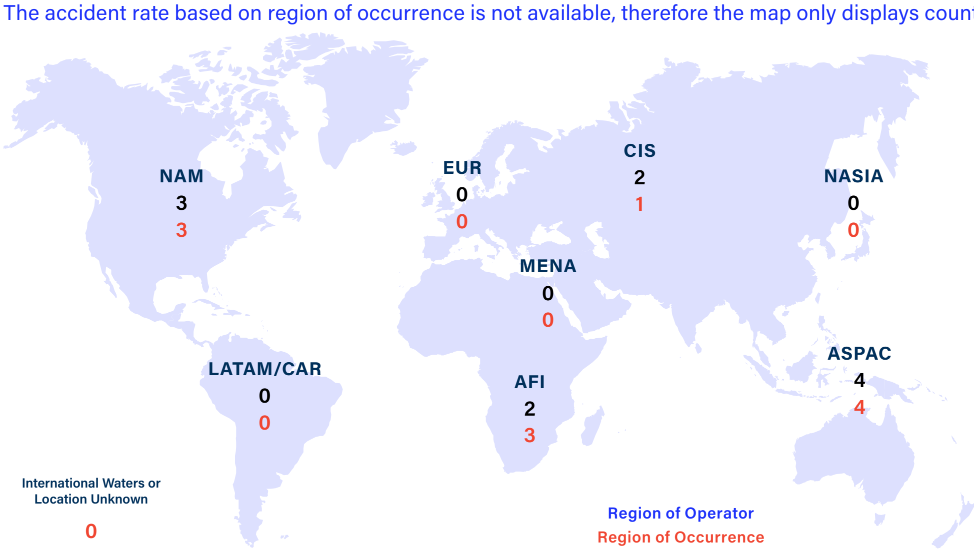
Accident Count % of Total	2018	'14-'18
IATA Member	100%	45%
Full-Loss Equivalents	2%	4%
Fatal	100%	18%
Hull Losses	100%	36%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	100%	0%	0%	100%	0%
2014-2018	64%	27%	9%	55%	45%

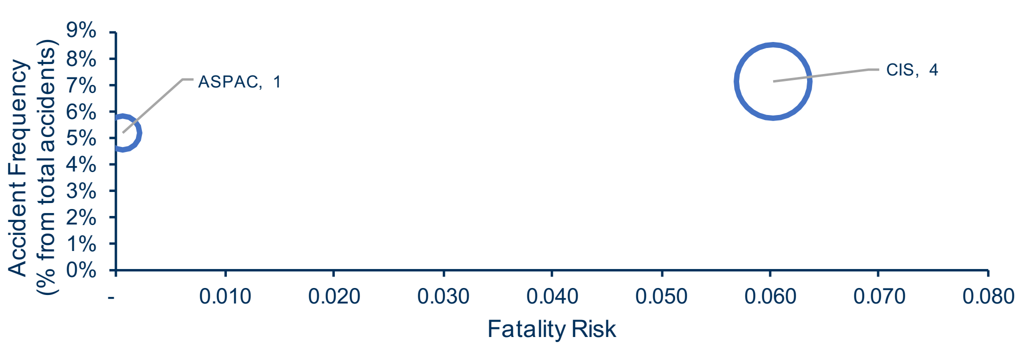
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
44%

Threats

Meteorology:
89%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
56%

Undesired Aircraft State

Vertical/Lateral/Speed Deviation:
56%

Countermeasure

Overall Crew Performance:
33%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Undershoot – Accident Rate*

2018 Accident rate: 0.02
2014-2018 Accident rate: 0.06

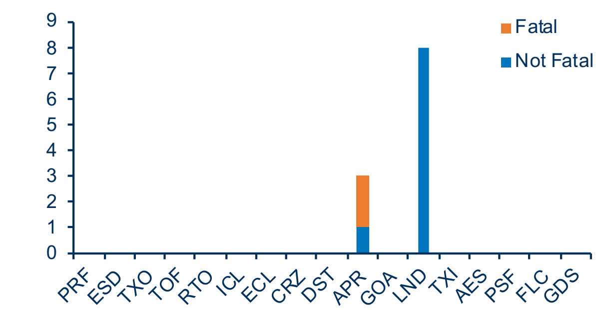
Accident Rate*	2018	'14-'18
IATA Member	0.04	0.05
Fatality Risk**	0.00	0.00
Fatal	0.02	0.01
Hull Losses	0.02	0.02

	Jet	Turboprop	
2018	0.03	–	Accident rates for Passenger, Cargo and Ferry are not available.
2014-2018	0.04	0.14	

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

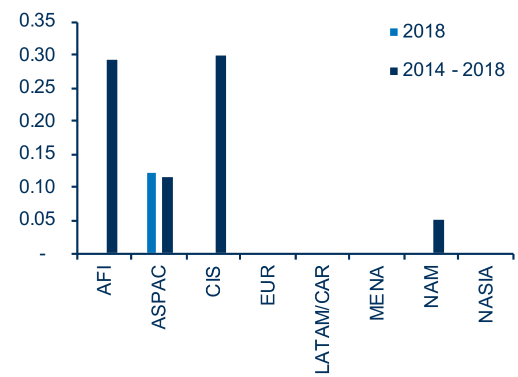
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



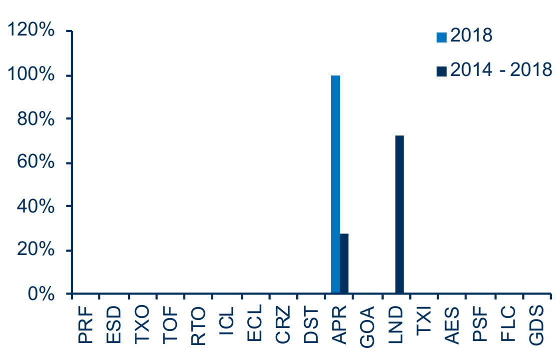
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



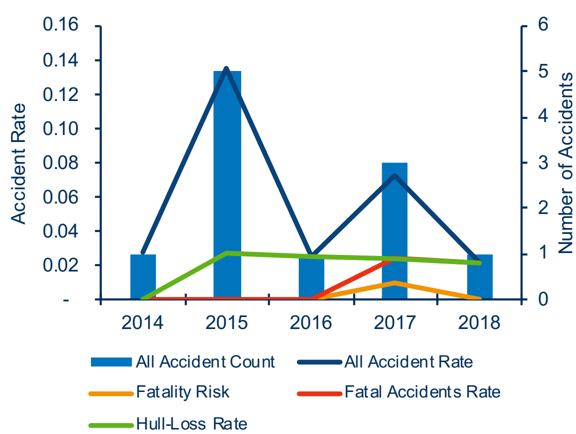
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Hard Landing – Accident Count

2018	Number of accidents: 4	Number of fatalities: 0
2014-2018	Number of accidents: 44	Number of fatalities: 0

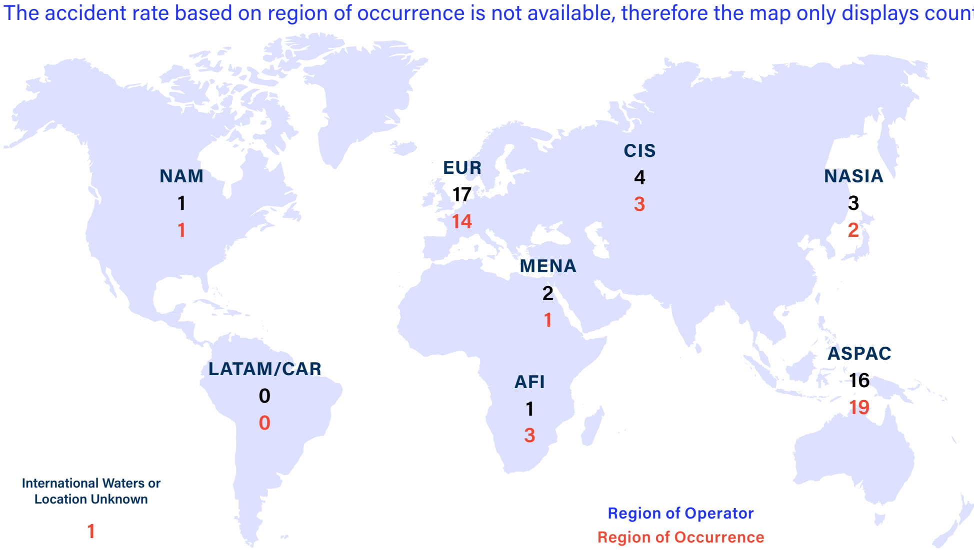
Accident Count % of Total	2018	'14-'18
IATA Member	100%	48%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	11%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	100%	0%	0%	100%	0%
2014-2018	86%	14%	0%	70%	30%

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

Number of Accidents per Region (2014-2018)

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



Note: An-74 Hard Landing. Location: Barneo Ice Base (International Waters)

Accident Category Frequency and Fatality Risk (2014-2018)

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.

Top Primary Contributing factors

Latent Conditions

Flight Operations:
30%

Threats

Meteorology:
42%

Flight Crew Errors

Manual Handling/Flight Controls:
81%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
58%

Countermeasure

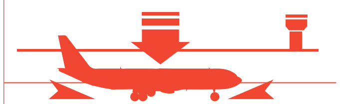
Overall Crew Performance:
35%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Hard Landing – Accident Rate*

2018 Accident rate: 0.09
2014-2018 Accident rate: 0.22



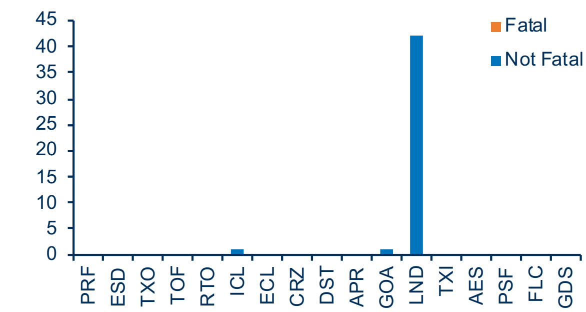
Accident Rate*	2018	'14-'18
IATA Member	0.17	0.20
Fatality Risk**	–	–
Fatal	–	–
Hull Losses	–	0.03

	Jet	Turboprop	
2018	0.11	–	Accident rates for Passenger, Cargo and Ferry are not available.
2014-2018	0.19	0.37	

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

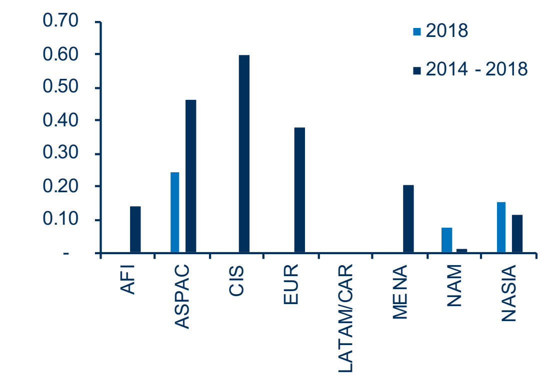
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



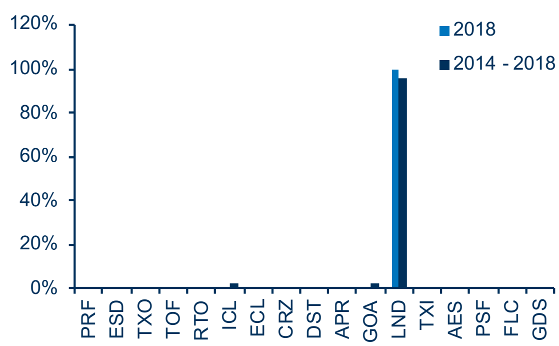
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



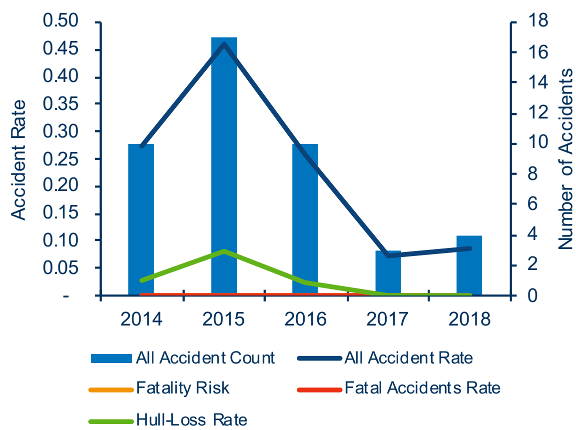
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Gear-up Landing/Gear Collapse – Accident Count

2018	Number of accidents: 9	Number of fatalities: 0
2014-2018	Number of accidents: 49	Number of fatalities: 0

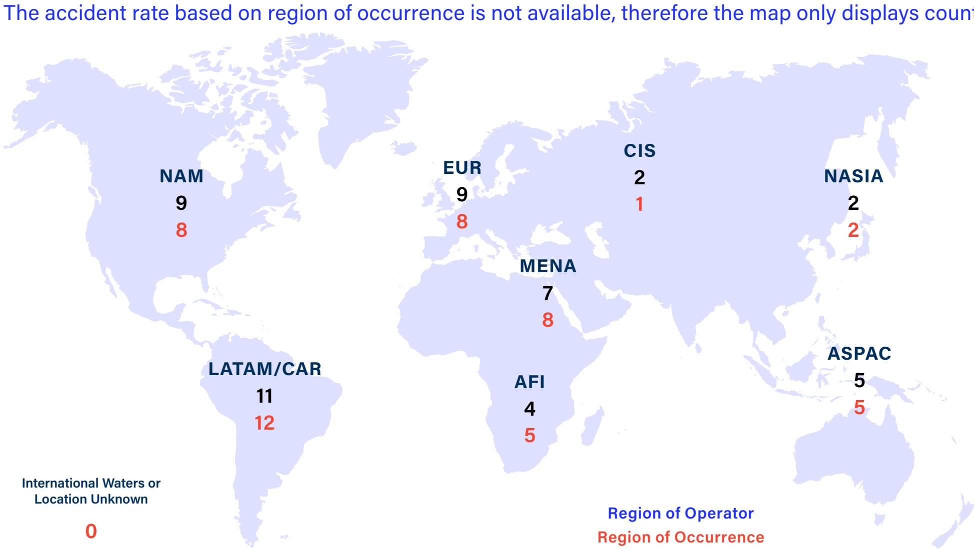
Accident Count % of Total	2018	'14-'18
IATA Member	22%	27%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	18%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	78%	22%	0%	56%	44%
2014-2018	78%	20%	2%	51%	49%

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

Number of Accidents per Region (2014-2018)

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



Top Primary Contributing factors

Latent Conditions

Maintenance Operations:
34%

Threats

Gear / Tire:
88%

Flight Crew Errors

Manual Handling/Flight Controls:
2%

Undesired Aircraft State

Landing Gear:
5%

Countermeasure

In-flight decision making/ contingency management:
2%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Accident Category Frequency and Fatality Risk (2014-2018)

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*

2018 Accident rate: 0.20
2014-2018 Accident rate: 0.25

Accident Rate*	2018	'14-'18
IATA Member	0.08	0.12
Fatality Risk**	-	-
Fatal	-	-
Hull Losses	-	0.05

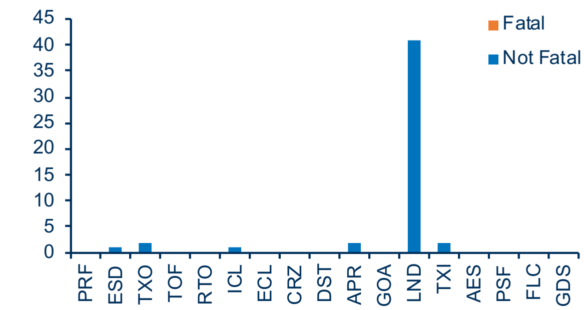
	Jet	Turboprop
2018	0.13	0.48
2014-2018	0.15	0.67

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

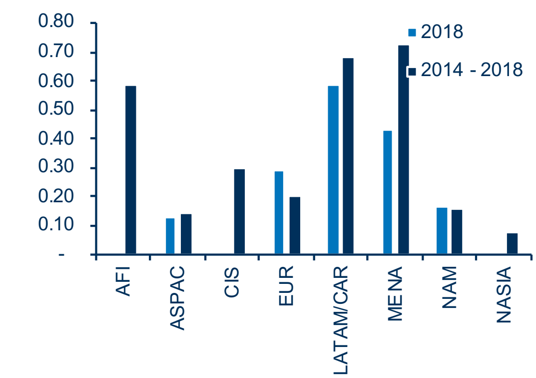
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



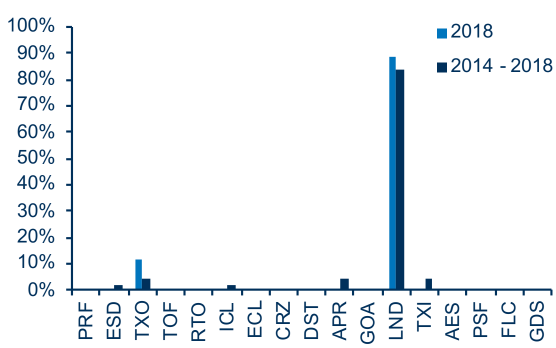
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



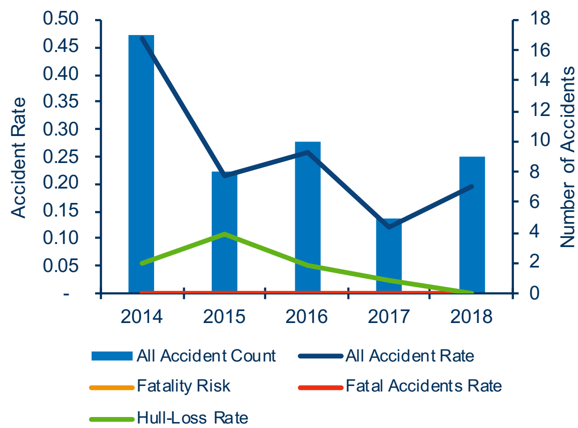
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



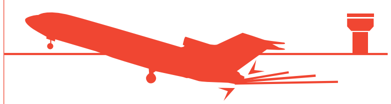
Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Tail Strike – Accident Count

2018	Number of accidents: 8	Number of fatalities: 0
2014-2018	Number of accidents: 18	Number of fatalities: 0



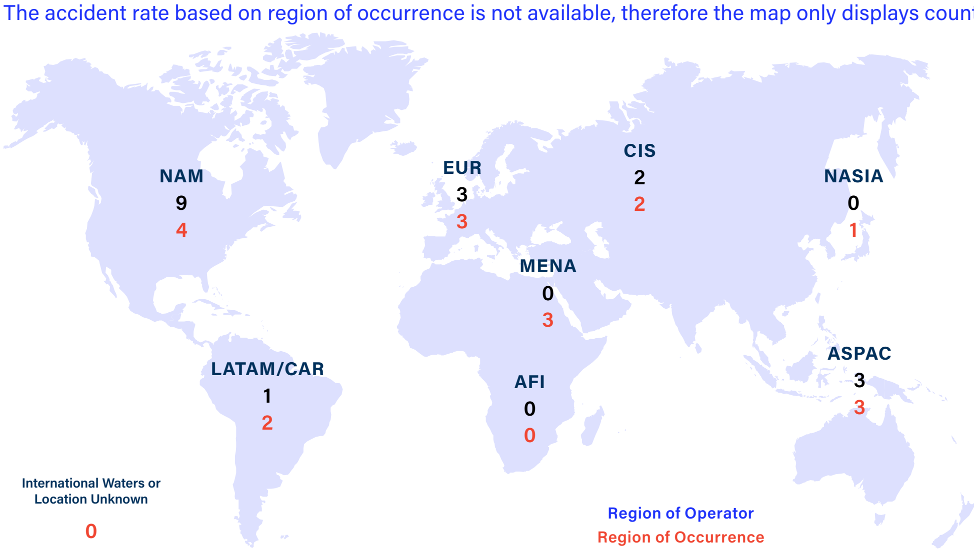
Accident Count % of Total	2018	'14-'18
IATA Member	63%	50%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	0%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	100%	0%	0%	88%	13%
2014-2018	94%	6%	0%	89%	11%

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

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)

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.

Top Primary Contributing factors

Latent Conditions

Flight Operations:
24%

Threats

Meteorology:
35%

Flight Crew Errors

Manual Handling/Flight Controls:
88%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
59%

Countermeasure

Monitor / Cross-check:
41%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Tail Strike – Accident Rate*

2018 Accident rate: 0.17

2014-2018 Accident rate: 0.09

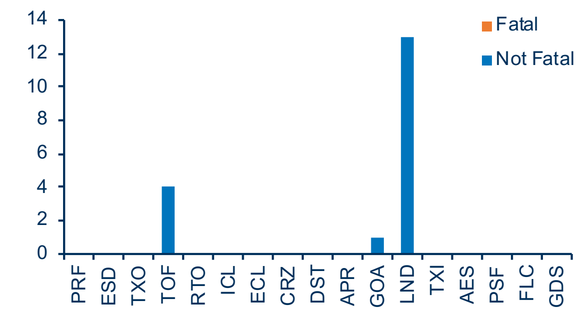
Accident Rate*	2018	'14-'18
IATA Member	0.21	0.09
Fatality Risk**	-	-
Fatal	-	-
Hull Losses	-	-

	Jet	Turboprop	
2018	0.19	0.12	Accident rates for Passenger, Cargo and Ferry are not available.
2014-2018	0.10	0.06	

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

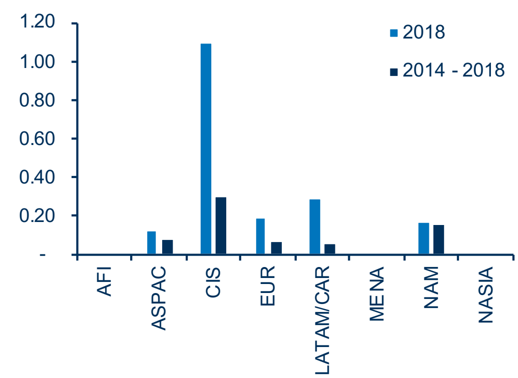
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



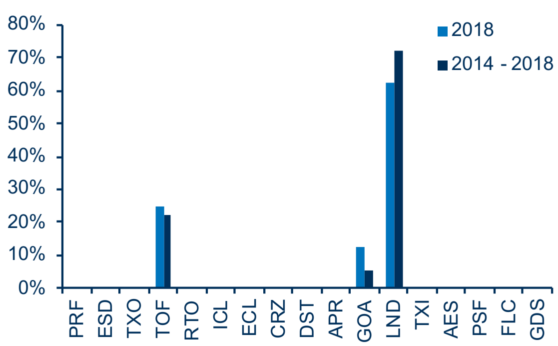
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



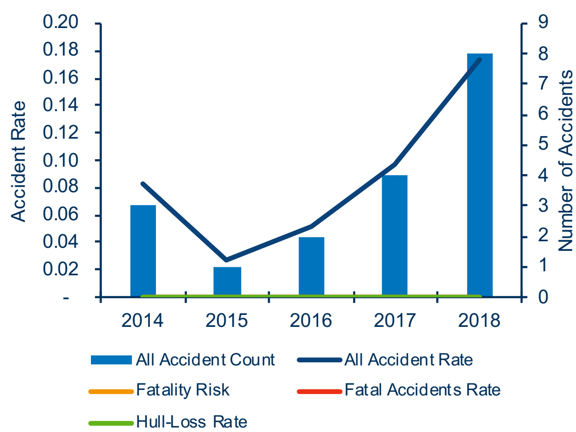
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Off-Airport Landing/Ditching – Accident Count

2018	Number of accidents: 0	Number of fatalities: 0
2014-2018	Number of accidents: 2	Number of fatalities: 0

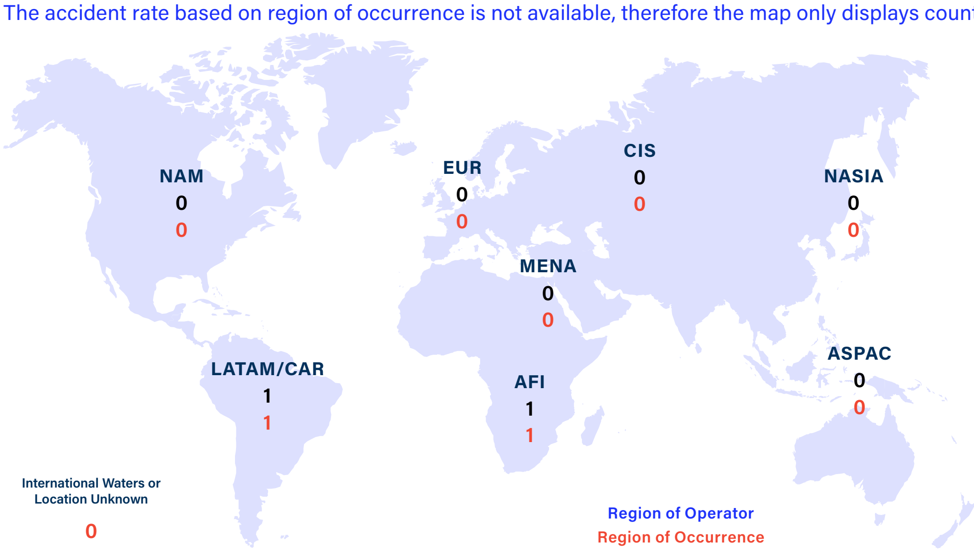
Accident Count % of Total	2018	'14-'18
IATA Member	0%	0%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	0%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	0%	0%	0%	0%	0%
2014-2018	0%	50%	50%	50%	50%

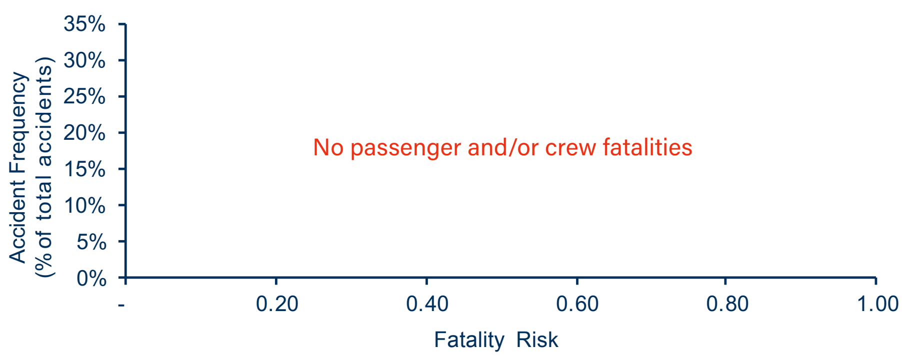
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

At least three accidents required to display classification

Threats

At least three accidents required to display classification

Flight Crew Errors

At least three accidents required to display classification

Undesired Aircraft State

At least three accidents required to display classification

Countermeasure

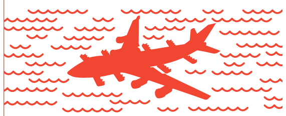
At least three accidents required to display classification

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Off-Airport Landing/Ditching – Accident Rate*

2018 Accident rate: –
2014-2018 Accident rate: 0.01



Accident Rate*	2018	'14-'18
IATA Member	–	–
Fatality Risk**	–	–
Fatal	–	–
Hull Losses	–	–

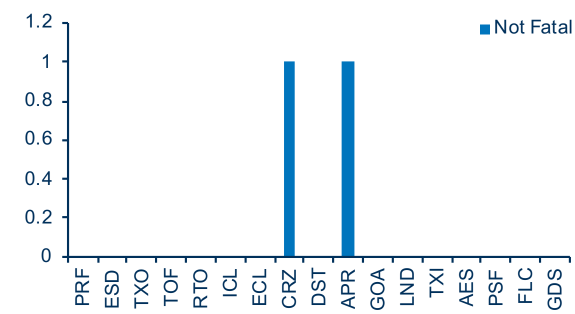
	Jet	Turboprop
2018	–	–
2014-2018	0.01	0.03

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

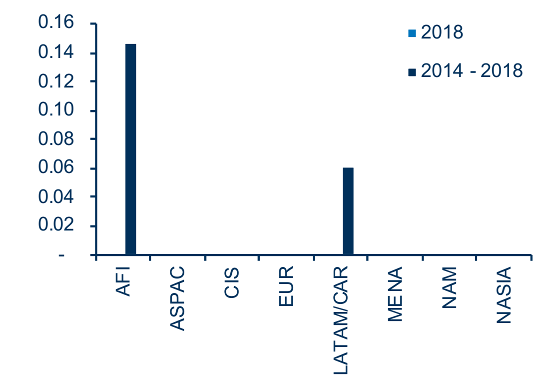
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



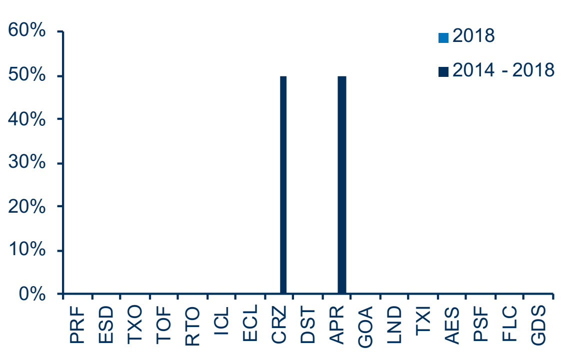
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



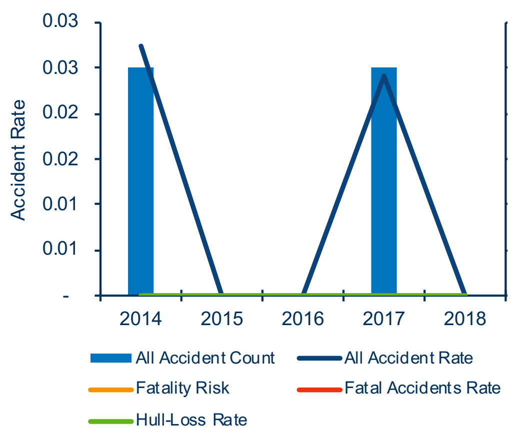
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Runway Collision – Accident Count

2018	Number of accidents: 0	Number of fatalities: 0
2014-2018	Number of accidents: 10	Number of fatalities: 0

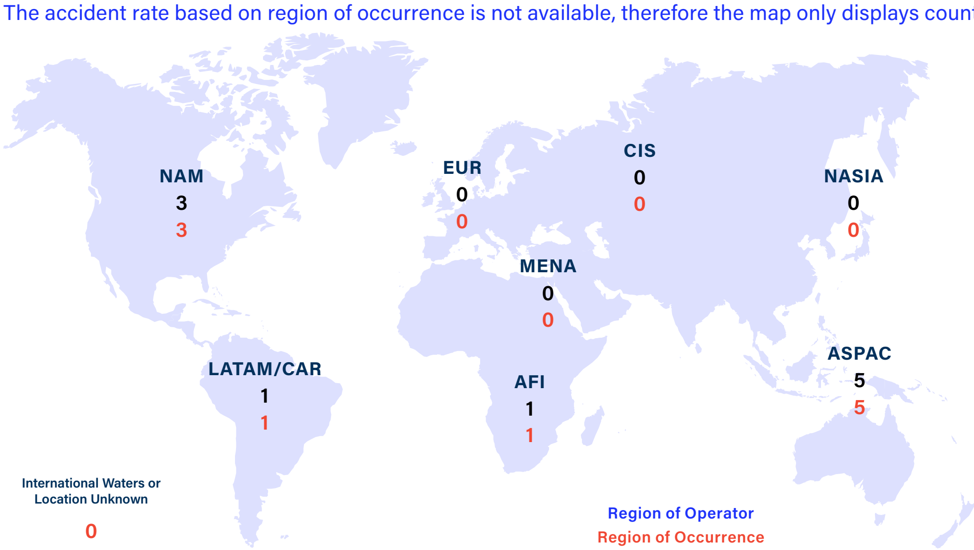
Accident Count % of Total	2018	'14-'18
IATA Member	0%	10%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	20%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	0%	0%	0%	0%	0%
2014-2018	100%	0%	0%	30%	70%

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

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)

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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
60%

Threats

Wildlife/Birds/Foreign Object:
40%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
10%

Undesired Aircraft State

Runway / Taxiway Incursion:
20%

Countermeasure

Overall Crew Performance:
10%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Runway Collision – Accident Rate*

2018 Accident rate: –
2014-2018 Accident rate: 0.05

Accident Rate*	2018	'14-'18
IATA Member	–	0.01
Fatality Risk**	–	–
Fatal	–	–
Hull Losses	–	0.01

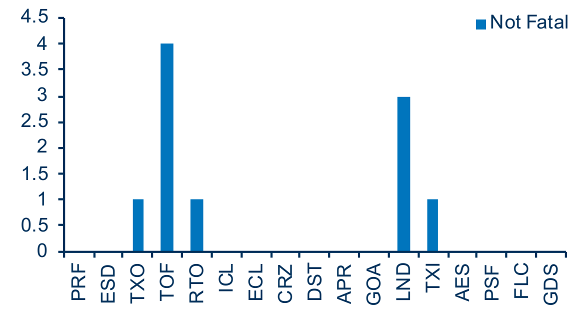
	Jet	Turboprop
2018	–	–
2014-2018	0.02	0.20

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

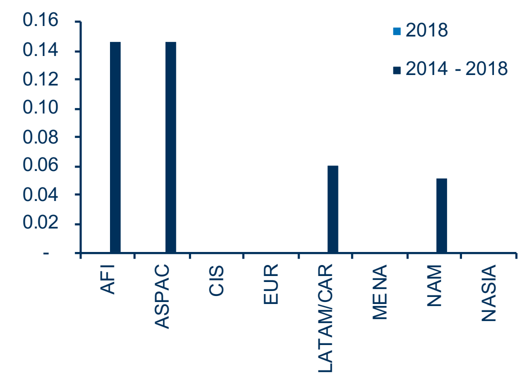
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



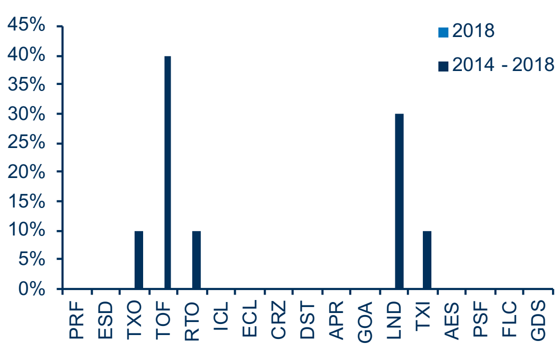
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



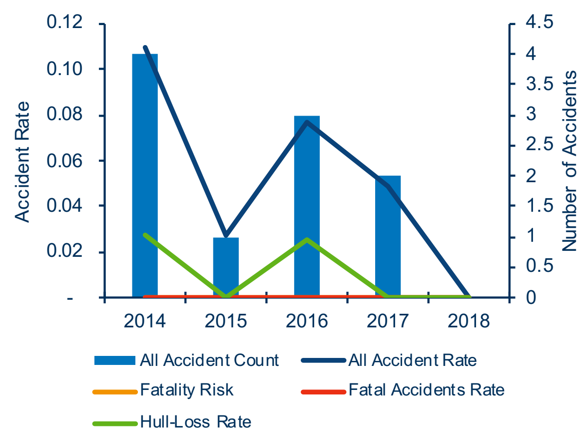
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



5-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Jet Aircraft Accidents – Accident Count

2018	Number of accidents: 47	Number of fatalities: 375
2014-2018	Number of accidents: 202	Number of fatalities: 1036

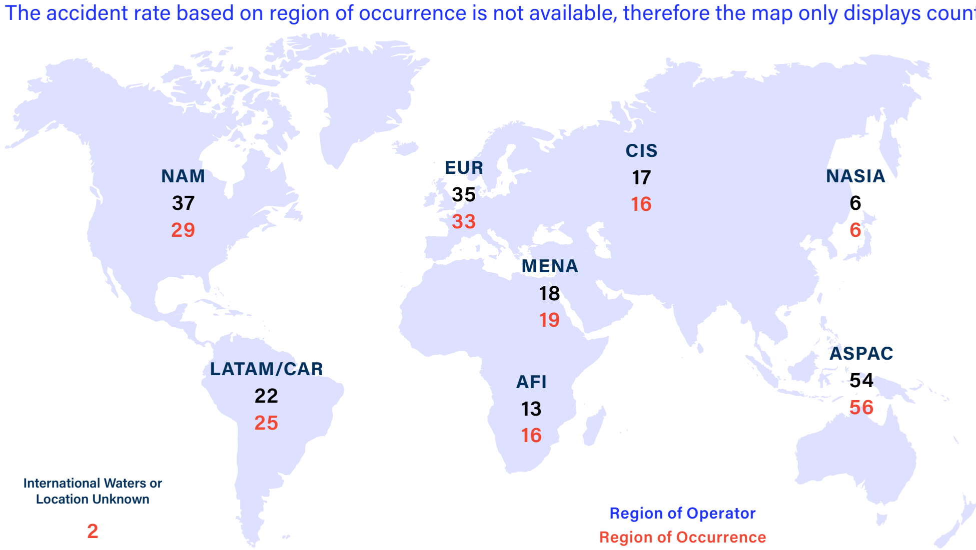
Accident Count % of Total	2018	'14-'18
IATA Member	47%	46%
Full-Loss Equivalents	0%	1%
Fatal	13%	7%
Hull Losses	15%	20%

	Passenger	Cargo	Ferry
2018	94%	6%	0%
2014-2018	87%	13%	0%

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

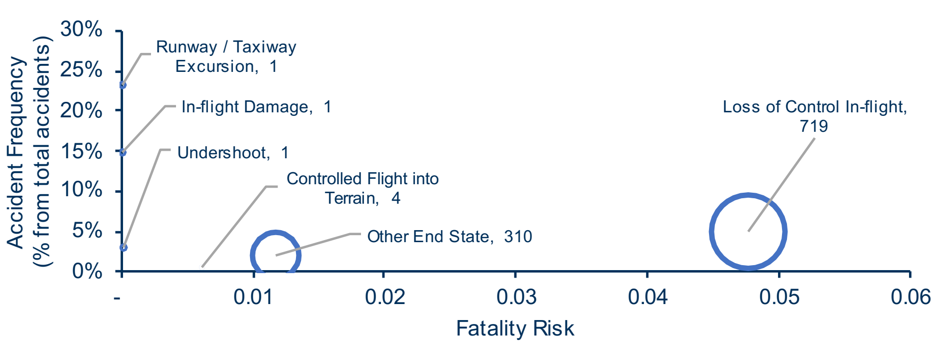
Number of Accidents per Region (2014-2018)

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



Note: An-74 Hard Landing. Location: Barneo Ice Base (International Waters)
B777 (MH370). Location: unknown

Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
28%

Threats

Meteorology:
33%

Flight Crew Errors

Manual Handling/Flight Controls:
39%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
26%

Countermeasure

Overall Crew Performance:
27%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Jet Aircraft Accidents – Accident Rate*

2018 Accident rate: 1.25
2014-2018 Accident rate: 1.23

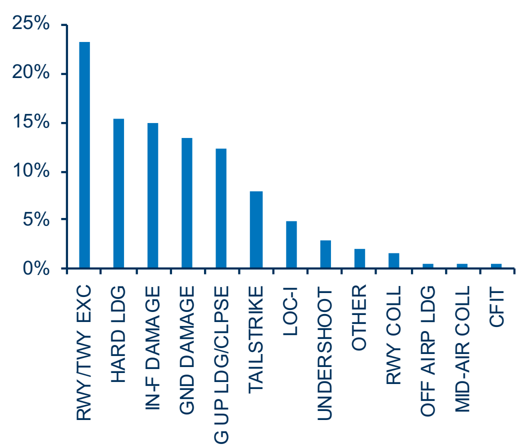
Accident Rate*	2018	'14-'18
IATA Member	0.98	0.95
Fatality Risk**	0.00	0.01
Fatal	0.16	0.09
Hull Losses	0.19	0.25

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 (2014-2018)

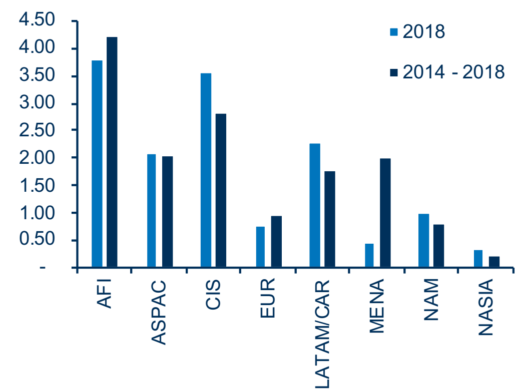
Distribution of accidents as percentage of total



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

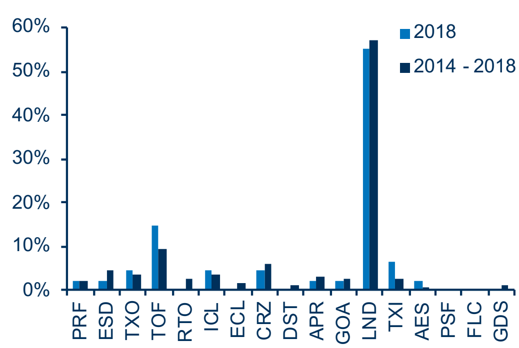
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



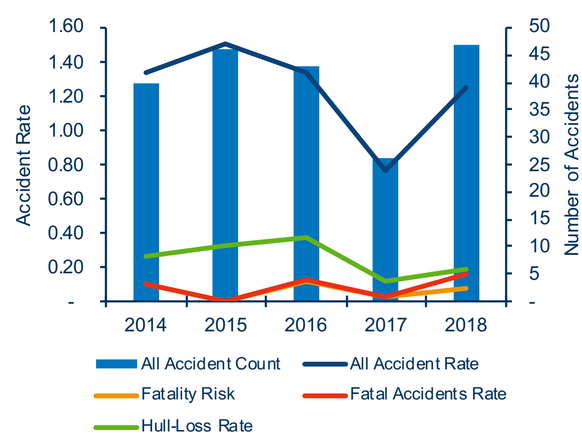
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



Turboprop Aircraft Accidents – Accident Count

2018	Number of accidents: 15	Number of fatalities: 148
2014-2018	Number of accidents: 114	Number of fatalities: 481

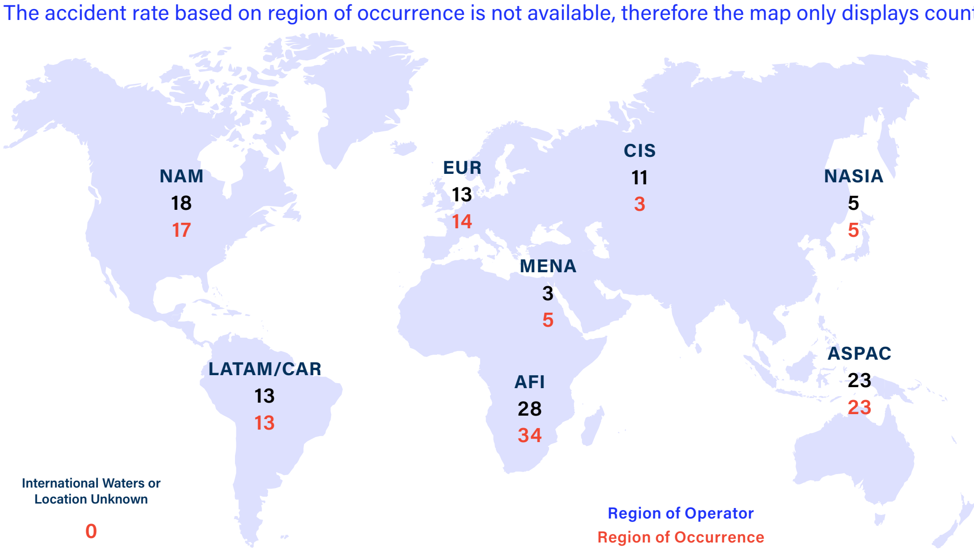
Accident Count % of Total	2018	'14-'18
IATA Member	27%	13%
Full-Loss Equivalents	7%	3%
Fatal	33%	24%
Hull Losses	33%	42%

	Passenger	Cargo	Ferry
2018	60%	40%	0%
2014-2018	61%	34%	4%

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

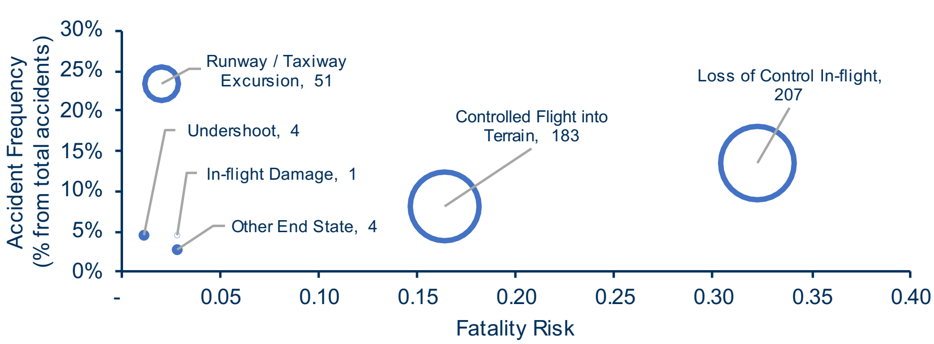
Number of Accidents per Region (2014-2018)

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



Note: B1900, presumingly crashed near Sao Tome and Principe. Wreckage not known to have been found.

Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
36%

Threats

Aircraft Malfunction:
39%

Flight Crew Errors

Manual Handling/Flight Controls:
31%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
19%

Countermeasure

Overall Crew Performance:
24%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Turboprop Aircraft Accidents – Accident Rate*

2018 Accident rate: 1.79
2014-2018 Accident rate: 3.20

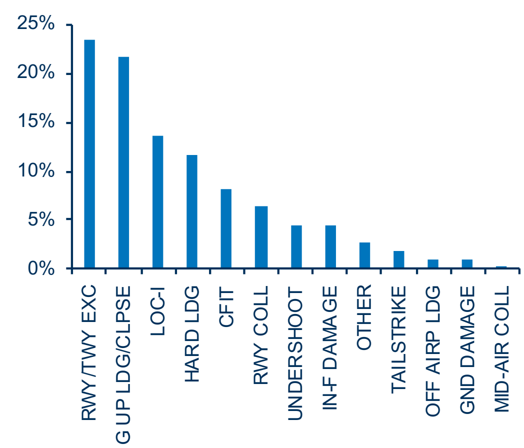
Accident Rate*	2018	'14-'18
IATA Member	2.51	2.09
Fatality Risk**	0.12	0.10
Fatal	0.60	0.76
Hull Losses	0.60	1.35

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 (2014-2018)

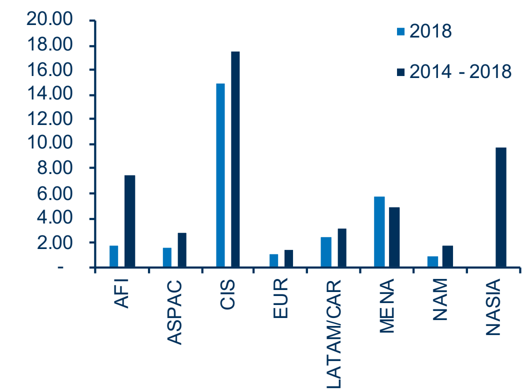
Distribution of accidents as percentage of total



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

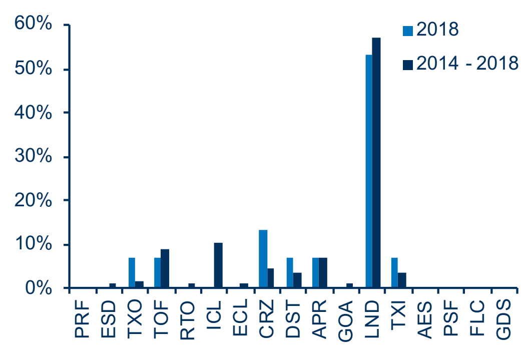
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



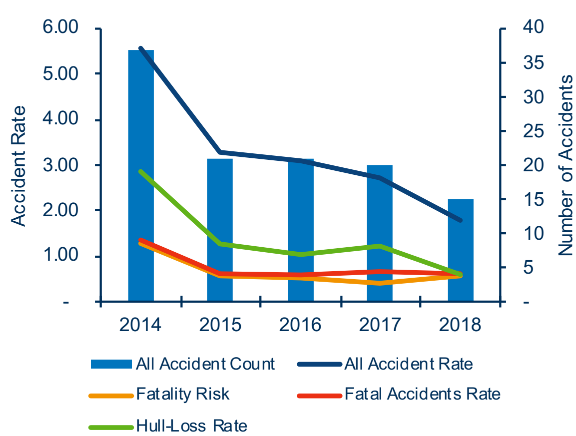
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used



> “In 2018, in 7 out of 8 regions, the accident rate increased compared to 2017. AFI was the only region to see the accident rate decrease.”

5

In-Depth Regional Accident Analysis

Following the same model as the in-depth analysis by accident category presented in Section 4, this section presents an overview of occurrences and their contributing factors broken down by the region of the involved operator(s).

The purpose of this section is to identify issues that operators located in the same region may share, in order 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).

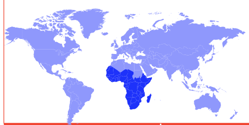
For example, if a Canadian-registered operator has an accident in Europe, this accident is considered a North American accident.

For a complete list of countries assigned per region, please consult Annex 1.

Image courtesy of Airbus

Africa Aircraft Accidents – Accident Count

2018	Number of accidents: 5	Number of fatalities: 11
2014-2018	Number of accidents: 41	Number of fatalities: 61



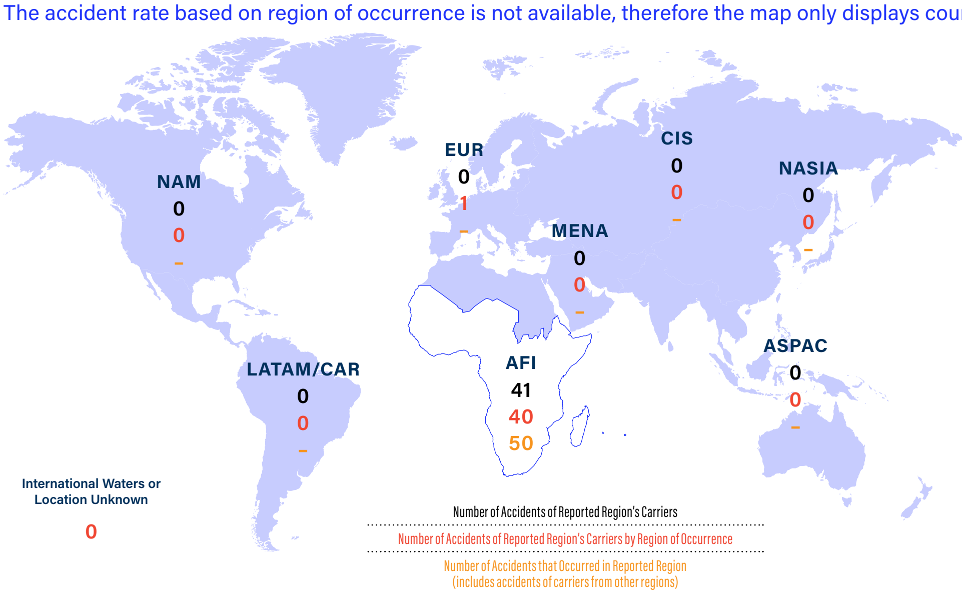
Accident Count % of Total	2018	'14-'18
IATA Member	20%	17%
Full-Loss Equivalents	40%	16%
Fatal	40%	17%
Hull Losses	40%	49%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	40%	60%	0%	60%	40%
2014-2018	54%	39%	7%	32%	68%

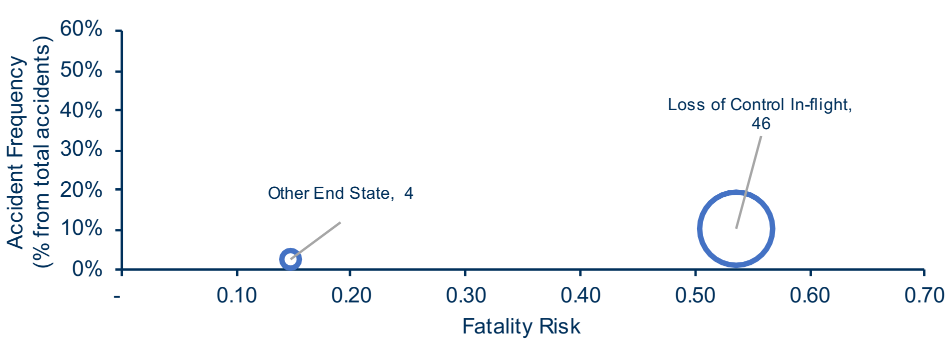
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
45%

Threats

Aircraft Malfunction:
35%

Flight Crew Errors

Manual Handling/Flight Controls:
20%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
25%

Countermeasure

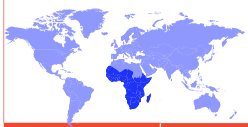
Overall Crew Performance:
20%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Africa Aircraft Accidents – Accident Rate*

2018 Accident rate: 2.71
2014-2018 Accident rate: 6.04



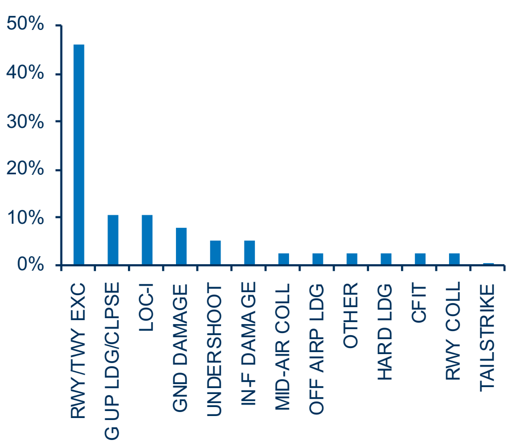
Accident Rate*	2018	'14-'18
IATA Member	1.51	2.57
Fatality Risk**	1.08	0.98
Fatal	1.08	1.03
Hull Losses	1.08	2.94

	Jet	Turboprop	
2018	3.80	1.90	Accident rates for Passenger, Cargo and Ferry are not available.
2014-2018	4.22	7.54	

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

Accident Category Distribution (2014-2018)

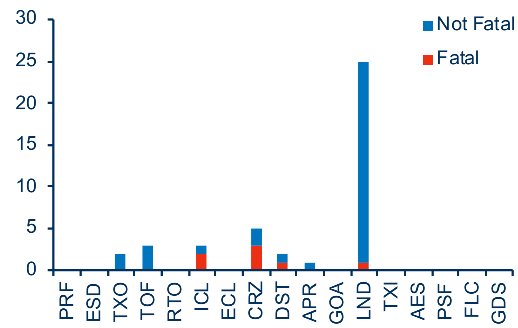
Distribution of accidents as percentage of total



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

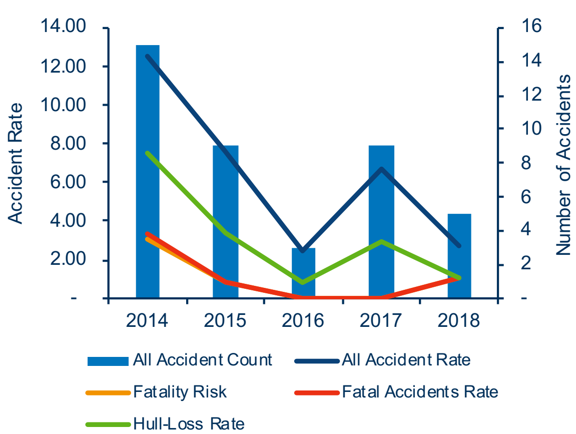
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



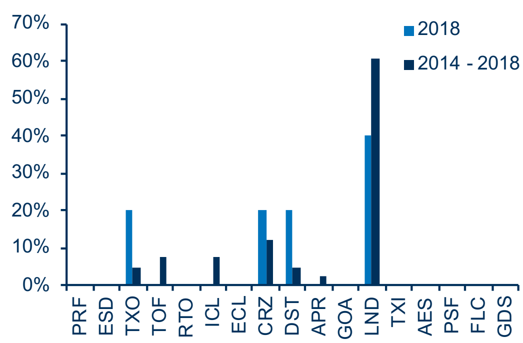
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



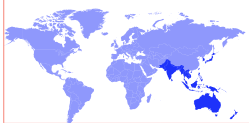
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Asia/Pacific Aircraft Accidents – Accident Count

2018	Number of accidents: 16	Number of fatalities: 241
2014-2018	Number of accidents: 77	Number of fatalities: 748



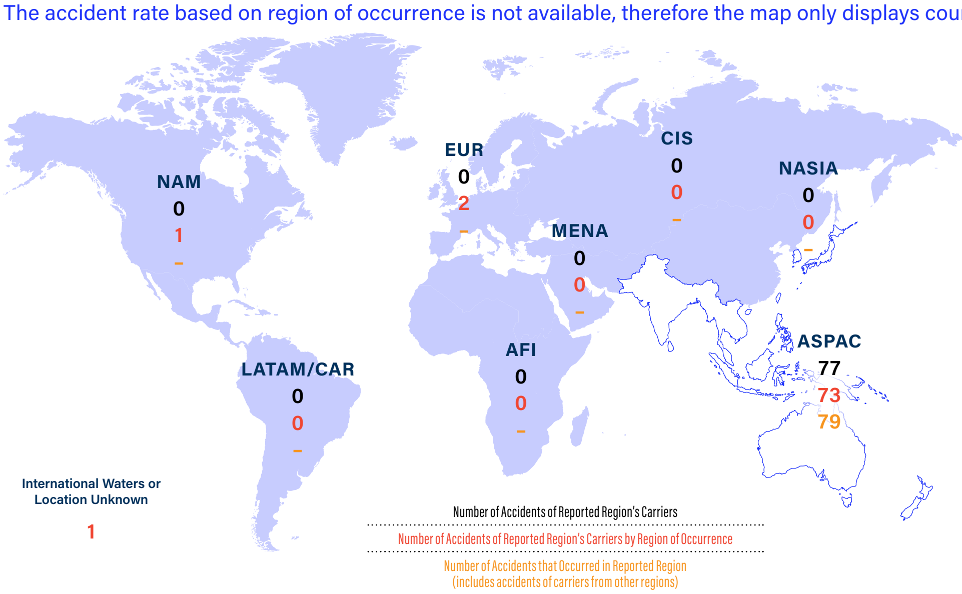
Accident Count % of Total	2018	'14-'18
IATA Member	50%	36%
Full-Loss Equivalents	11%	9%
Fatal	19%	12%
Hull Losses	19%	19%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	94%	6%	0%	81%	19%
2014-2018	88%	12%	0%	70%	30%

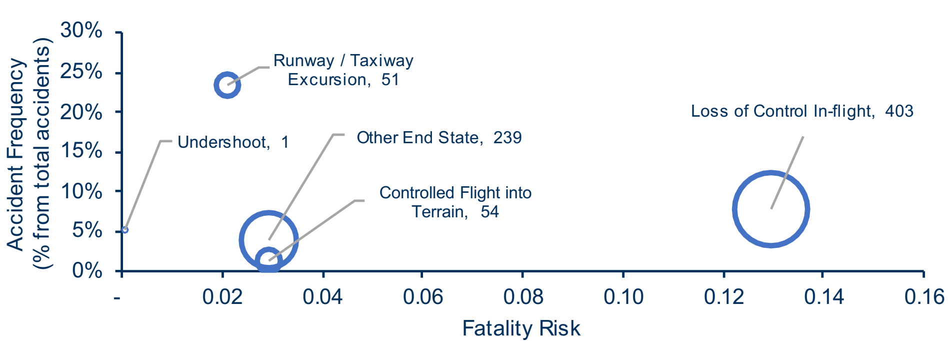
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
49%

Threats

Meteorology:
30%

Flight Crew Errors

Manual Handling/Flight Controls:
46%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
28%

Countermeasure

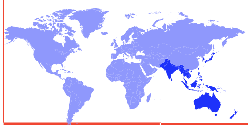
Overall Crew Performance:
30%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Asia/Pacific Aircraft Accidents – Accident Rate*

2018 Accident rate: 2.01
2014-2018 Accident rate: 2.26



Accident Rate*	2018	'14-'18
IATA Member	2.34	2.10
Fatality Risk**	0.22	0.21
Fatal	0.38	0.26
Hull Losses	0.38	0.44

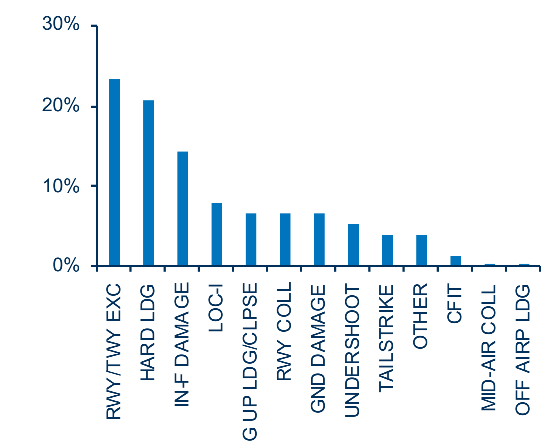
	Jet	Turboprop
2018	2.08	1.73
2014-2018	2.07	2.88

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 (2014-2018)

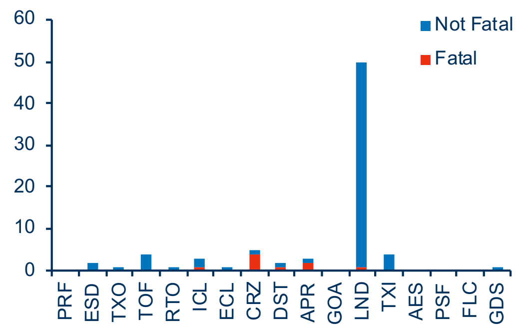
Distribution of accidents as percentage of total



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

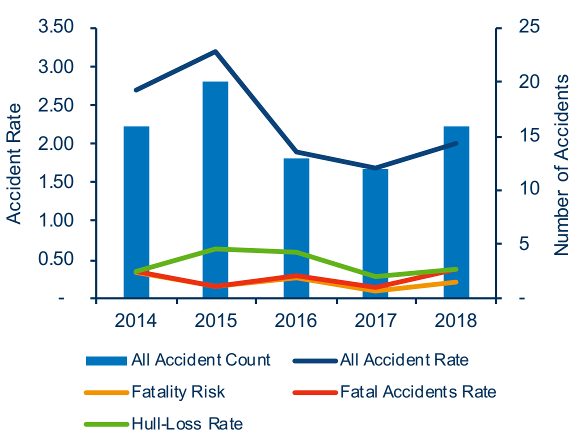
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



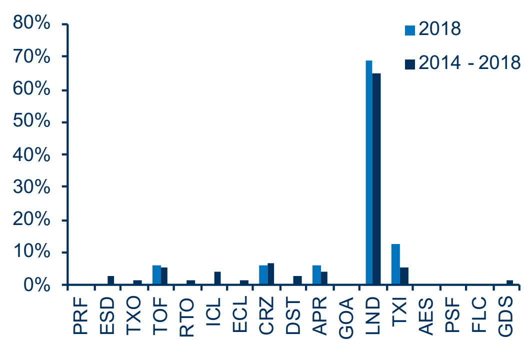
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



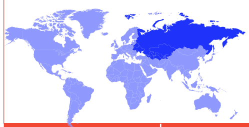
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Commonwealth of Independent States (CIS) Aircraft Accidents – Accident Count

2018	Number of accidents: 8	Number of fatalities: 91
2014-2018	Number of accidents: 28	Number of fatalities: 121



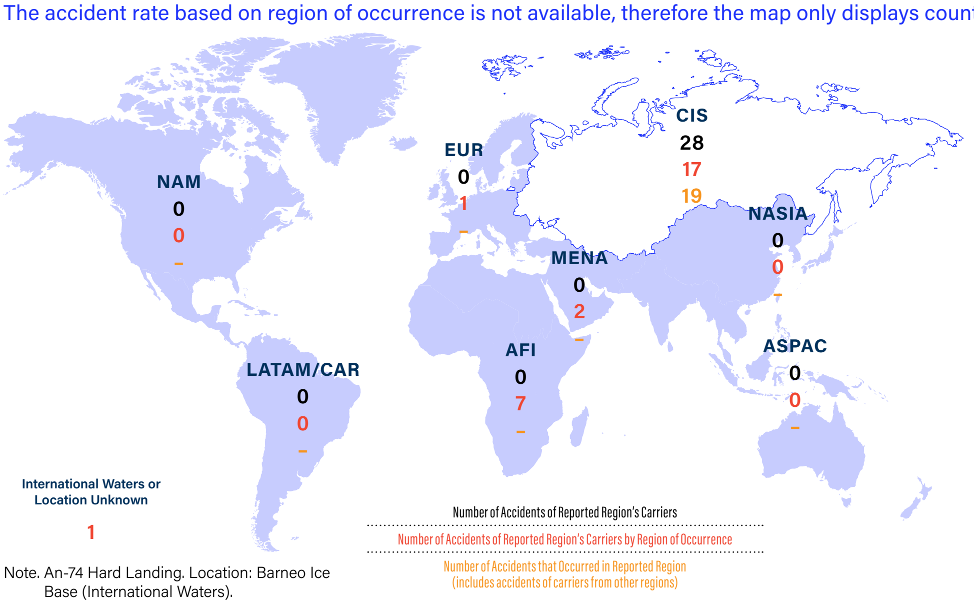
Accident Count % of Total	2018	'14-'18
IATA Member	38%	14%
Full-Loss Equivalents	23%	21%
Fatal	25%	25%
Hull Losses	38%	57%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	88%	13%	0%	75%	25%
2014-2018	61%	32%	7%	61%	39%

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

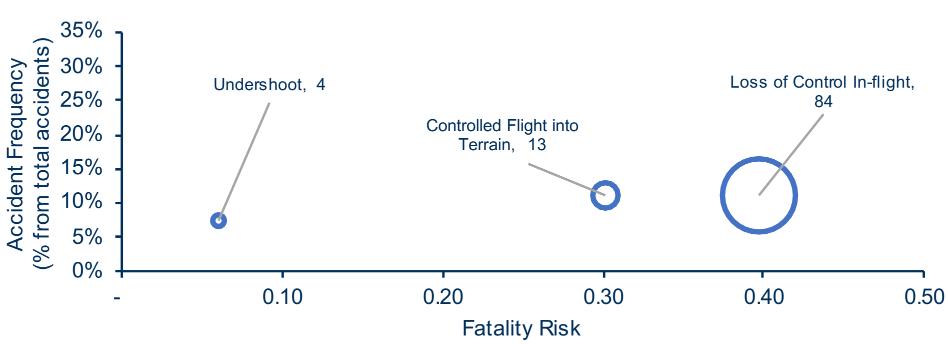
Number of Accidents per Region (2014-2018)

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



Note. An-74 Hard Landing. Location: Barneo Ice Base (International Waters).

Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Safety Management:
30%

Threats

Meteorology:
57%

Flight Crew Errors

Manual Handling/Flight Controls:
43%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
35%

Countermeasure

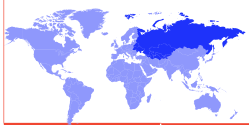
Overall Crew Performance:
26%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Commonwealth of Independent States (CIS) Aircraft Accidents – Accident Rate*

2018 Accident rate: 4.41
2014-2018 Accident rate: 4.22



Accident Rate*	2018	'14-'18
IATA Member	2.41	1.00
Fatality Risk**	1.03	0.89
Fatal	1.10	1.05
Hull Losses	1.65	2.41

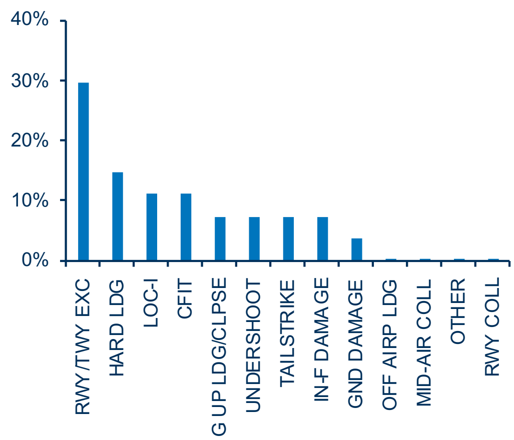
	Jet	Turboprop
2018	3.57	14.96
2014-2018	2.83	17.61

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 (2014-2018)

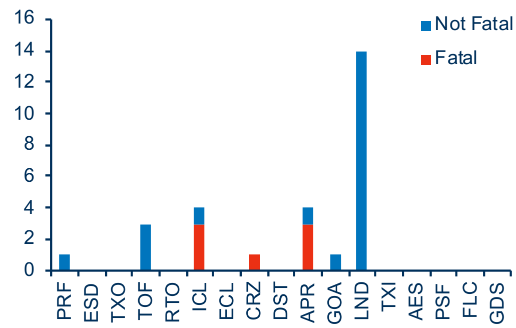
Distribution of accidents as percentage of total



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

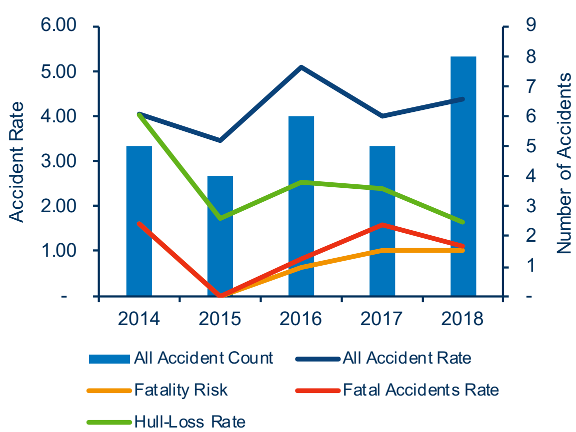
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



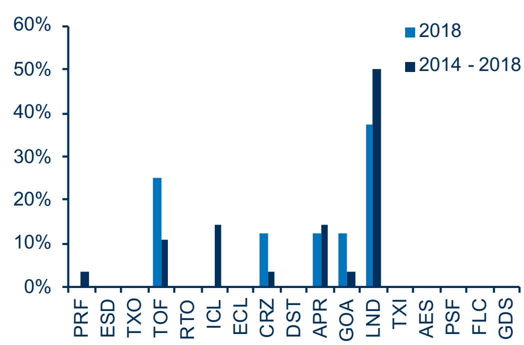
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



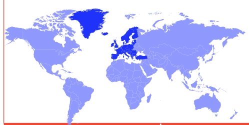
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Europe Aircraft Accidents – Accident Count

2018	Number of accidents: 9	Number of fatalities: 0
2014-2018	Number of accidents: 48	Number of fatalities: 122



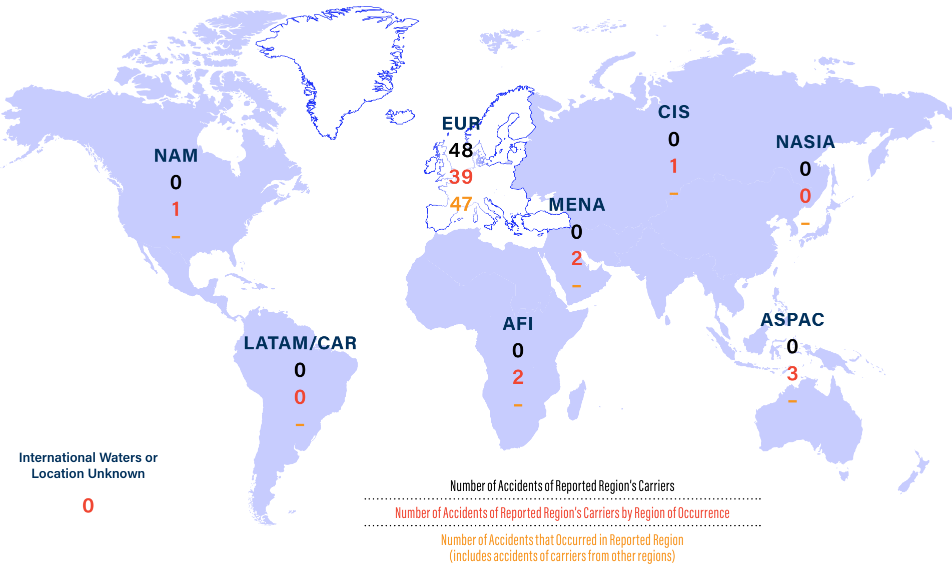
Accident Count % of Total	2018	'14-'18
IATA Member	56%	48%
Full-Loss Equivalents	0%	6%
Fatal	0%	6%
Hull Losses	0%	13%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	89%	11%	0%	67%	33%
2014-2018	85%	15%	0%	73%	27%

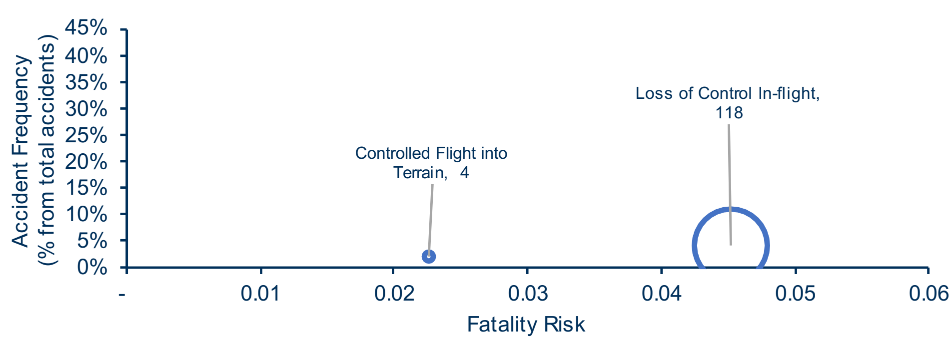
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Flight Operations:
23%

Threats

Meteorology:
36%

Flight Crew Errors

Manual Handling/Flight Controls:
43%

Undesired Aircraft State

Vertical/Lateral/Speed Deviation:
27%

Countermeasure

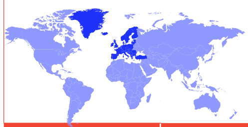
Overall Crew Performance:
32%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Europe Aircraft Accidents – Accident Rate*

2018 Accident rate: 0.87
2014-2018 Accident rate: 1.08



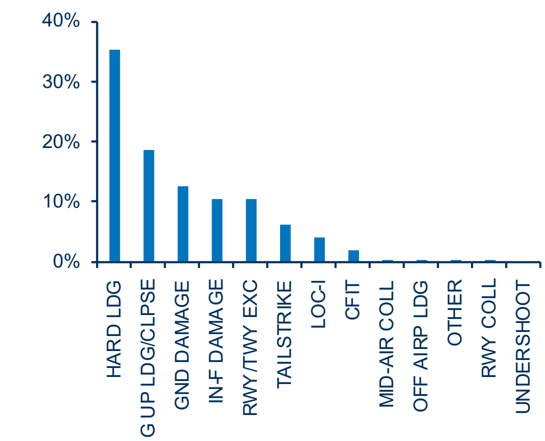
Accident Rate*	2018	'14-'18
IATA Member	1.00	1.02
Fatality Risk**	-	0.07
Fatal	-	0.07
Hull Losses	-	0.14

	Jet	Turboprop	
2018	0.76	1.22	Accident rates for Passenger, Cargo and Ferry are not available.
2014-2018	0.97	1.56	

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

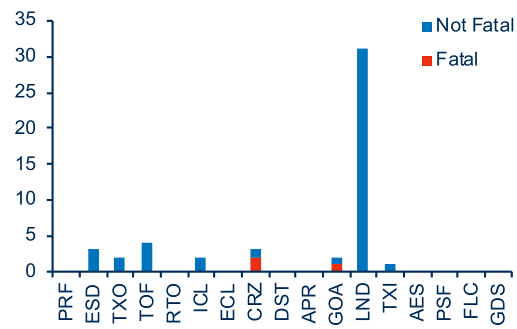
Accident Category Distribution (2014-2018)

Distribution of accidents as percentage of total



Accidents per Phase of Flight (2014-2018)

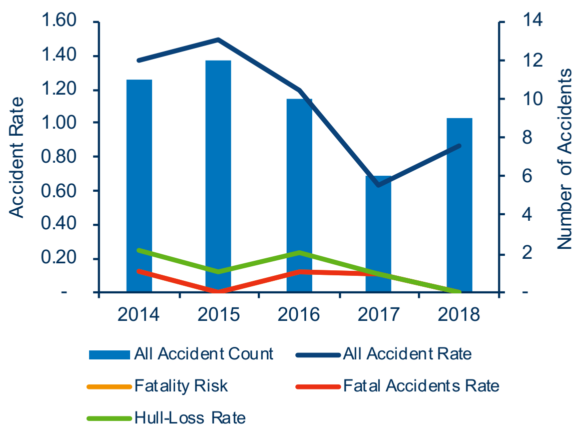
Total Number of Accidents (Fatal vs. Nonfatal)



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

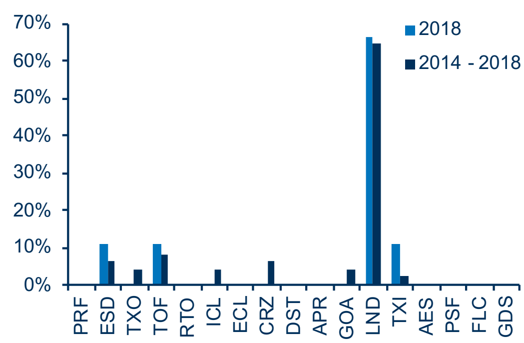
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



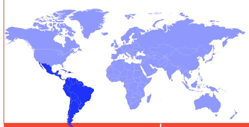
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Latin America & the Caribbean Aircraft Accidents – Accident Count

2018	Number of accidents: 8	Number of fatalities: 113
2014-2018	Number of accidents: 35	Number of fatalities: 189



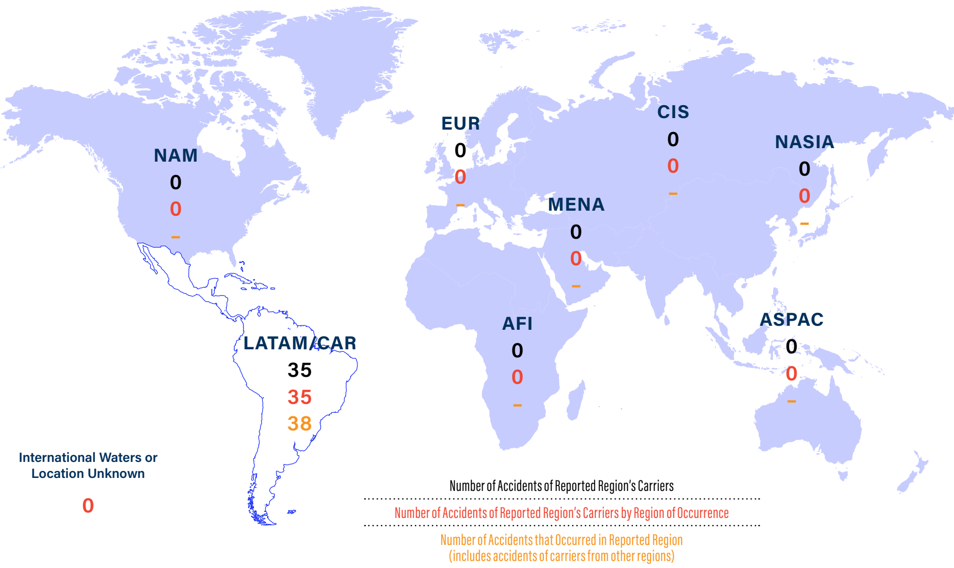
Accident Count % of Total	2018	'14-'18
IATA Member	13%	20%
Full-Loss Equivalents	12%	8%
Fatal	25%	11%
Hull Losses	25%	23%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	100%	0%	0%	75%	25%
2014-2018	77%	23%	0%	63%	37%

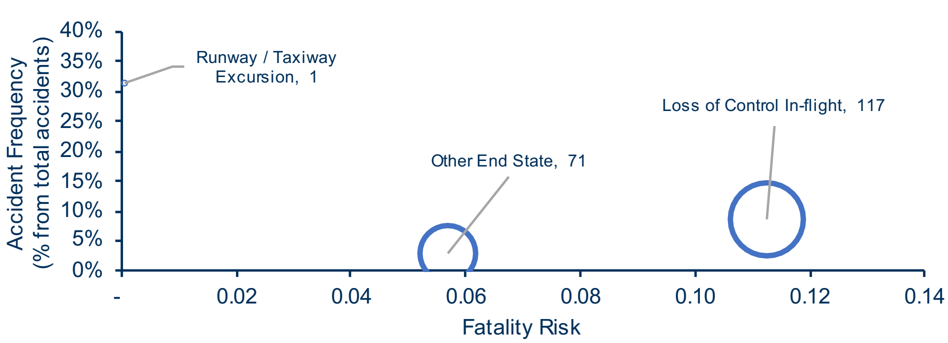
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Safety Management:
39%

Threats

Aircraft Malfunction:
43%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
21%

Undesired Aircraft State

Unnecessary Weather Penetration:
14%

Countermeasure

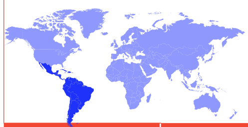
Overall Crew Performance:
18%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Latin America & the Caribbean Aircraft Accidents – Accident Rate*

2018 Accident rate: 2.33
2014-2018 Accident rate: 2.16



Accident Rate*	2018	'14-'18
IATA Member	0.46	0.66
Fatality Risk**	0.29	0.17
Fatal	0.58	0.25
Hull Losses	0.58	0.49

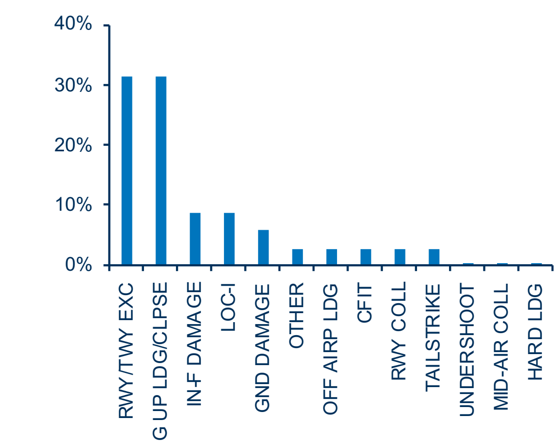
	Jet	Turboprop
2018	2.28	2.51
2014-2018	1.80	3.28

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 (2014-2018)

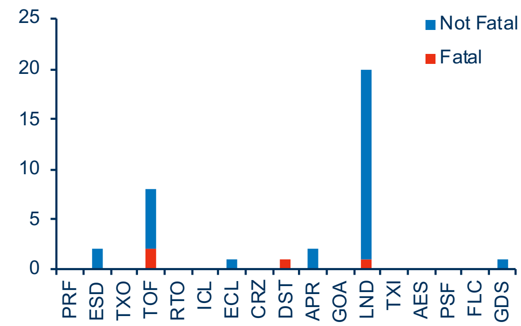
Distribution of accidents as percentage of total



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

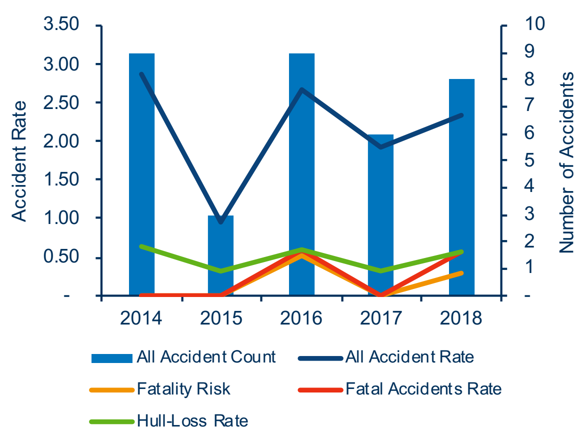
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



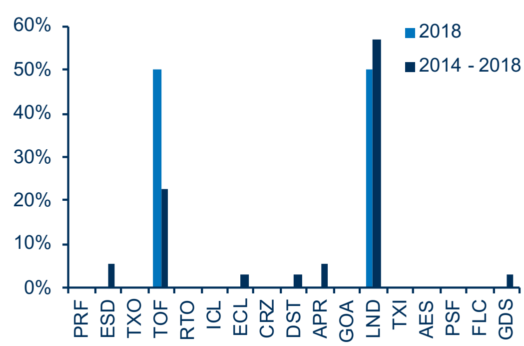
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



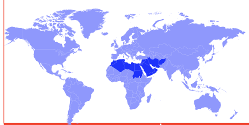
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



Middle East & North Africa Aircraft Accidents – Accident Count

2018	Number of accidents: 2	Number of fatalities: 66
2014-2018	Number of accidents: 21	Number of fatalities: 176



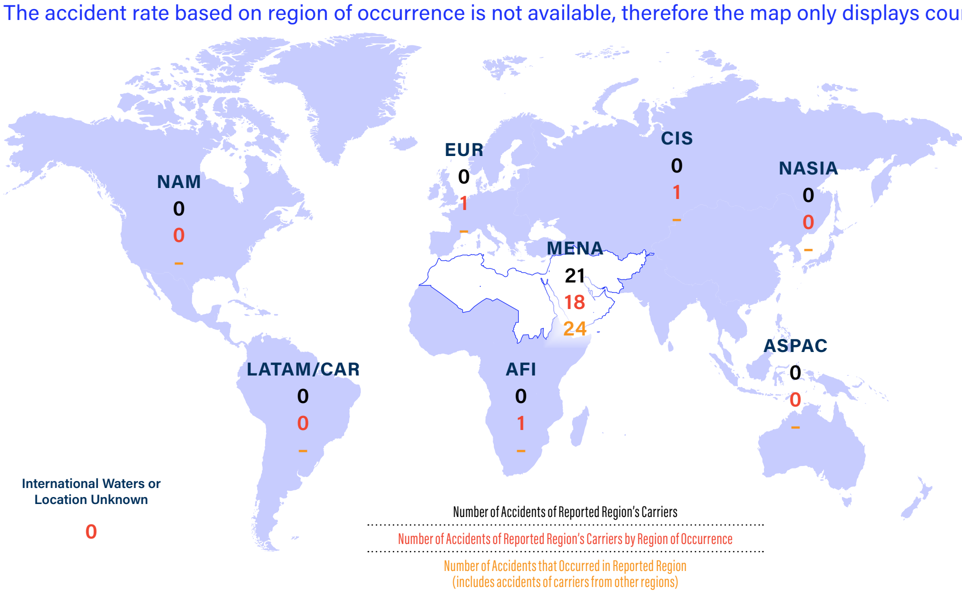
Accident Count % of Total	2018	'14-'18
IATA Member	50%	62%
Full-Loss Equivalents	50%	14%
Fatal	50%	14%
Hull Losses	50%	29%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	100%	0%	0%	50%	50%
2014-2018	95%	0%	5%	86%	14%

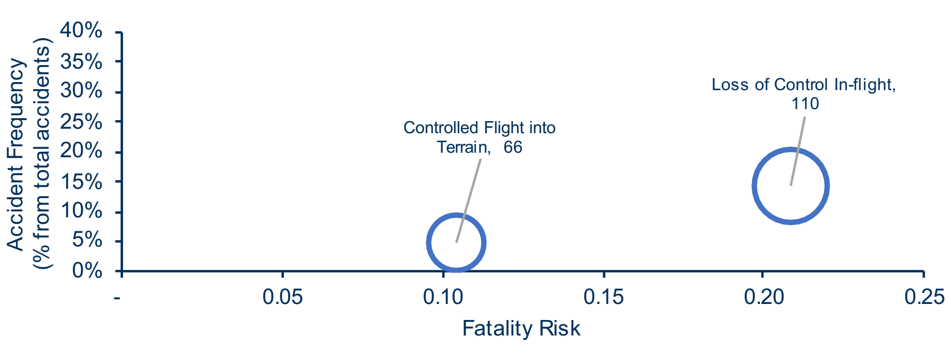
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Safety Management:
42%

Threats

Aircraft Malfunction:
47%

Flight Crew Errors

Manual Handling/Flight Controls:
37%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
21%

Countermeasure

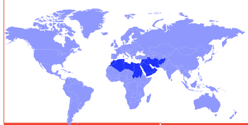
Monitor / Cross-check:
26%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Middle East & North Africa Aircraft Accidents – Accident Rate*

2018 Accident rate: 0.86
2014-2018 Accident rate: 2.19



Accident Rate*	2018	'14-'18
IATA Member	0.61	1.73
Fatality Risk**	0.43	0.31
Fatal	0.43	0.31
Hull Losses	0.43	0.63

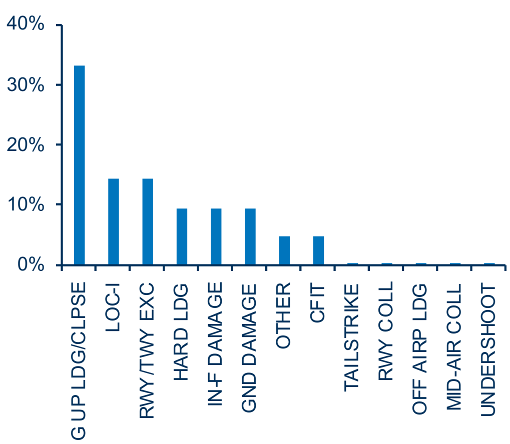
	Jet	Turboprop
2018	0.47	5.86
2014-2018	2.00	4.90

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 (2014-2018)

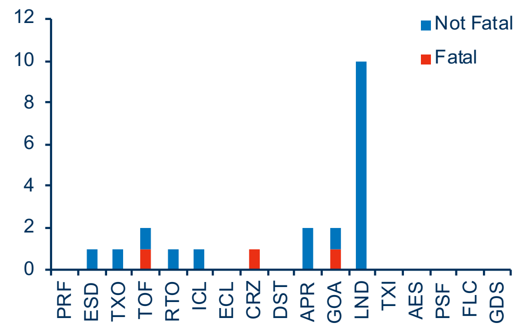
Distribution of accidents as percentage of total



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

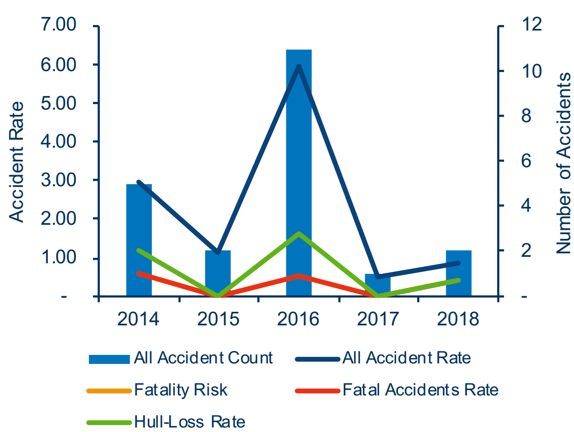
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



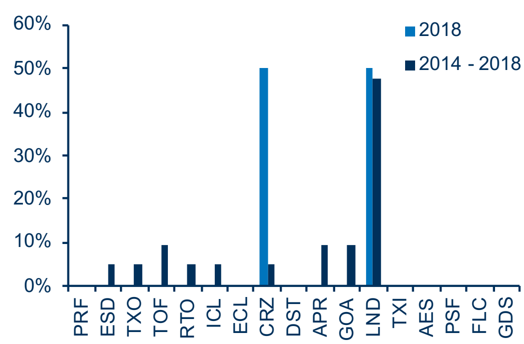
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



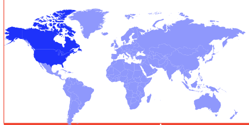
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



North America Aircraft Accidents – Accident Count

2018	Number of accidents: 12	Number of fatalities: 1
2014-2018	Number of accidents: 55	Number of fatalities: 9



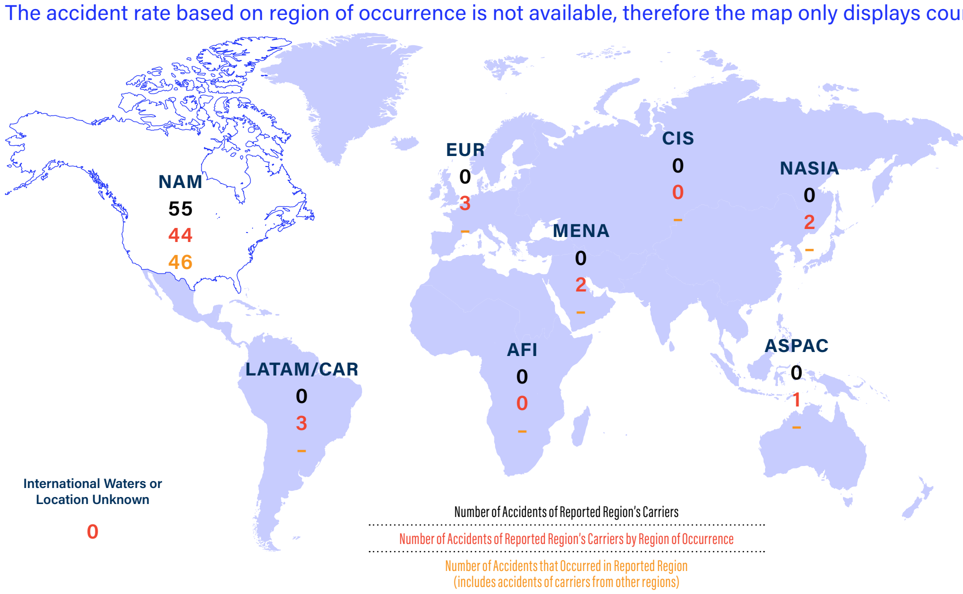
Accident Count % of Total	2018	'14-'18
IATA Member	42%	35%
Full-Loss Equivalents	0%	7%
Fatal	8%	11%
Hull Losses	8%	27%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	75%	25%	0%	83%	17%
2014-2018	75%	25%	0%	67%	33%

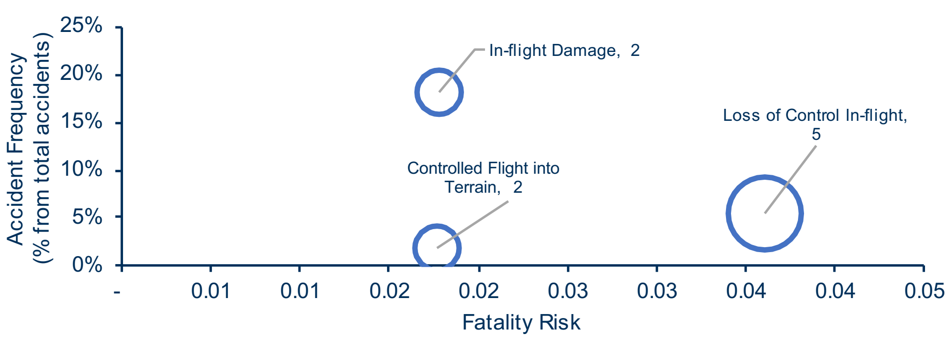
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
19%

Threats

Aircraft Malfunction:
38%

Flight Crew Errors

Manual Handling/Flight Controls:
23%

Undesired Aircraft State

Vertical/Lateral/Speed Deviation:
17%

Countermeasure

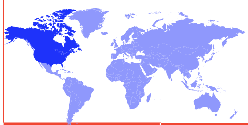
Overall Crew Performance:
17%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

North America Aircraft Accidents – Accident Rate*

2018	Accident rate: 1.00
2014-2018	Accident rate: 0.97



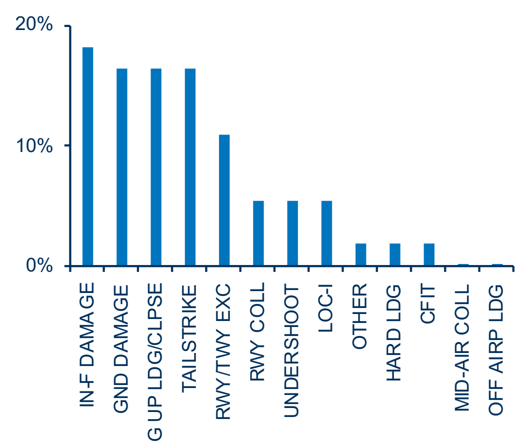
Accident Rate*	2018	'14-'18
IATA Member	1.01	0.86
Fatality Risk**	0.00	0.07
Fatal	0.08	0.11
Hull Losses	0.08	0.27

	Jet	Turboprop	
2018	0.99	1.04	Accident rates for Passenger, Cargo and Ferry are not available.
2014-2018	0.79	1.82	

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

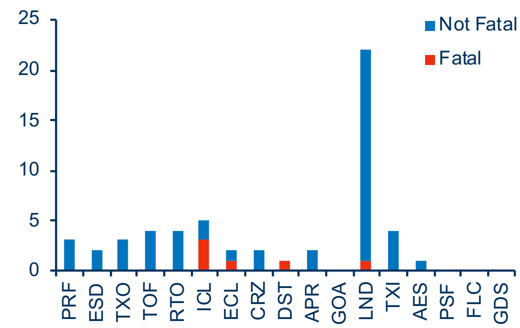
Accident Category Distribution (2014-2018)

Distribution of accidents as percentage of total



Accidents per Phase of Flight (2014-2018)

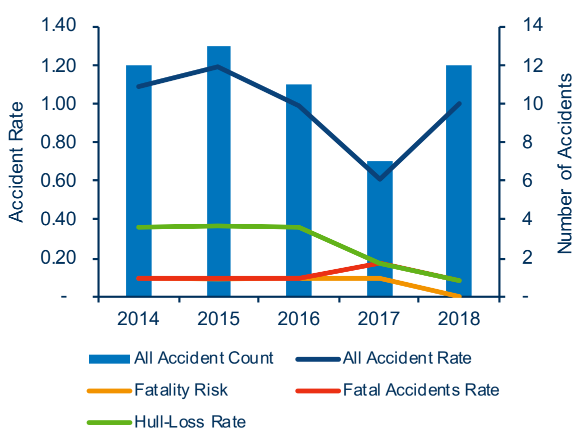
Total Number of Accidents (Fatal vs. Nonfatal)



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

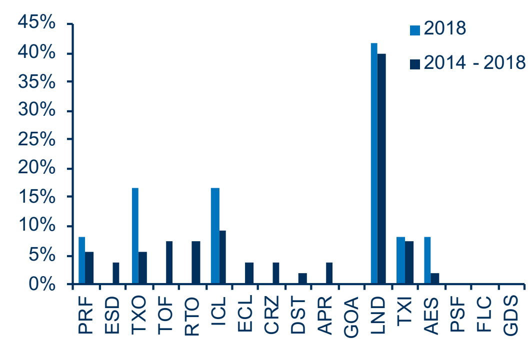
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



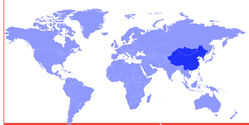
Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



North Asia Aircraft Accidents – Accident Count

2018	Number of accidents: 2	Number of fatalities: 0
2014-2018	Number of accidents: 11	Number of fatalities: 91



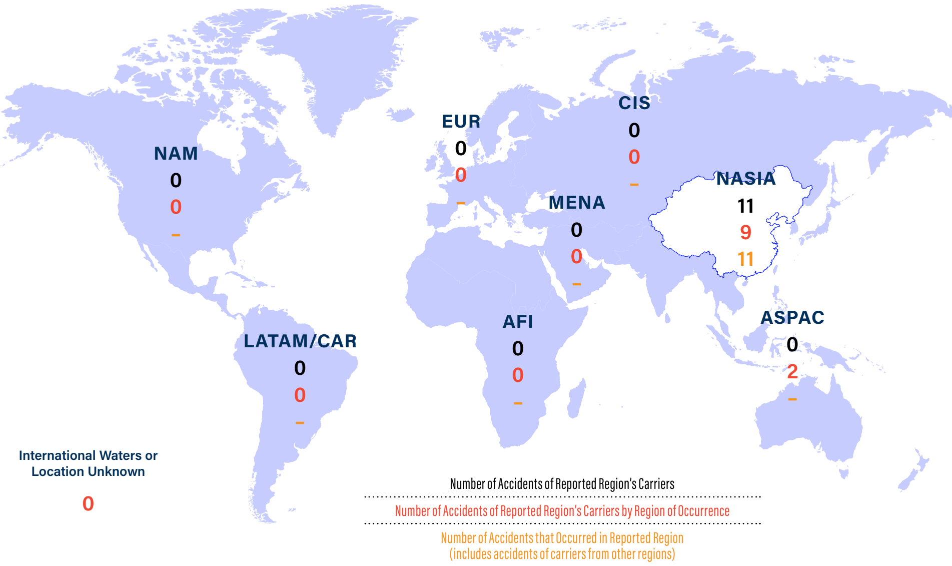
Accident Count % of Total	2018	'14-'18
IATA Member	100%	55%
Full-Loss Equivalents	0%	14%
Fatal	0%	18%
Hull Losses	0%	27%

	Passenger	Cargo	Ferry	Jet	Turboprop
2018	100%	0%	0%	100%	0%
2014-2018	82%	18%	0%	55%	45%

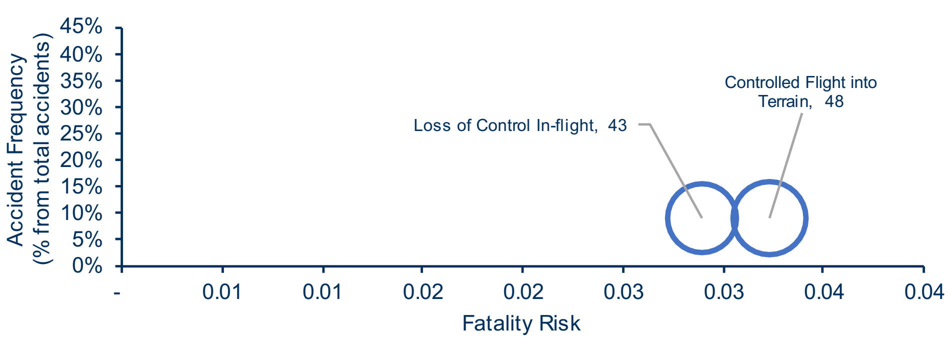
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2014-2018)

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



Accident Category Frequency and Fatality Risk (2014-2018)



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.

Top Primary Contributing factors

Latent Conditions

Flight Operations:
50%

Threats

Meteorology:
70%

Flight Crew Errors

Manual Handling/Flight Controls:
70%

Undesired Aircraft State

Abrupt Aircraft Control:
50%

Countermeasure

Monitor / Cross-check:
60%

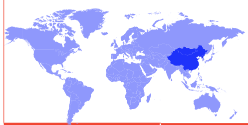
For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

North Asia Aircraft Accidents – Accident Rate*

2018 Accident rate: 0.32

2014-2018 Accident rate: 0.43



Accident Rate*	2018	'14-'18
IATA Member	0.40	0.28
Fatality Risk**	-	0.06
Fatal	-	0.08
Hull Losses	-	0.12

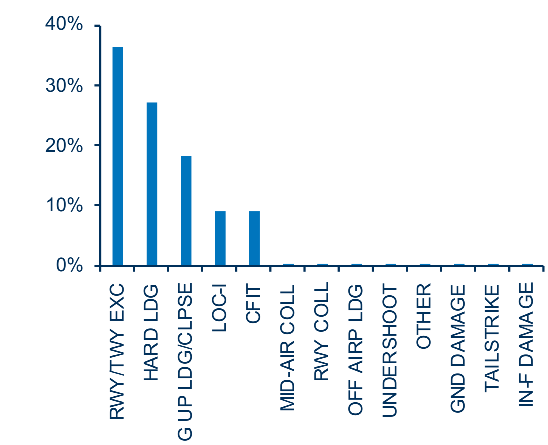
	Jet	Turboprop
2018	0.32	-
2014-2018	0.24	9,85

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 (2014-2018)

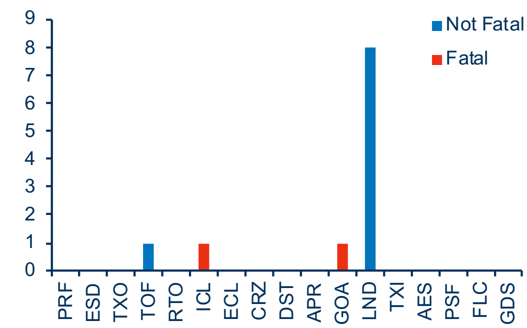
Distribution of accidents as percentage of total



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

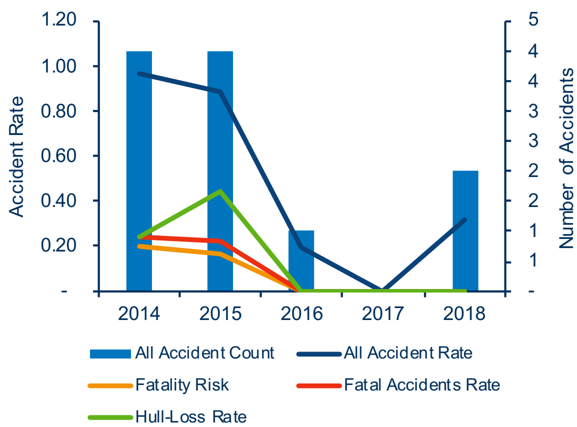
Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)



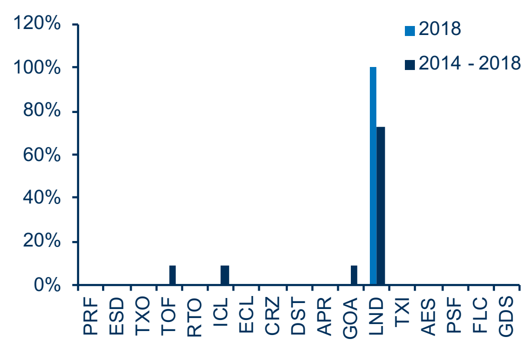
Regional Accident Rate (2014-2018)

Accidents per Million Sectors



Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



6

Analysis of Cargo Aircraft Accidents

2018 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	2,179	1	0.46	2	0.92	3	1.38
Passenger	25,115	6	0.24	38	1.51	44	1.75
Total	27,294	7	0.26	40	1.47	47	1.72

HL = Hull Loss SD = Substantial Damage

Note: Fleet Size includes both in-service and stored 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	1,254	2	1.595	4	3.19	6	4.78
Passenger	4,159	3	0.721	6	1.44	9	2.16
Total	5,413	5	0.924	10	1.85	15	2.77

HL = Hull Loss SD = Substantial Damage

Note: Fleet Size includes both in-service and stored 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

2018	Number of accidents:	9	Number of fatalities:	11
2014-2018	Number of accidents:	65	Number of fatalities:	105

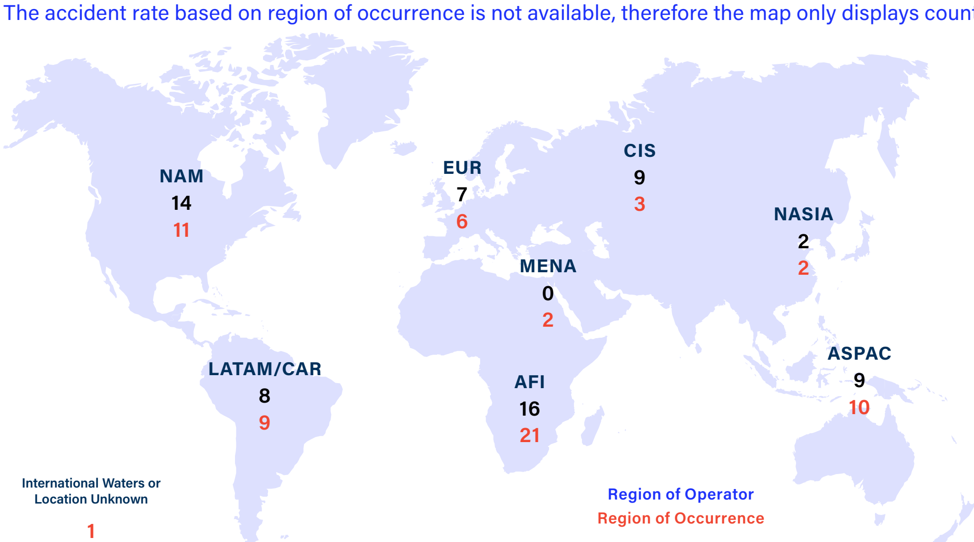
Accident Count % of Total	2018	'14-'18
IATA Member	0%	6%
Full-Loss Equivalents	22%	26%
Fatal	22%	29%
Hull Losses	33%	54%

	Jet	Turboprop
2018	33%	67%
2014-2018	40%	60%

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

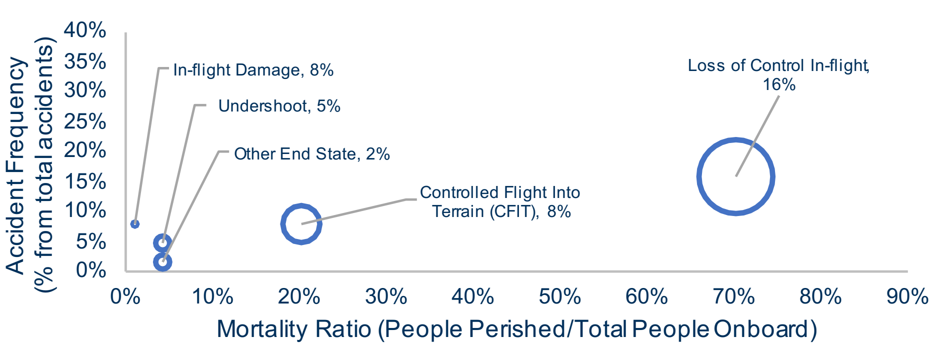
Number of Accidents per Region (2014-2018)

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



Note: An74 Hard Landing. Location: Barneo Ice Base (International Waters)

Accident Category Frequency and Fatality Risk (2014-2018)



Note: Since the sector count broken down by cargo flights is not available, rates could not be calculated. The 'fatality risk' rate was therefore substituted by a 'fatality ratio' value, which is the total number of fatalities divided by the total number of people carried. Although this removes the effect of the percentage of people who perished in each fatal crash, it can still be used as a reference to determine which accident categories contributed the most to the amount of fatalities on cargo flights. Accident categories with no fatalities are not displayed.

Top Primary Contributing factors

Latent Conditions

Regulatory Oversight:
32%

Threats

Meteorology:
39%

Flight Crew Errors

Manual Handling/Flight Controls:
36%

Undesired Aircraft State

Long/floated/bounced/firm/off-center/crabbed landing:
32%

Countermeasure

Overall Crew Performance:
25%

For more info regarding primary contributing factors, see Section 8.

➤ See detailed view

Cargo Aircraft Accidents – Accident Rate*

Accident rate*: –

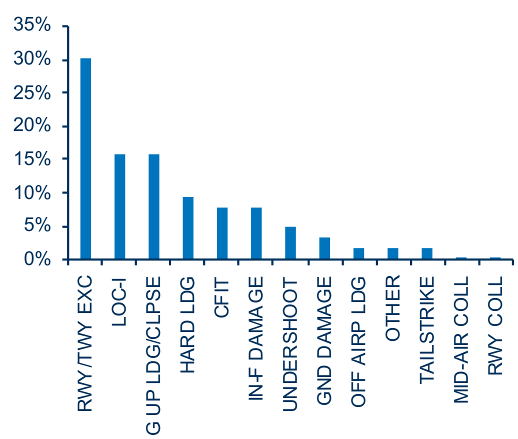
Accident Rate*	2018
IATA Member	-
Fatality Risk**	-
Fatal	-
Hull Losses	-

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 (2014-2018)

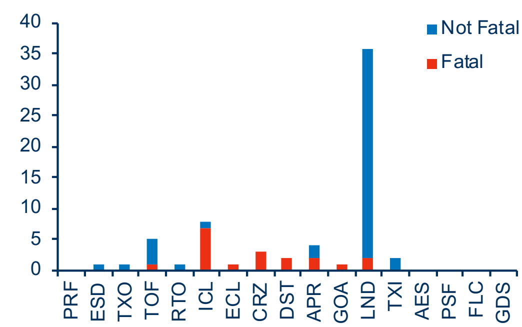
Distribution of accidents as percentage of total



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

Accidents per Phase of Flight (2014-2018)

Total Number of Accidents (Fatal vs. Nonfatal)

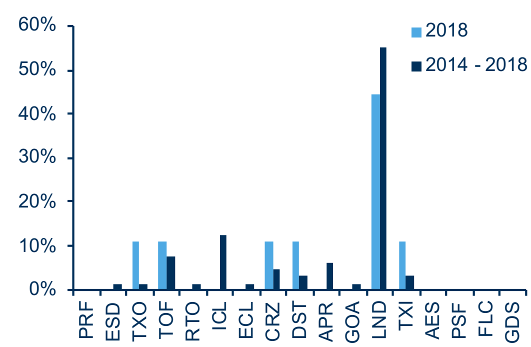


Five-Year Trend (2014-2018)

See Annex 1 for the definitions of different metrics used

Accidents per Phase of Flight (2014-2018)

Distribution of accidents as percentage of total



7

Cabin Safety

CABIN SAFETY

Cabin Safety is a broad subject, encompassing cabin ergonomics and design, normal and emergency operating procedures, cabin crew standards and requirements, continuous assessment of risks associated with on board products and services, rules and regulations, security requirements, unruly passenger management and injury prevention.

Everything in an aircraft cabin involves an underlying aspect of safety and there is always the potential for an abnormal situation to escalate into an emergency. This is why it is sometimes difficult to objectively measure the direct positive impact that cabin safety risk assessments, regulations, policies, procedures and training can have on safe operations.

An effective and integrated SMS within an airline will help ensure that safety is considered at all stages of on board service design. An effective and open safety culture will also give cabin crew the confidence to report safety incidents and errors, confident in the knowledge that these reports are used to enhance safety.

IATA's role within cabin safety is to keep airlines informed of regulatory changes, give advice on best practices as well as new and emerging issues, and act as a resource for assistance. IATA Cabin Safety continues to achieve these objectives using a variety of methods, communication tools and resources for airlines.

CABIN SAFETY PROMOTION

Safety promotion is a major component of SMS and the sharing of safety information is an important focus for IATA. The organization of global conferences and regional seminars brings together a broad spectrum of experts and stakeholders to exchange cabin safety information.

The global IATA Cabin Operations Safety Conference enters its sixth year in 2019 and has become an established and popular venue for the exchange of ideas and education of Cabin Safety specialists. The format of this event aims to educate and inform delegates with plenary and interactive workshops addressing the issues identified through IATA's activities as needing focus and attention.

IATA CABIN OPERATIONS SAFETY TECHNICAL GROUP

The IATA Cabin Operations Safety Technical Group (COSTG) was established to maintain a close working link with the operational environment. The members of COSTG are industry experts in the cabin safety environment and include safety investigators, policymakers, cabin crew trainers and safety auditors. A global representation of member airlines is maintained and membership is reviewed every two years.

The COSTG mandate includes reviewing and updating the IATA Operational Safety Audit (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.

During 2018, COSTG engaged with the international standards organization SAE International to further influence cabin design standards in the area of operational safety.

COSTF Members (2018-2019)

Lisa Mounce AMERICAN AIRLINES	Catherine Chan (Chair) CATHAY PACIFIC	Johnny Chin (Vice-Chair) SINGAPORE AIRLINES
Artem Fillipov AIR ASTANA	Anabel Brough EMIRATES AIRLINE	Lerato Luti SOUTH AFRICAN AIRWAYS
Christiane Raspa AIR CANADA	Jonathan Jasper (Secretary) IATA	Martin Ruedisueli SWISS INTERNATIONAL AIR LINES
Anne Frederique Houlbreque AIR FRANCE	Berry Ochieng' KENYA AIRWAYS	Carlos Mouzaco Dias TAP PORTUGAL
Gennaro Anastasio ALITALIA	Alexandra Wolf LUFTHANSA	Mary Gooding VIRGIN ATLANTIC AIRWAYS
Ruben Inion AUSTRIAN AIRLINES	Rosnina Abdullah MALAYSIA AIRLINES BERHAD	Sophie O'Ferrall VIRGIN AUSTRALIA
Matthew Whipp BRITISH AIRWAYS	Warren Elias QATAR AIRWAYS	

IATA CABIN OPERATIONS SAFETY BEST PRACTICES GUIDE (5th EDITION)

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. It is provided free of charge to IATA member airlines and available for purchase by others at the online IATA store.

This guide is updated annually by a global team of cabin safety professionals. It includes standards and recommended practices from IOSA, ICAO and other regulators, combined with the extensive operational experience of our member airlines. It also suggests and gives guidance on the appropriate risk assessments within cabin operations.

As with all safety-related reference documents, it is important to keep up-to-date with any changes and new requirements. This latest edition includes updated information in the following areas:

- Risk assessment relating to cabin layout and design
- Risk assessment relating to virtual reality equipment and cabin electronic flight bag
- Updated definition and response to unruly passenger incidents
- Procedures and best practices to help identify suspected trafficking in persons
- Procedures and best practices relating to crew protection during civil unrest and major incidents during layovers

HEALTH AND SAFETY GUIDELINES – PASSENGERS AND CREW

In the airline industry, health-related issues concerning passengers or crew are crucial in most activities: aircraft operations, passenger transport, cargo, etc. They cover matters as diverse as duty time limitations, transmission of communicable diseases, and disinfection.

IATA's Medical Advisory Group creates guidelines regarding the health and safety of passengers and crew, and regularly reviews the recommendations on the carriage of emergency medical equipment, medications and first aid kits. These guidelines and many others are available at: www.iata.org/health.

IOSA AND CABIN OPERATIONS SAFETY

The IOSA Standards Manual (ISM) includes Section 5 – Cabin Operations (CAB), which contains key elements of cabin safety, such as the IATA Standards and Recommended Practices (ISARPs) for:

- Management and control
- Training and qualification
- Line operations
- Cabin systems and equipment

These standards are reviewed annually by COSTG and updated where necessary to enhance the understanding and application of safety standards globally. For more information on IOSA and to download the latest version of the ISM, go to: www.iata.org/iosa.

ACCIDENTS – CABIN END STATES

This section of the 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 into or onto water.
- **Hull Loss/Nil Survivors:** Aircraft impact resulting in a complete hull loss and/or no survivors.

The factors contributing to most of the accidents detailed in the charts and graphs in this section are not attributed to cabin operations or the actions taken inside the cabin by the crew. The statistics do show, however, the result of an accident and highlight where cabin crew may have had a positive impact on the outcome and survivability of the aircraft occupants. These statistics can also be used to help airlines and training organizations to identify suitable practical training scenarios and training discussions.

Image courtesy of ATR

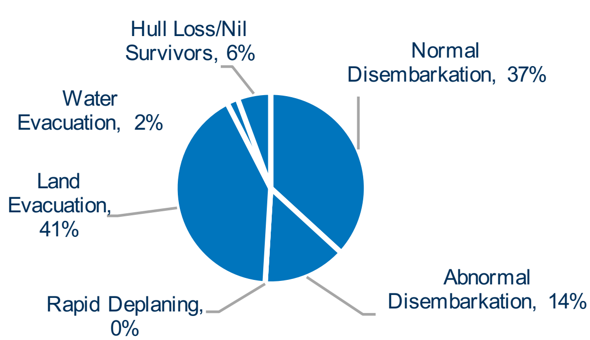
Cabin End States

	2018	2016-2018
Total 'Passenger-only' Accidents	53	135

The total number of accidents in 2018 was 53, up from 32 in 2017. Despite the increase, the small number of accidents makes it difficult to identify trends or patterns and draw conclusions; therefore, this figure is added to data from 2016 onwards. This three-year figure of 135 accidents is used in the following tables.

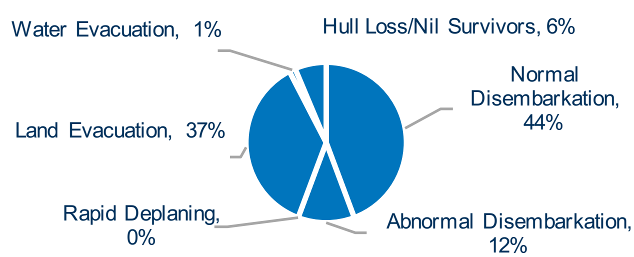
	2016-2018					
	Normal Disembarkation	Abnormal Disembarkation	Land Evacuation	Water Evacuation	Hull Loss/ Nil survivors	Total
All	39	15	44	2	6	106
IATA Member	26	5	13	1	2	47
IOSA-Registered	31	7	16	1	3	58
Fatal	0	1	4	2	6	13
Hull Loss	1	0	10	2	6	19
Jet	35	9	29	1	5	79
Turboprop	4	6	15	1	1	27

Cabin End State – Jet and Turboprop Aircraft



Overall, in 51% of accidents, passengers were able to disembark the aircraft in an orderly manner using boarding doors, either normally (37%) or abnormally (14%). Evacuation procedures were carried out in 43% of accidents. None of the reports were categorized using the Rapid Deplaning definition. This procedure is used as a precautionary measure in case a situation worsens. IATA recommends that airlines have such procedures included in their operations manuals, but it is more likely that this procedure would be used during a safety incident, rather than an accident.

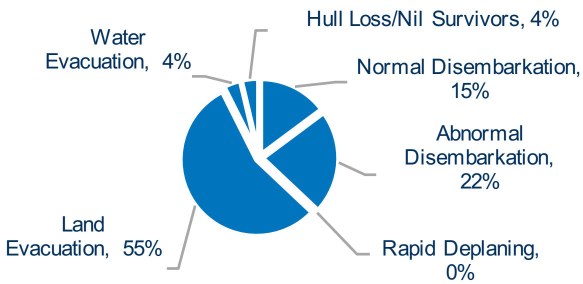
Cabin End State – Jet



In 56% of jet aircraft accidents, passengers were able to disembark the aircraft in an orderly manner using boarding doors, either normally (44%) or abnormally (12%). Evacuation procedures were carried out during 38% of accidents on jet aircraft.

The majority of passenger jet aircraft are typically larger than turboprops and, therefore, more likely to be fitted with escape slides. Where there is no immediate danger to the occupants, it is usually preferred to use normal disembarkation methods to protect from the risks involved in using evacuation slides or sliding off wings.

Cabin End State - Turboprop

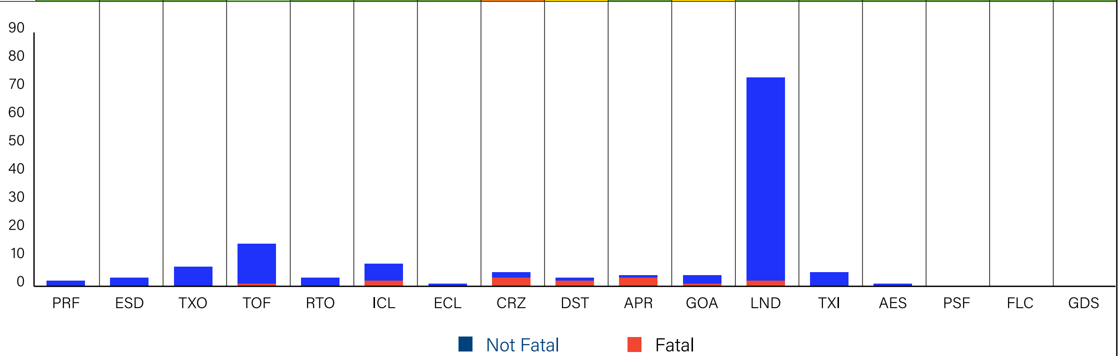


In turboprop aircraft accidents, normal disembarkation was possible in 15% of cases. Abnormal disembarkation methods were used in 22% of accidents, and 55% resulted in an evacuation on land.

On these smaller aircraft, evacuation to the ground is easier to facilitate as evacuation systems such as integral steps pose less risk to the occupants. The distinction between abnormal disembarkation and evacuation is, therefore, less apparent than in larger jet aircraft.

Cabin End States per Phase of Flight (2016-2018)

	PRF	ESD	TXO	TOF	RTO	ICL	ECL	CRZ	DST	APR	GOA	LND	TXI	AES	PSF	FLC	GDS
Total Accidents	2	3	7	15	3	8	1	5	3	4	4	74	5	1	0	0	0
Normal Disembarkation	50%	33%	71%	33%	0%	50%	100%	20%	33%	25%	50%	20%	40%	0%	0%	0%	0%
Abnormal Disembarkation	0%	33%	14%	7%	0%	25%	0%	0%	0%	0%	0%	14%	0%	0%	0%	0%	0%
Rapid Deplaning	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Land Evacuation	0%	0%	0%	13%	100%	13%	0%	0%	0%	25%	25%	47%	20%	0%	0%	0%	0%
Water Evacuation	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	0%	0%	0%	0%	0%	0%	0%
Hull Loss/Nil Survivors	0%	0%	0%	7%	0%	0%	0%	60%	33%	0%	25%	0%	0%	0%	0%	0%	0%



Total Accidents: 135

Note: please 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. The table's first row shows the total number of accidents for 2016-2018, while the table and chart below give some additional contextual information. Accidents that did not identify a phase of flight are not included in this set.

The critical stages of flight for cabin crew are taxi, takeoff and landing. During these stages of flight, cabin crew should be secured in their crew seats and carrying out a silent review of safety procedures to increase readiness for evacuation should the need arise (Ref: IATA Cabin Operations Safety Best Practices Guide section 12.6).

Accident End States and Cabin End States (2016-2018)

	Total	Normal Disembarkation	Abnormal Disembarkation	Rapid Deplaning	Land Evacuation	Water Evacuation	Hull Loss/ Nil Survivors
Runway / Taxiway Excursion	30	0	5	0	25	0	0
Gear-up Landing / Gear Collapse	15	0	6	0	9	0	0
In-flight Damage	13	10	2	0	1	0	0
Tail Strike	10	10	0	0	0	0	0
Hard Landing	9	7	0	0	2	0	0
Ground Damage	8	7	1	0	0	0	0
Loss of Control In-flight	8	0	0	0	4	0	4
Runway Collision	4	2	1	0	1	0	0
Other End State	3	1	0	0	1	0	1
Undershoot	3	1	0	0	1	1	0
Controlled Flight into Terrain	2	1	0	0	0	0	1
Off-Airport Landing / Ditching	0	0	0	0	0	0	0
Mid-Air Collision	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 operators with useful information for cabin crew training exercises and discussion. It shows, for example, that a runway excursion will likely result in a land evacuation or abnormal disembarkation and that cabin crew should always be prepared for such a situation upon landing. It also shows that gear collapse accidents resulted in nine land evacuation responses and six 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 cabin crew the tools they need to manage such rare situations.

Cabin Incidents

The analysis of cabin end states is a reactive review of cabin crew responses to accidents, which are typically outside of their control.

Cabin crew are tasked with managing safety in the cabin throughout every flight to prevent various situations from escalating into an emergency. As part of an effective SMS, cabin crew are encouraged to report low level incidents as well as near misses that did not result in an emergency situation.

Using the IATA GADM business intelligence tool STEADES, we are able to review and analyze incident reports to support cabin safety activities and direct resources toward areas that most need attention.

The following data includes high-level excerpts from recent analyses that were carried out by IATA Cabin Safety for incident reports from January to December 2017. This is the most recent full year of data available for analysis.

The full analysis reports and more recent safety data are available to GADM program members on the IATA GADM website.

UNRULY PASSENGER REPORTS

The rate of unruly passenger incidents is important to IATA as it helps identify where additional support to the industry can be provided. Annual analysis of these reports supports IATA's advocacy efforts to encourage governments to ratify the Montreal Protocol 2014 as well as support other initiatives to prevent unruly behavior.

There were 8,731 validated reports of unruly behavior identified within STEADES data during 2017. A total of 81 airlines submitted cabin-related data for 9,494,838 flights. This demonstrates a global rate of approximately 0.95 unruly passenger incidents per 1,000 sectors, or approximately one incident per 1,053 sectors operated. This demonstrates an increase over the previous year's rate of 0.73 per 1,000 sectors.

It is important to note that this number is likely to be a much lower rate than the actual global rate, as there are many reasons why participating airlines may not submit this data to STEADES, including for example:

- An airline may have a separate Security department handling unruly passenger incidents. These do not always submit data to STEADES.
- Some airlines do not record all incidents of unruly behavior within a safety database. Only reports that directly affect flight safety are required to be reported in an Air Safety Report. These reports represent high severity, low frequency incidents.
- Software changes at the airline level may occasionally delay the transfer of data from the airline to STEADES.

Where an airline opts to submit Cabin Safety Reports to STEADES in addition to Air Safety Reports, it is more likely that ALL incidents, including the low severity, high frequency incidents, are included.

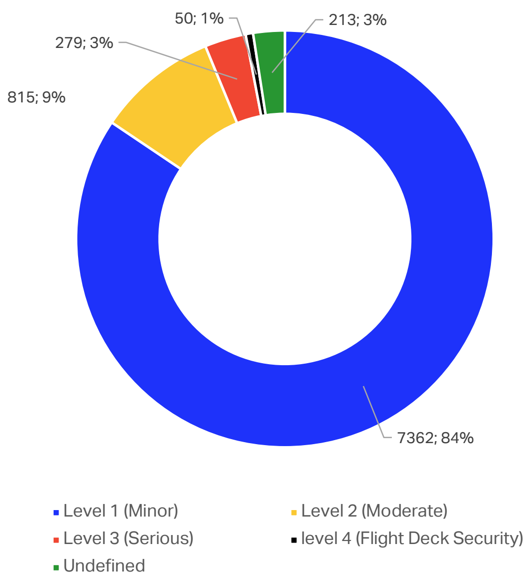
Levels of Unruly Behavior

For the purposes of this analysis, the IATA-established levels of disruptive behavior are levels 1 – 4, as follows:

Level 1 Minor	Level 2 Moderate
▪ Noncompliant with safety regulations and policies ▪ Suspicious behavior ▪ Boisterous/lively/excitable ▪ Argumentative	▪ Physically aggressive ▪ Obscene or lewd physical contact ▪ Causing damage to aircraft fixtures or equipment

Level 3 Serious	Level 4 Flight Deck Breach
▪ Dangerous ▪ Display of or use of weapon ▪ Intent or threat to injure	▪ Attempt to enter the flight deck ▪ Act of sabotage ▪ Credible threat of unlawful seizure of the aircraft

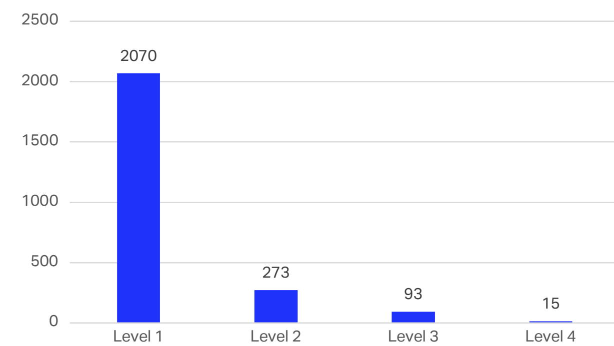
Level of behavior



Intoxication

There were 2,454 reports in which intoxication was identified. Of these, 381 (15.5%) demonstrated physical and/or dangerous behavior (levels 2, 3 and 4).

Intoxication – Behavior levels



Level 1 – This category includes verbal aggression to crew members or other passengers, noncompliance with safety regulations, such as smoking in the lavatories, refusing to comply with the fasten seatbelt signs and standing during taxi in to retrieve personal items. There were 7,362 Level 1 incidents, which accounted for 84% of the total reports.

While 3,289 (45%) of the incidents were relatively minor and resolved without further action identified within the report, 55% required further management. These included warnings to passengers (2,583), calling police or security services (1,741), offloading passengers before departure (995) and six instances where the aircraft diverted to offload an unruly passenger.

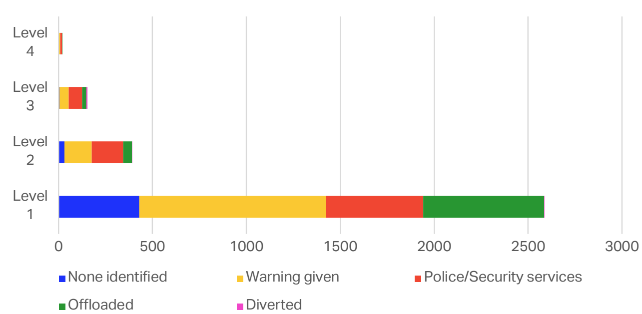
Level 2 – This category includes acts of physical aggression. There were 812 Level 2 reports, representing 9% of the total reports reviewed. Police or security services were called to assist in over half (59%) of Level 2 incidents.

Level 3 – This category includes serious unruly behavior, which could be interpreted as a direct threat to the safety of a person or the aircraft. It also includes reports of self-harm. There were 279 reports (3%) in this category.

Level 4 – This category includes the most serious incidents where flight deck security could have been, or potentially was, compromised. There were 50 incidents (1%) where passengers attempted to enter the flight deck or behaved in a manner in which the security of the flight was deemed to be compromised.

A formal level of response from the cabin crew was identified in 1,987 (81%) of these incidents:

Response to Intoxication



Note: The number of responses identified in the above graph is greater than the overall number of reports of intoxication. This is due to the cabin crew response types not being mutually exclusive. For example, cabin crew response to one incident may include a formal warning, police attendance and offload.

Key Findings

Key findings from the unruly passenger analysis include the following:

- Level 1 behavior is generally not a concern for the safe operation of the aircraft; nevertheless, cabin crew deal with the issue regularly, which can distract from safety duties and potentially add to their workload, stress and fatigue levels.
- While Level 1 behavior is predominantly verbal in nature, the narrative of some reports shows a considerable level of verbal assault aimed toward cabin crew members and airport staff.
- There has been a considerable increase in the rates of more serious levels of unruly passenger behavior (levels 3 and 4).
- There was a slight reduction in the number of passengers consuming their own alcohol onboard.
- Passengers travelling as part of a group often pose an increased risk of unruly behavior.
- Levels of passenger restraint remain consistent, with no significant increase or decrease compared to 2016 figures.
- Inappropriate behavior, including sexual harassment and inappropriate touching, is currently receiving growing media attention. This analysis shows that, where such incidents were reported to cabin crew, they were able to take appropriate action to segregate the alleged victim and offender and report the incident through the reporting system. However, many of the report narratives show that the alleged victim was not willing to take further action upon landing and/or the law enforcement authorities were not able to take the matter further.

CABIN INJURIES

It is often stated that turbulence is the leading cause of injuries onboard aircraft in nonfatal accidents; however only serious injuries that require hospitalization for 48 hours or more are required to be submitted to regulators and are deemed to be classified as an accident.

There are many other less serious injuries that occur on a daily basis onboard aircraft, which are not caused by operation of the aircraft itself.

Cabin crew report injuries sustained by passengers and crew onboard; however, not all of the contributing airlines submit these reports to STEADES. The data in the following analysis will likely, therefore, represent a small fraction of the total injuries that occurred onboard member airlines.

Within the STEADES database, a total of 3,473 incident reports relating to injuries sustained in the cabin were able to be identified during 2017; these occurred over 9,194,838 sectors operated by the airlines submitting cabin data. This represents an overall rate of 0.38 injury reports per 1,000 sectors or 1 report per 2,626 sectors. This is further broken down into the following rates for passengers and cabin crew, respectively:

	Injury Reports	Rate per 1000 Sectors	1 Report in XX Sectors
Passenger	1,348	0.15	6,821
Cabin Crew	2,148	0.23	4,281
Undefined	5	0.00	1,838,968
Total	3,501	0.38	2,626

Note that these numbers are not exclusive and some of the 3,473 incident reports indicated both passengers and crew members injured.

Passenger Injury

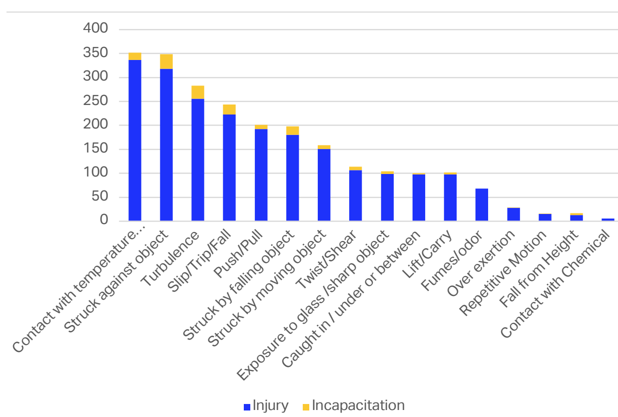
When taking into account the number of passengers carried over the flights operated by the participating airlines, it is likely that the reporting rate of passenger injury to the STEADES program is very low. This is often because Safety departments are not responsible for managing this data within airlines, or the airlines hold reports within a non-safety-related database. Nevertheless, from the data available, the most common types of passenger injury reported are:

- Burns and scalds caused by hot food/beverages (437 reports)
- Soft tissue injuries, e.g., small cuts and bruises (373 reports)

Cabin Crew Injury

Events of cabin crew injury or incapacitation are more likely to be recorded within the airline's safety database due to the direct impact on safety. There were 2,148 reports involving cabin crew, of which 9% reported that the cabin crew member was unable to continue their duties onboard.

Cabin crew incapacitation



Where the cause of cabin crew injury was identified, the two highest categories were:

- Contact with extreme temperature (e.g., burns and scalds): 337 injury + 15 incapacitation reports
- Struck against object: 318 injury + 31 incapacitation reports

Key Findings

The key findings of the cabin injury analysis were:

- The most common type of injury for passengers was burns/scalds.
- The most common type of injury for cabin crew was soft tissue injury.
- The most common cause of cabin crew incapacitation was fall from height, including falling down stairs from crew rest areas or stairways on double-deck aircraft.
- A substantial number of incapacitating cabin crew injuries occurred while the aircraft was parked; for example, during preflight preparations when cabin crew workload and time pressure are both high.
- The most severe injuries, which required turn back or diversion, included slips/trips/falls and striking against objects.
- 10% of cabin crew incapacitation events were attributed to turbulence encounters.

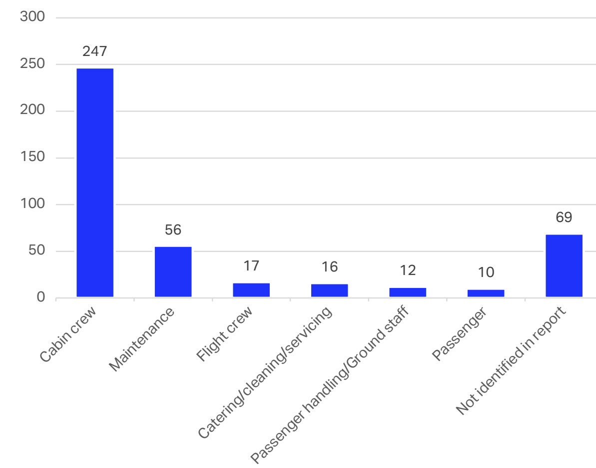
INADVERTENT SLIDE DEPLOYMENT

Accidental deployment of evacuation slides is an operational safety problem most typically caused by human error. Door design is intended to make operation easier; however, features vary between aircraft types and manufacturers.

The most recent GADM analysis relating to inadvertent slide deployment included 426 reports from 2015 to 2017.

The following workgroups were identified as the door operators during the slide deployment incidents.

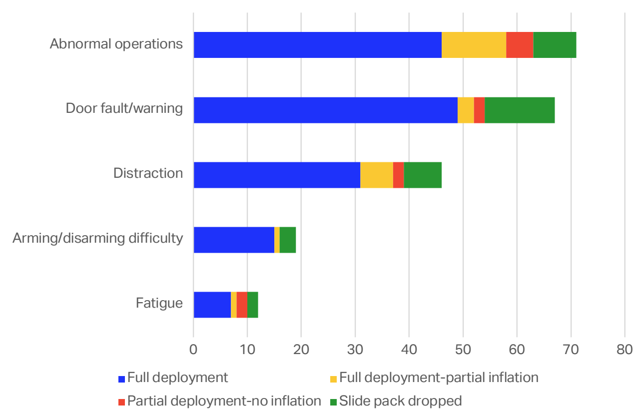
Doors operators



Threats

Deeper analysis of the report narratives was able to identify some of the contributing threats, as follows:

Threats leading to incidents of slide deployment



Abnormal operations happen infrequently. Some abnormal situations are not included in airline operations manuals and require cabin and flight crew to perform an immediate risk assessment and adapt procedures as safely as possible. There were 70 incidents where abnormal operations contributed to a slide deployment incident and 66% of these resulted in full deployment.

Door faults and electronic warnings were included in 66 (15%) of the 426 incidents of slide deployment. Faults were varied and included jammed girt bars, jammed arming levers, door/slide pressure warnings and faulty micro switches giving false information to aircraft monitoring systems. In some cases, the slide was deployed while maintenance staff investigated the fault.

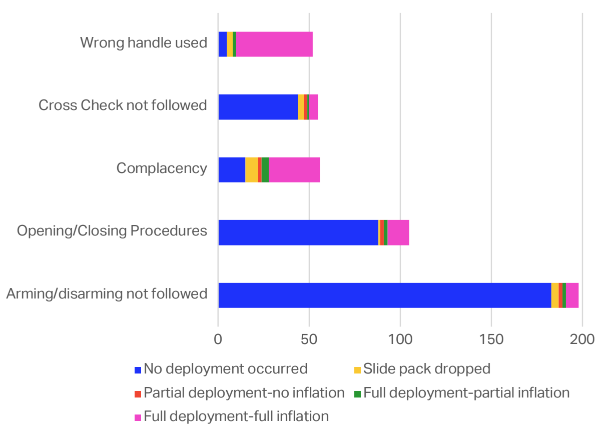
Cabin crew's safety workload is greatly increased while the aircraft is on the ground. Pressure to minimize turnaround times means that cabin crew are tasked with working rapidly to ensure the aircraft can return to the air as quickly as possible. Door opening, arming and disarming all take place during a period of increased cabin crew workload and, at the same time, passengers are more likely to need assistance (e.g., during boarding or disembarkation). Distraction was indicated in 46 (11%) of slide deployment incidents.

Errors

As these incidents of slide deployment were unintentional, each report was read to identify any errors made by the door operator. Many of the door operators simply used the wrong handle when disarming the door for arrival, inadvertently grasping the door operation handle instead. Such actions were usually carried out subconsciously and with speed, leaving little time for corrective action to be taken.

Complacency was identified as a key error resulting in a high number of slide deployment incidents.

Errors and consequences



Conclusions and Recommendations

There are many different factors that contribute to inadvertent slide deployment and, with very few exceptions, they are unintentional acts. A nonpunitive safety culture seeks to identify the contributing factors surrounding the human errors and focuses on preventing similar errors from occurring in the future.

IATA has produced guidance in the Cabin Operations Safety Best Practices Guide that is aimed at prevention of inadvertent slide deployments. Section 10, Aircraft Door Safety, includes guidance aimed at optimizing SOPs regarding communication, cross-checking, abnormal operations and crew training.

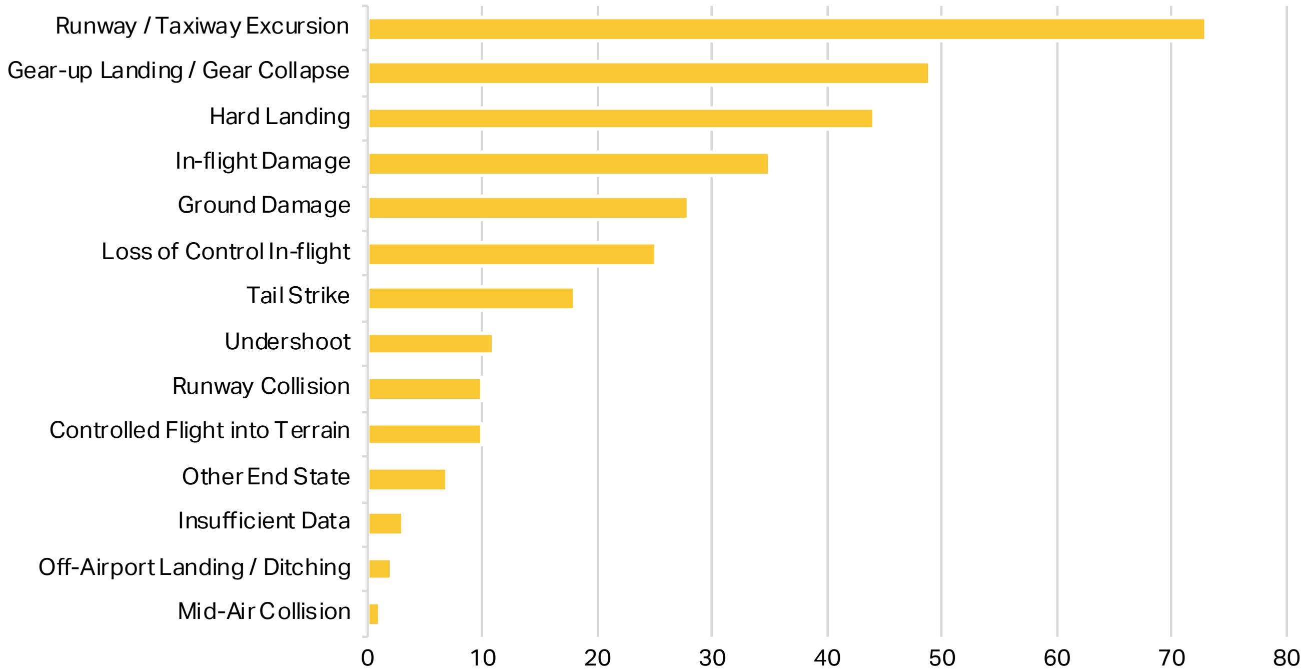
The majority of inadvertent slide deployment incidents are attributed to cabin crew and the most common error is selecting the wrong handle when attempting to disarm the slide upon arrival. This is a basic error in the human and mechanical interface. While procedures are usually aimed at preventing this type of error, training and awareness are also required on a regular basis to help prevent complacency, especially where the arming/disarming lever is positioned close to the door operating handle.

8

Report Findings

TOP FINDINGS: 2014-2018

Covering a five-year period, the 2014-2018 Accident End State Distribution, as assigned by the Accident Classification Technical Group (ACTG), was as follows:

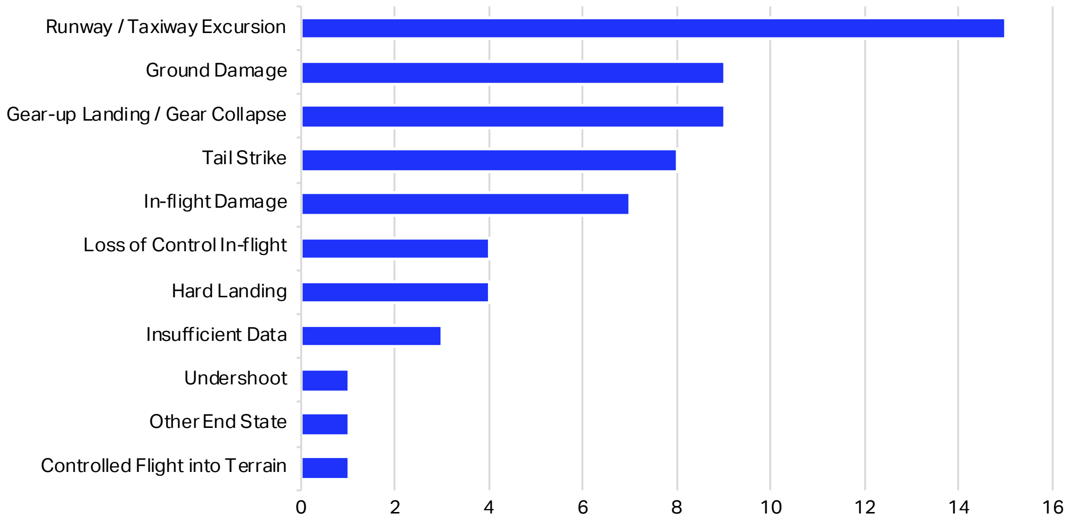


2014-2018 Accident End State Distribution

Preliminary analysis of 2018's accident statistics, both individually and against the five-year average trend, has yielded mixed results. In the critical area of all-accident numbers, replicating 2017's exceptional performance would always be challenging; however, IATA members continued to outperform non-IATA members, with an accident rate more than two times better over the 2014-2018 period (1.03 v. 2.19 per million flights). This translated into two fatal accidents in 2018, which caused 67 fatalities.

TOP FINDINGS: 2018

The Accident End State Distribution of the 62 accidents that occurred in 2018, as assigned by the ACTG, was as follows:



2018 Accident End State Distribution

The accident end states with associated fatalities in 2018 were:

- Loss of Control - In-flight (3) with 372 fatalities
- Controlled Flight into Terrain (1) with 66 fatalities
- Runway Excursion (2) with 52 fatalities
- In-flight Damage (1) with one fatality
- Undershoot (1) with one fatality
- Insufficient data for the ACTG to designate an end state (3) with 31 fatalities

With a full breakdown of each accident end state to follow, the table below provides an overview of 2018's performance compared to the five-year average.

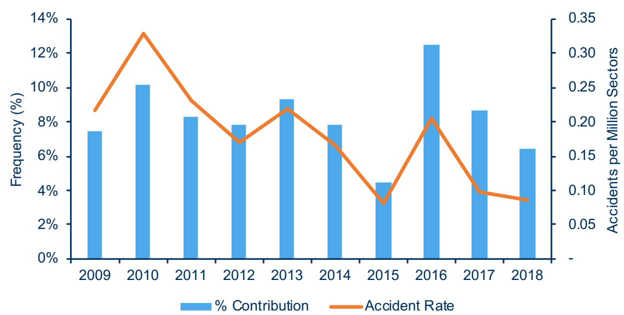
2018 vs 2014-2018

	2018	Comparison vs 5Y	5 Y Average (2014-2018)
Number of accidents	62	▼	63.2
% of accidents involving IATA members	42%	▲	34%
% of fatal accidents	18%	▲	13%
% aircraft propulsion - Jet	76%	▲	64%
% aircraft propulsion - Turboprop	24%	▼	36%
% type of operations - Passenger	85%	▲	78%
% type of operations - Cargo	15%	▼	21%
% Hull losses	19%	▼	28%
Top 3 phases of flight - All accidents	Landing - 55%	▼	Landing - 57%
	Takeoff - 13%	▲	Takeoff - 9%
	Cruise - 6%	▲	Initial Climb - 6%
Top 3 phases of flight - Fatal accidents	Cruise - 36%	▲	Cruise - 27%
	Landing - 18%	▲	Initial Climb - 24%
	Approach - 18%	▲	Approach - 12%

Loss of Control - In-flight

Loss of aircraft control while in flight. The expected flight path could not be maintained, or a stall that was not recovered.

From 2014 to 2018, 25 Loss of Control - In-flight (LOC-I) accidents have caused a total of 926 fatalities. The four LOC-I accidents in 2018 resulted in 372 fatalities. Described another way, in 2018, LOC-I accounted for 6% of accidents, but resulted in 71% of the onboard fatalities. As such, LOC-I has retained its status of having a high fatality risk. Of the four accidents, one operator was an IOSA-accredited airline (Boeing 737-800 operator).



Percentage of all accidents attributed to LOC-I, 2009-2018

The following are descriptions of the four LOC-I accidents in 2018 using the available investigation information:

1. A Boeing 737-800 lost height and crashed into the sea during initial climb, resulting in a hull loss and 189 fatalities. Preliminary investigation found incorrect readings from one of the angle of attack sensors, which could cause the aircraft's trim system to make uncommanded trim nose down. This "could cause the flight crew to have difficulty controlling the airplane, and lead to excessive nose-down attitude, significant altitude loss, and possible impact with terrain."[1]

   - In late 2018, Boeing released Operator's Manual Bulletin TBC-19 describing an angle of attack failure condition, and a multi-operator message highlighting the pitch augmentation system, the Maneuvering Characteristics Augmentation System.

   - The Federal Aviation Administration (FAA) released an Emergency Airworthiness Directive (AD 2018-23-51) concerning all Boeing 737 MAX aircraft that required an update to the procedures in the Aircraft Flight Manual and reinforced that flight crew should follow their documented procedures.

   While the investigation is ongoing, the ACTG categorized this accident's contributing maintenance elements in both the threat category: dispatch/paperwork and maintenance events, and latent conditions as Maintenance Operations (Ops): Standard Operating Procedures (SOPs) and checking, Design, and Maintenance Ops: Training systems.

2. An Embraer 190 suffered an engine failure at or around V1 (not confirmed), during the takeoff run, resulting in a hull loss and zero fatalities. The investigation determined the aircraft reached 30ft AGL on takeoff before losing speed and altitude, impacting the ground 2,150m down the runway and colliding with runway edge lights. The right-hand engine contacted the ground and both engines detached. The aircraft overran the runway and eventually came to rest 500m beyond and slightly to the left of the runway extended centerline; it was subsequently destroyed by fire.

   The final report released in February 2019 concluded that *"The aircraft impacted the runway as a result of loss of control in the final stages of the takeoff due to wind shear at low height causing a loss of speed and lift."*[2] The investigation designated contributing factors to both flight crew and air traffic services, which included (not exhaustive):

   - Decreased situational awareness by the crew (the commander provided unauthorized instruction to, and assigned pilot flying duties to, a pilot not certified)

   - Lack of adherence to sterile cockpit procedures and operating procedures

   - Non-detection of airspeed indicator fluctuations on the primary flight display during the takeoff run

3. A Boeing 737-200 lost height and crashed shortly after takeoff, resulting in a hull loss and 112 fatalities. The aircraft was destroyed by the impact and post-impact fire after it lost control and crashed immediately after takeoff. Witnesses described the aircraft suddenly veering right after takeoff and descending into the ground. No official findings had been released at the time of writing.

4. An Antonov 148-100 was destroyed after impacting terrain, resulting in a hull loss and 71 fatalities. After an apparently normal takeoff, the aircraft climbed to around 6,500ft before descending to approximately 6,000ft. The aircraft seems to have briefly levelled off before entering a steep descent that continued until impact with the ground. There was no distress call.

   Preliminary findings released by the investigation agency found: *"Based on the analysis of the recorded data and the studies of similar accidents in past, it could be concluded that the in-flight emergency situation might have been caused by the incorrect speed readings shown on the cockpit instrument panel, which in their turn could be related to the Pitot probes' iced condition with the heating system set to OFF."*[3] The investigation is ongoing.

The ACTG found no common threats between 2018's LOC-I accidents. Coded threats included adverse weather conditions, spatial disorientation, as well as complex aircraft systems and systems degradations. Where these threats were not managed by the flight crew, they manifested as flight crew errors, of which there were some common themes. Non-compliance with SOPs (intentional and unintentional) was determined in three of the four accidents. Manual handling errors/flight controls and pilot-to-pilot communication were evident in two of the accidents.

Undesired aircraft states are defined as flight crew-induced states that reduce safety margins, but are still considered to

1 Follow-up link

2 Follow-up link
3 Follow-up link.

be recoverable. Perhaps surprisingly, given the current global perception of flight crew's degrading handling skills, automation dependency was only considered present in one accident. Common across the three coded accidents was vertical/lateral speed deviations and operations outside of aircraft limitations. Of the others, the following undesired aircraft states were noted:

- AN148-100 was destroyed after impacting terrain from the cruise: abrupt aircraft control
- E190 veered off and overran runway after a rejected takeoff: unnecessary weather penetration
- B737-800 lost height after takeoff and crashed into the sea: manual handling/flight controls

Countermeasures across the LOC-I accidents found that in-flight decision-making and overall crew performance were a recurrent theme and, if demonstrated, may have caused a different outcome.

Linked to the outcomes are the organizational deficiencies (latent conditions). Common to all the coded LOC-I events was Flight Operations (FOPs): SOPs and checking highlighting the importance of robust training systems. Parallel to this precursor, FOPs: Training systems was designated in two of the accidents, while Regulatory Oversight and Safety Management were coded against three of the accidents.

The IATA publication Loss of Control - In-flight, Beyond the Control of Pilots, 1st Edition, Section 3.2 Management – Some Considerations describes the responsibilities for LOC-I at an organizational level, and states:

"Management decisions may not have an immediate effect on the outcome of every flight, but potentially they can play a role in an accident long before it occurs.

LOC-I accidents do not conform to a clear pattern and there have been multiple different reasons why pilots have lost control of their aircraft. These include:

- *Flawed maintenance practices leading to system malfunctions*
- *Inadequate flight crew selection and training standards (e.g., behavioral deficiencies, lack of training with respect to illusions, high g-load environment, managing unexpected situations)*
- *Operating procedures (e.g., erosion of manual flying skills or deficiencies in handling automation)*
- *Environmental conditions (e.g., meteorological phenomena that can cause aircraft upsets)*
- *Air traffic environment (e.g., wake vortices)*

If there is a common factor in LOC-I accidents, it appears to be the 'startle-factor', when the situation facing the pilot is unexpected and/or unrecognized and he/she is unable to devise and implement a solution in the time available." [4]

Further reading can be found here.

The following pilot competencies were identified as weak countermeasures to manage the threats and errors, and to recover from the undesired aircraft state:

- Aircraft flight path management, manual control 3
- Application of procedures 3
- Communication 2
- Leadership and teamwork 2
- Problem-solving and decision-making 2
- Situational awareness 2
- Aircraft flight path management, automation 1
- Workload management 1

ACTG Categorization of 2018 LOC-I Accidents

AN148-100 was destroyed after impacting terrain from cruise, resulting in a hull loss and 71 fatalities

Latent Conditions	Dispatch Ops: SOPs and checking Safety management Regulatory oversight Ground Ops: SOPs and checking FOPs: SOPs and checking
Threats	Icing conditions Ground events Spatial disorientation Minimum Equipment List (MEL) item
Errors	Intentional Systems/Radios/Instruments Normal checklists Pilot-to-pilot communication Manual handling/flight controls Callouts Unintentional
Undesired Aircraft States	Operations outside aircraft limits Systems Abrupt aircraft control Vertical/lateral speed deviation
Countermeasures	Monitor/cross-check Overall crew performance In-flight decision-making

4 Follow-up link

E190 veered off and overran runway after rejected takeoff and burst into flames, resulting in a hull loss and 0 fatalities

Latent Conditions	Selection systems Regulatory oversight FOPs: SOPs and checking Safety management FOPs: Training systems
Threats	Lack of visual reference Wind/Wind shear/Gusty wind Thunderstorms Other
Errors	Intentional Pilot-to-pilot communication Unintentional
Undesired Aircraft States	Unnecessary weather penetration Operations outside aircraft limitations
Countermeasures	In-flight decision-making Captain's leadership Overall crew performance FO assertiveness Safety management

B737-800 lost height shortly after takeoff and crashed into sea, resulting in a hull loss and 189 fatalities

Latent Conditions	Maintenance Ops: SOPs and checking MNT Ops: Training Safety management Design Change management FOPs: SOPs and checking FOPs: Training systems Selection systems
Threats	Avionics/Flight Instruments Dispatch/Paperwork Manuals/Charts/ Checklists Maintenance events
Errors	Manual Handling/Flight Controls Unintentional
Undesired Aircraft States	Flight Controls/Automation Vertical/Lateral/Speed Deviation
Countermeasures	Nil

B737-200 lost height and crashed shortly after takeoff, resulting in a hull loss and 112 fatalities

Latent Conditions	Safety Management Regulatory Oversight Selection Systems
Threats	Nil
Errors	Nil
Undesired Aircraft States	NIl
Countermeasures	NIl

Summary of LOC-I events, with common categorizations

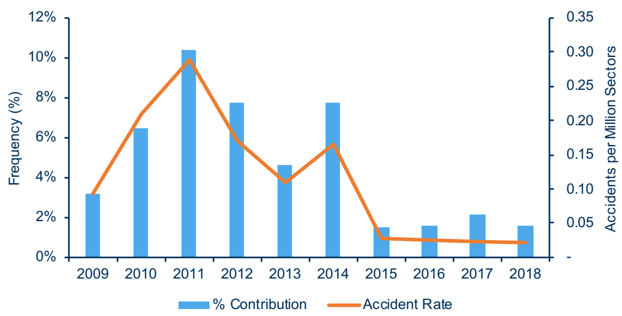
Latent Conditions	Safety management Regulatory oversight FOPs: SOPs and checking Regulatory oversight Selection systems
Threats	No common threats
Errors	Intentional Unintentional Pilot-to-pilot communication Manual handling/flight controls
Undesired Aircraft States	Operations outside aircraft limitations Vertical/lateral speed deviation
Countermeasures	Overall crew performance In-flight decision-making

Controlled Flight into Terrain

In-flight collision with terrain, water or obstacle without indication of loss of control. Cases where an aircraft hits an obstacle (e.g., power lines) on final approach, performs a go-around and successfully lands will also count towards Controlled Flight into Terrain (CFIT).

Over the last five years, from 2014 to 2018, 10 CFIT accidents have caused a total of 187 fatalities, 90% of these on turboprop aircraft. In 2018, CFIT represented 9% of total fatal accidents and caused 13% of fatalities. In 2018, one accident was categorized as CFIT, which caused 66 fatalities. Preliminary analysis confirmed that the operator was an IOSA-accredited airline.

The graph below indicates the percentage of all accidents that were CFIT over the past ten years.



Percentage of all accidents attributed to CFIT, 2009-2018

The single CFIT accident that occurred in 2018 occurred on an ATR 72 turboprop aircraft, which was destroyed after impacting a mountainside[5]. All onboard perished in the crash, totaling 66 fatalities. Commensurate with last year's accidents and a five-year look back at similar accidents, a lack of visual reference (poor visibility/IMC) contributed to 2018's CFIT accident. This trend has continued this threat's record as the single largest recurring contributing threat to CFIT accidents.

In this instance, poor visibility was compounded by high terrain/obstacles and wind shear/gusty wind (due to mountain wave turbulence), and exacerbated by a series of flight crew errors, including intentional noncompliance with SOPs and poor manual handling/flight controls, which saw the aircraft descend to below minimum sector altitude. Course of action ultimately caused a reduction in safety margins and, when the flight crew intervened, it was determined that there was poor application of recovery technique. Further details may be found in the preliminary information released, which found that *"The flight encountered to [sic] mountain wave phenomenon, and tendency to increase altitude of the aircraft was due to updraft, followed by air motion down draft at the area of aircraft near to the top of the mountain. Aircraft experienced low energy flight and low speed, finally caused to approach stall condition."*[6]

On review of all CFIT accident errors, intentional noncompliance with SOPs accounted for 67% of the categorized errors for all CFIT accidents since 2014. The undesired aircraft states have strong correlation to those in this year's LOC-I category, and included operations outside aircraft limitations, abrupt aircraft control as well as vertical/lateral and speed deviations. Critically for CFIT accidents, controlled flight towards terrain accounted for the final main undesired aircraft state.

As per the countermeasures listed for most other CFIT accidents, the six countermeasures that were considered crucial to prevent this occurrence were heavily based on the crew's overall performance, including the Captain's leadership and First Officer (FO)'s assertiveness, in-flight decision-making, communication and monitoring & cross-checking. All of these are tied into the existing latent condition of FOPs: SOPs and checking, in addition to safety management and regulatory oversight.

The following pilot competencies were identified as weak countermeasures to manage the threats and errors, and to recover from the undesired aircraft state:

- Aircraft flight path management, manual control 1
- Application of procedures 1
- Communication 1
- Leadership and teamwork 1
- Problem-solving and decision-making 1
- Situational awareness 1

ACTG Categorization of 2018 CFIT Accidents

ATR 72 was destroyed after impacting a mountain-side, resulting in a hull loss and 66 fatalities

Latent Conditions	Safety management Regulatory oversight FOPs: SOPs and checking
Threats	Terrain/obstacles Wind/Wind shear/Gusty wind Poor visibility/IMC Other
Errors	Briefings Callouts Intentional Manual handling/Flight controls
Undesired Aircraft States	Controlled flight towards terrain Operation outside aircraft limitations Engine Abrupt aircraft control Vertical/lateral/speed deviation
Countermeasures	Captain should show leadership Communication environment In-flight decision-making FO assertive when necessary Monitor/cross-check Overall crew performance

5 This accident was classified as CFIT by ACTG in January 2019. In February 2019, the interim ADREP report was generated and, based on this information, SISG classified the accident as LOC-I. ACTG will review the updated information in June 2019.
6 AVHerald.

2014 -2018: all CFIT accidents

Latent Conditions	FOPs: SOPs and checking Regulatory oversight FOPs: Training systems Technology and equipment Selection systems Safety management Management decisions
Threats	Nav/Aids Poor visibility/IMC Terrain/obstacles Operational pressure Wind/Wind shear/Gusty wind Fatigue Air traffic services Lack of visual reference Airport facilities
Errors	Callouts Intentional Briefings Manual handling/Flight controls
Undesired Aircraft States	Vertical/lateral/speed deviations Controlled flight towards terrain Unnecessary weather penetration Continued landing after unstable approach Abrupt aircraft control Engine Operation outside aircraft limitations Unstable approach Long/floated/bounced/firm/crabbed landing
Countermeasures	Captain should show leadership In-flight decision-making FO is assertive when necessary Monitor/cross-check Overall crew performance Execution - other Automation management Communication environment

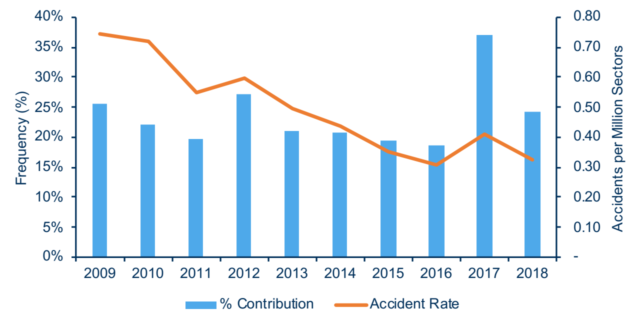
Runway/Taxiway Excursions

An overrun off the runway surface. A veer off the runway surface. A departure from the taxiway surface.

Runway/taxiway excursions remained the most frequently occurring accident end state. Over the last five years (2014–2018), there have been 73 runway/taxiway excursion accidents. Despite their frequency, associated hull losses and fatalities are rare, and as such, runway excursion fatality risk is comparatively low. In 2018, there were 15 runway excursion accidents, including eight runway veer-offs and seven runway overruns. Of these, five were from IOSA-registered operators, while 10 were not IOSA registered.

In the first half of 2018, runway excursions became a fatal accident category after four years of non-fatal accidents following a Dash-8 400 that crashed while approaching to land, causing a hull loss and 51 fatalities. This was followed in late 2018 by another runway excursion fatality accident (on a Boeing 757-200), bringing the total runway excursion fatalities in 2018 to 52. In 2018, runway excursions represented 18% of the total fatal accidents and caused 10% of all fatalities, sharply increased from a total fatality contribution of 3% between 2014 and 2018.

The graph below indicates the percentage of all accidents that were runway/taxiway excursions over the past ten years.



Percentage of all accidents attributed to runway/taxiway excursions, 2009-2018

Because the accident occurred in late 2018, there was little information available at the time of reporting to categorize the Boeing 757-200 accident. Preliminary reports, however, detail a possible hydraulic failure necessitating an air turnback and subsequent runway overrun. It was reported that a passenger injured during the emergency evacuation died in hospital eight days later. Due to insufficient information at the time of writing, a single threat of hydraulic system has been assigned to the accident.

The Dash-8 400 accident report is publicly available and sets out a complex sequence of events, which lead to the runway excursion. A report released in January 2019 found the probable cause of the accident was *"due to disorientation and a complete loss of situational awareness on the part of crewmember. Contributing to this the aircraft was offset to the proper approach path that led to maneuvers in a very dangerous and unsafe attitude to align with the runway. Landing was completed in a sheer desperation after sighting the runway, at very close proximity and very low altitude. There was no attempt made to carry out a go around, when a go around seemed possible until the last instant before touchdown on the runway."* Examination by the ACTG, found errors common to the other fatal accident categories in 2018, including intentional noncompliance with SOPs, manual handling/flight controls and pilot-to-pilot communication. Also common to the other accident end states are several of the undesired aircraft states, including vertical and lateral speed deviations, abrupt aircraft control and operations outside aircraft limitations. Tied to these are the underlying latent issues of safety management and regulatory oversight.

Excluding the two fatal accidents, the ACTG noted the contributing factors to the remaining 13 runway excursions included an increased number of environmental factors. These included thunderstorms (46%), wind/wind shear/gusty wind (38%) and contaminated runway/taxiway (31%), with the undesired aircraft state of unnecessary weather penetration (46%) factoring in nearly half of all these non-fatal accidents.

Proposed countermeasures included overall crew performance (38%), in-flight decision making/contingency planning (31%), taxiway/runway management (23%) and workload management (15%).

The following pilot competencies were identified as weak countermeasures to manage the threats and errors, and to recover from the undesired aircraft state (Jet):

- Aircraft flight path management, manual control 3
- Application of procedures 4
- Communication 2
- Leadership and teamwork 5
- Problem-solving and decision-making 4
- Situational awareness 4
- Workload management 2
- Aircraft flight path management, automation 1

The following pilot competencies were identified as weak countermeasures to manage the threats and errors, and to recover from the undesired aircraft state (Turboprop):

- Aircraft flight path management, manual control 1
- Application of procedures 2
- Communication 1
- Leadership and teamwork 1
- Problem-solving and decision-making 1
- Situational awareness 1
- Workload management 1

757-200 suffered a runway excursion on landing, causing substantial damage and one fatality

Latent Conditions	–
Threats	Hydraulic system failure
Errors	–
Undesired Aircraft States	–
Countermeasures	–

Dash 8-400 crashed while approaching to land, causing a hull loss and 51 fatalities

Latent Conditions	Safety management Regulatory oversight Selection system
Threats	Fatigue Crew incapacitation Air traffic servics Operational pressure
Errors	Callouts Intentional ATC Failure to GOA after unstable approach Manual handling/flight controls Pilot-to-pilot communications
Undesired Aircraft States	Unauthorised airspace penetration Operations outside aircraft limitations Vertical/lateral/speed deviation Unstable approach Controlled flight into terrain Abrupt aircraft control Long/floated/bounced/firm/off-center/crabbed landing Continued landing after unstable approach
Countermeasures	Workload management Communication environment In-flight decision-making/contingency Taxiway/runway management Monitor/cross-check Captain should show leadership Overall crew performance FO is assertive when necessary

Summary of contributing factors from all non-fatal runway/taxiway excursions

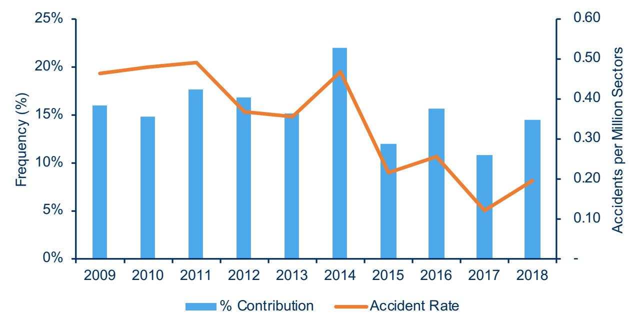
Latent Conditions	Safety management Regulatory oversight FOP: Training systems Technology & equipment
Threats	Thunderstorms Wind;/wind shear/gusty wind Contaminated runway/taxiway Poor visibility/IMC Inadequate overrun area/trench/ditch Operational pressure MEL item Airport perimeter control/fencing/ wildlife Birds Fatigue Contained engine failure Fire/smoke (cockpit/cabin/cargo) Air Traffic Services Ground-based
Errors	Manual handling/flight controls Failure to GOA after a bounced landing Intentional Failure to GOA after a destablized approach Abnormal checklist Unintentional Automation Callouts Pilot-to-pilot communciation ATC
Undesired Aircraft States	Unnecessary weather penetration Long/floated/bounced/firm/off-center/crabbed landing Vertical/lateral/speed deviation Unstable approach Brakes/thrust reversers/ground spoilers Continued landing after unstable approach Abrupt aircraft control Flight controls/automation Operations outside aircraft limitations Rejected takeoff after V1
Countermeasures	Overall crew performance In-flight decision-making/contingency Taxiway/runway management Workload management Evaluation of plans Automation management Monitor/cross-check Communication environment Captain should show leadership

Aircraft Technical Failures, Maintenance Safety

Any gear-up/collapse landing resulting in substantial damage (without a runway excursion).

Gear-up/collapse landings increased to nine accidents in 2018 (from five in 2017), but caused zero fatalities. This is consistent with data over the past five years, which found that from 2014 to 2018 there were a total of 49 gear-up/collapse landings, which caused zero fatalities. Of the operators that experienced a gear-up/collapse landing in 2018, three were IOSA registered, five occurred on jet aircraft and four on turboprop aircraft; none resulted in a hull loss.

The graph below indicates the percentage of all accidents that were gear-up/collapse landings over the past ten years.



Percentage of all accidents attributed to gear-up/collapse landings, 2009-2018

While this accident end state focuses on one type of aircraft technical failure, some brief findings of specific maintenance threats and their contribution to all accidents in 2018 is provided below.

In all, the following maintenance and aircraft technical-related threats were observed in 2018:

- Maintenance events
- Hydraulic system failure
- MEL item
- Aircraft technical – other
- Extensive/uncontained engine failure
- Contained engine failure/powerplant malfunction
- Fire and smoke (cockpit/cabin/cargo)

The findings were as follows:

- Maintenance events were found to be a threat in 12% of all accidents and contributed to one fatal accident; specifically, the Boeing 737-800 LOC-I event previously covered, whereby the aircraft crashed shortly after takeoff.
- MEL item was identified as a threat in 6% of all accidents and contributed to one fatal accident (the AN148-100 LOC-I accident previously covered).

- Fire/smoke (cockpit/cabin/cargo) was identified as a threat in 4% of all accidents, but did not contribute to any fatal accidents.

- Hydraulic system failure was identified as a threat in 4% of all accidents and contributed to one fatal accident in 2018.

- Extensive/uncontained engine failure and contained engine failure/powerplant malfunction were each identified as a threat in 2% of all accidents, with extensive/uncontained engine failure causing one fatality (covered further below).

- Aircraft technical – other was identified as a threat in 2% of all accidents, but did not contribute to any fatal accidents.

Underscoring the above statistics were the accidents where maintenance activities, checking and training, and SOPs were deficient at an organizational level (latent conditions). These results were as follows:

- Maintenance Ops: SOPs and checking contributed to 10% of all accidents and 14% of fatal accidents

- Maintenance Ops: Training systems contributed to 2% of all accidents and 14% of fatal accidents

The following pilot competencies were identified as weak countermeasures to manage the threats and errors, and to recover from the undesired aircraft state:

- Problem-solving and decision-making 1

- Situational awareness 1

ACTG Categorization of 2018 Gear-up/Collapse Landing Accidents

EMB 110 experienced a gear collapse with subsequent runway excursion

Dash 8-400 landing with nose gear that failed to extend

B737-500, main landing gear collapsed on landing

B737-800 landed without nose gear extended

A330-200 landed without nose gear extended

B1900 landing gear collapsed upon commencing taxi (cargo)

MD-80-83 collapse of right main landing gear during landing rollout

Beechcraft 200 Super King Air gear-up landing of a cargo aircraft

Fokker 100 left main landing gear failed to deploy prior to landing

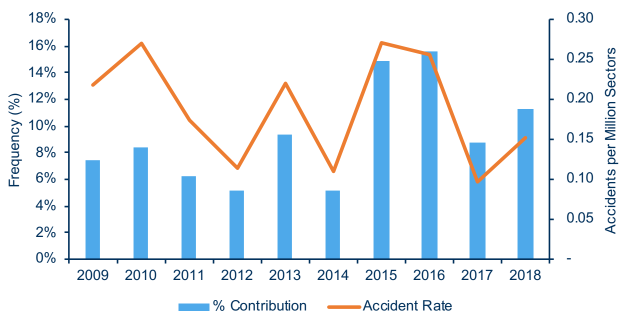
Latent Conditions	Safety management Regulatory oversight Maintenance Ops: SOPs and checking Design Selection systems
Threats	Gear/tire Maintenance events Poor visibility/IMC Dispatch/paperwork Thunderstorms Wind/Wind shear/Gusty conditions Hydraulic system failure
Errors	Nil
Undesired Aircraft States	Landing gear collapse Unstable approach Unnecessary weather penetration
Countermeasures	In-flight decision-making

In-flight Damage

Damage while airborne, including weather-related events, technical failures, bird strikes and fire/smoke/fume.

In-flight damage events increased to seven accidents in 2018 (from four in 2017) and caused one fatality. Of the 35 accidents from 2014 to 2018, two were fatal, with the previous fatality in 2016. Of the operators that experienced in-flight damage in 2018, four were not IOSA registered, six occurred on jet aircraft and none resulted in a hull loss.

The graph below indicates the percentage of all accidents that were in-flight damage over the past ten years.



Percentage of all accidents attributed to in-flight damage, 2009-2018

An extensive/uncontained engine failure and subsequent single fatality occurred on a Boeing 737-700 and was categorized as the in-flight damage accident end state. The damage occurred during climb through FL320, when the left-hand engine (CFM56) experienced a fan blade failure, resulting in the loss of the engine inlet and cowling; these then breached the fuselage causing a depressurization. An emergency descent and diversion were subsequently carried out.

As the investigation continues to unfold, the event has been assigned regulatory oversight and design as two contributing latent conditions. Upon review, the ACTG has categorized at least one extensive/uncontained engine failure each year since 2005 (which is as far as GADM accident records allow), resulting in 20 accidents and 176 fatalities (five hull losses and three fatal accidents).

Other in-flight damage threats included aircraft technical events on the ground, maintenance events, as well as environmental factors such as birds and hail. Upon review of threats over the past five years, uncontained engine failure and maintenance events have traditionally been the largest threat categorized in this end state, each representing 22%, with the main undesired aircraft state of unnecessary weather penetration.

Organizational deficiencies (latent conditions) associated with 2018 in-flight damage revolved primarily around maintenance and ground activities, including Ground Ops: SOPs and checking, Ground Ops: Training systems, and Maintenance Ops: SOPs and checking.

There were no Evidence-based Training Recommendations associated with in-flight damage in 2018.

ACTG Categorization of 2018 In-flight Damage Accidents

B777-300 main gear axle fracture on landing

B737-200 cargo service dropped thrust reverser in the touchdown zone on landing and veered off runway

B737-300 encountered hail storm during takeoff

A330-300 experienced engine fire during initial climb

B737-700 experienced uncontained engine failure during climb

A319 rejected takeoff due to bird strikes in both engines

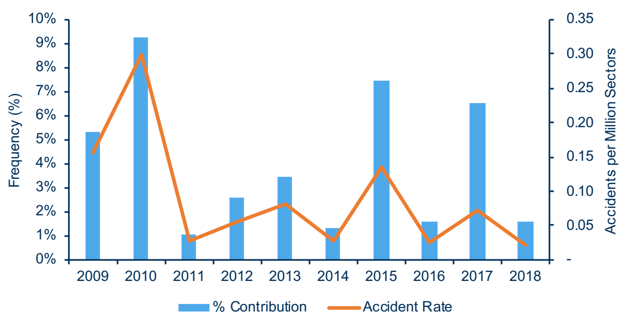
An-12 cargo service suffered cargo shift during takeoff

Latent Conditions	Regulatory oversight Safety management Maintenance Ops: SOPs and checking Design Ground Ops: Training systems
Threats	Gear/tire Maintenance events Birds Hail Ground events Extensive/uncontained engine failure Aircraft malfunction
Errors	Nil
Undesired Aircraft States	Unnecessary weather penetration
Countermeasures	—

Undershoot

One undershoot accident occurred in 2018, which caused one fatality. Eleven accidents occurred in this category from 2014 to 2018, causing a total of five fatalities. In 2018, the single fatal undershoot accident occurred on a B737-800, which was an IOSA-registered operator.

The graph below indicates the percentage of all accidents that were undershoots over the past ten years.



Percentage of all accidents attributed to undershoots, 2009-2018

The single fatal accident in 2018 occurred on a Boeing 737-800 approaching in poor visibility/IMC, during an NDB/DME approach, to a runway with no precision approaches available. The aircraft landed around 1,500ft short of the runway on the water, resulting in a single fatality.

In common with previous accidents, threats such as poor visibility, thunderstorms and lack of visual reference were categorized as threats in this 2018 accident. These were then compounded by several errors, including manual handling/ flight controls, intentional violation of SOPs, poor pilot-to-pilot communication and failure to go-around following a destabilized approach.

The leading undesired aircraft states from 2018, in line with the previous five years' accidents, include unnecessary weather penetration, vertical and lateral speed deviations, controlled flight towards terrain and an unstable approach.

Organizational deficiencies (latent conditions) associated with 2018's undershoots comprise the two main contributors of safety management and regulatory oversight.

The following pilot competencies were identified as weak countermeasures to manage the threats and errors, and to recover from the undesired aircraft state:

- Aircraft flight path management, manual control 1
- Application of procedures 1
- Communication 1
- Leadership and teamwork 1
- Situational awareness 1
- Aircraft flight path management, automation 1

ACTG Categorization of 2018 Undershoot Accidents

B737-800 touched down in the sea, short of the runway, suffering a hull loss and one fatality

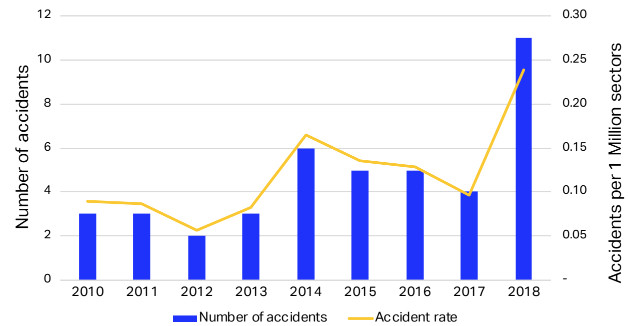
Latent Conditions	Safety management Regulatory oversight Other
Threats	Thunderstorms Other Poor visibility/IMC Lack of visual reference Operational pressure
Errors	Manual handling/flight controls Intentional Failure to go around after unstable approach Pilot-to-pilot communication
Undesired Aircraft States	Unnecessary weather penetration Vertical and lateral speed deviation Continued landing after unstable approach Controlled flight towards terrain
Countermeasures	Monitor/cross-check Communication environment Automation management Overall crew performance

All undershoot accidents from 2014 to 2018

Latent Conditions	Safety management Regulatory oversight Flight Ops Management Decisions Technology & Equipment
Threats	Thunderstorms Other Poor visibility/IMC Lack of visual reference Operational pressure Optical illusion/visual misperception Wind/Wind shear/Gusty wind Ground-based navaid malfunction Poor/faint markings/signs on runway
Errors	Manual handling/flight controls Intentional Failure to go around after unstable approach Pilot-to-pilot communication Unintentional
Undesired Aircraft States	Unnecessary weather penetration Vertical and lateral speed deviation Continued landing after unstable approach Controlled flight towards terrain Unstable approach Long/floated/bounced/crab landing
Countermeasures	Monitor/cross-check Communication environment Automation management Overall crew performance FO is assertive when necessary

Continuation of Airline Operation During Hazardous Weather

Hazardous weather/meteorological conditions was identified as a factor in 37% of all classified accidents in 2018, an increase over the 33% of accidents from 2014 to 2018. Concerning fatal accidents, meteorology contributed to three accidents, which included one CFIT accident, one LOC-I accident and one undershoot accident.



Continuation of airline operation during hazardous weather, 2009-2018

Under the accident classification taxonomy, meteorological events are listed in two categories: threat and undesired aircraft state. Under the threat category, meteorology encompasses the following events:

- Thunderstorms
- Poor visibility/IMC
- Gusty wind and wind shear
- Icing conditions
- Hail

Further review of the meteorological conditions (37%) that contributed to 2018 accidents, the following specific phenomenon were identified:

- Wind/wind shear/gusty wind, the single largest threat to accidents in 2018, was present in 23% of all accidents and 14% of fatal accidents.
- Thunderstorms, the second largest threat, were present in 19% of all accidents and 14% of fatal accidents.
- Poor visibility/IMC was present in 12% of all accidents and 29% of fatal accidents.
- Icing conditions were present in 4% of all accidents and 14% of fatal accidents.
- Hail was present in 2% of all accidents.

It should be noted that in-flight weather management commences before the flight crew arrive at the aircraft and in-flight there are additional external influences. As such, additional threats coded with meteorology included dispatch/paperwork (5%) and air traffic services (2%). The most frequently assigned flight crew errors were manual handling (53%) and intentional noncompliance with SOPs (47%). As an undesired aircraft state, unnecessary weather penetration was present in 11 (18%) of accidents and contributed to one fatality (undershoot accident). Noticeably, unnecessary weather penetration contributed to six runway excursions. Upon review of the airline threats, operational pressure featured most highly with unnecessary weather penetration. Regarding these findings, the top two effective countermeasures were determined to be overall crew performance and in-flight decision-making.

The latent conditions underscoring the meteorology events were regulatory oversight (42%), safety management (42%) as well as FOPs: Training systems and SOPs and checking (16% each, respectively).

The following pilot competencies were identified as weak countermeasures to manage the threats and errors, and to recover from the undesired aircraft state:

Jet:

- Leadership and teamwork 10
- Application of procedures 9
- Situational awareness 9
- Aircraft flight path management, automation 8
- Problem-solving and decision-making 7
- Communication 5
- Aircraft flight path management, automation 3
- Workload management 3

Turboprop:

- Problem-solving and decision-making 3
- Situational awareness 3
- Aircraft flight path management, manual control 2
- Application of procedures 2
- Leadership and teamwork 2
- Communication 1

Proposed Countermeasures

Every year, the ACTG classifies accidents and, with the benefit of hindsight, determines actions or measures that could have been taken to prevent an accident. These proposed countermeasures can include issues within an organization or country, or involve the performance of frontline personnel, such as pilots or ground personnel. They are valid for accidents involving both Eastern and Western-built jet and turboprop aircraft.

This section presents countermeasures and the percentage of accidents that the ACTG analysis determined could have been prevented if the countermeasures had been actioned. The intention is to help operators, regulators and flight crews enhance safety by implementing and strengthening these countermeasures.

Countermeasures are aimed at two levels:

- The operator or the state responsible for oversight. These countermeasures are based on activities, processes and systemic issues internal to the airline operation or State's oversight activities
- Flight crew. These countermeasures are to help flight crew manage threats and errors during operations

COUNTERMEASURES FOR THE OPERATOR AND THE STATE

Subject	Description	% of accidents where counter-measures could have been effective (2014-2018)
Regulatory oversight by the State of the Operator	States must be responsible for establishing a safety program to achieve an acceptable level of safety, encompassing the following responsibilities: ▪ Safety regulation ▪ Safety oversight ▪ Accident/incident investigation ▪ Mandatory/voluntary reporting systems ▪ Safety data analysis and exchange ▪ Safety assurance ▪ Safety promotion	**31%**
Safety Management System (Operator)	The operator should implement a safety management system accepted by the State that, as a minimum: ▪ Identifies safety hazards ▪ Ensures that remedial action necessary to maintain an acceptable level of safety is implemented ▪ Provides for continuous monitoring and regular assessment of the safety level achieved ▪ Aims to make continuous improvements to the overall level of safety	**27%**
Flight operations: Standard Operating Procedures and Checking	▪ 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 computer-based training devices	**14%**

COUNTERMEASURES FOR FLIGHT CREWS

Subject	Description	% of accidents where counter-measures could have been effective (2014-2018)
Overall crew performance	Overall, crew members should perform well as risk managers. Includes flight, cabin, and ground crew as well as their interactions with Air Traffic Control	**26%**
Monitor/Cross-check	Crewmembers should actively monitor and cross-check the flight path, aircraft performance, systems performance and the performance of other crewmembers, as well as verify the aircraft position, settings and crew actions	**18%**
In-flight decision-making/ Contingency management	Crewmembers should develop effective strategies to manage threats to safety	**11%**
Leadership	▪ Captain should show leadership and coordinate flight deck activities. ▪ First Officer is assertive when necessary and able to take over as the leader	**11%**
Taxiway/Runway management	Crewmembers use caution and keep watch outside when navigating taxiways and runways	**8%**

9

STEADES Analysis

Unmanned Aircraft Systems (UAS)

THE ISSUE

"The ... use of drones is rapidly increasing and the related risk of incidents and accidents with manned aircraft must be mitigated. In fact, irresponsible recreational and commercial drone use constitutes serious safety risks that are often underestimated."
(Taken from "Joint call to safely integrate Drones / UAS into Europe's Airspace")

In 2018, an analysis was requested in recognition of the increased threat from UAS encounters. The five-year trend analysis was requested to identify any specific issues caused by UAS encounters and produced in consultation with IATA's ATM Infrastructure Team.

The analysis confirmed that aircraft encounters with unauthorized operated UAS remained a top safety risk to the aviation industry and that there is little predictability in the appearance of these operators at locations. As the use of UAS is rapidly increasing, so too is the related risk of associated incidents and/or accidents, which make the risk mitigation of these illegal UAS operators that much more difficult to manage. One of the main concerns is the unpredictability of the operators and inability to pinpoint their location.

As such, a large part of the risk mitigation lies in educating the public associated with the dangers of operating any type of UAS in designated airspace (i.e., near airports).

THE GLOBAL DATASET

This analysis was completed using a five-year dataset from 2012 to 2016, inclusively, across all phases of flight and on a worldwide scale. The IATA Global Aviation Data Management (GADM) database was interrogated for all reports of aircraft encountering UAS during a normal flight.

A review of the IATA Safety Trend Evaluation, Analysis and Data Exchange System (STEADES) database produced an initial dataset of 548 reports over the five-year period. All reports were analyzed in-depth and 68 reports (12%) were classified as out of scope. The final dataset resulted in 480 reports that were deemed suitable for further analysis. A rate analysis was performed and resulted in 0.0089 reports per 1,000 STEADES flights or 1 report per 112,360 STEADES flights.

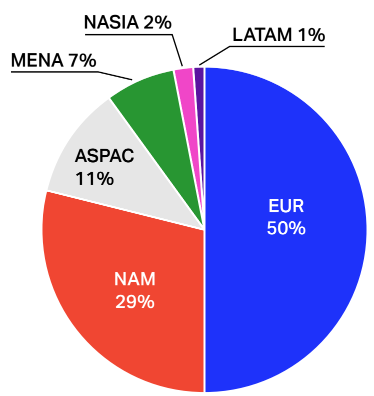
Given these relatively low numbers, the GADM team suspected that the STEADES UAS report set was under-representative of global statistics and contacted external stakeholders and safety agencies for further data samples. Various agencies confirmed having higher numbers of occurrences than those represented in the STEADES database, some of which were supplied to the GADM team. Due to the lack of a cohesive classification system and possible duplications between the various datasets, the reports from the other agencies were not combined with the STEADES dataset. Instead, they were used for comparison purposes. Nevertheless, and consistent with reporting from other global/international agencies, IATA's UAS reports showed a significant increase in UAS incident reports starting around 2014.

It is likely that, globally, UAS incidents are heavily underreported, with differing mandatory reporting requirements. During the gathering of information for this analysis, the GADM team found instances of some States having disparate reporting requirements between the regulator, safety agency and ANSPs, and a lack of clarity concerning which body was responsible for the collection of UAS data.

Further masking the issue is the lack of a single UAS reporting standard for flight crew to input consistent reports. While UAS categorization and certification is weight-based, the safety reports and summaries submitted by flight crew describe UAS by size, color, and, where possible, by type. Until such time that there is full alignment across the industry, it will be difficult to understand the full scale of the threat posed to aviation operations.

THE RESULTS

From a global vantage, GADM's European region (EUR) membership submitted the highest number of reports detailing UAS occurrences, by both region of operator and region of occurrence. [1]



Regional distribution
Source: STEADES Database

Unmanned Aircraft Systems – Size

23% (111) of the reports described the approximate size of the UAS encountered, which presented a unique problem for the analysis. While globally, UAS are generally defined and categorized by their weight, flight crew tended to describe the UAS by size, color, type, etc. For example:

> *"When cleared for approach 01R, we passed a blue fairly large drone on our left side. Distance is hard to judge."*

> *"I noticed we instantly approached and overflew an object by less than 1,000. It was the size of a tire and had a metal-looking object suspended about three feet below the UAV."*

In attempting to develop a standardized method to capture this information, the GADM team classified the reports into three different sizes[2]:

- Small: less than 60cm wide
- Medium: between 60cm and 1m wide
- Large: more than 1m wide

The most frequently reported size of UAS was Large, covering 45% (50) of reports. The distribution was consistent across all regions of occurrence.

Encounter Type

98% (472) of the reports described the type of encounter. With no global standard to categorize the UAS event types, categories were developed based on the vertical and horizontal proximity of the UAS to the aircraft (as described by the reporter). The UAS incident report narratives were then studied and grouped into three categories:

- Collision: When there was a collision between aircraft and UAS.
- Near Collision: When the separation between UAS and aircraft was less than 3NM horizontally and 1000ft vertically.
- Encounter: When the separation between UAS and aircraft was greater than 3NM horizontally and 1000ft vertically.

Near Collision was the most frequently reported event category, and 80% (378) of the reports described an estimated reduction in separation to less than 3NM and 1,000ft separation between the aircraft and UAS. 19% of the reports (91) described the occurrence as a UAS encounter.

Of concern, three reports described a possible collision occurring between the aircraft and UAS (in two cases, the flight crew never saw what caused the damage). One of these collisions occurred in EUR, the two remaining reports did not include the region of occurrence. Example narrative:

> *"On approach at about 1,700ft, an inert nonorganic object approximately one foot across (up to 18 inches max) struck the aircraft immediately below the Captain's windshield and bounced off and down the left upper side of the aircraft. Both pilots saw the object strike and left seat pilot witnessed accompanying noise. ATC informed. Engines assessed quickly as sound and eventless landing. Police report filed. Other aircraft markings: pale yellow color."* [3]

1 Readers should note that these numbers are based on the STEADES program membership report submission rates and are influenced by program members' contributions to GADM, as well as their own internal safety reporting culture.

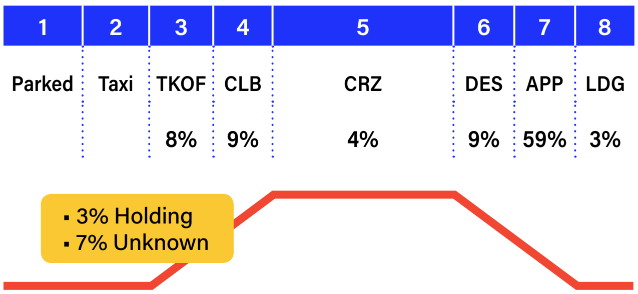
2 The derived classification is not aligned with the ICAO classification standard used for UAS certification.

3 Edited for brevity and anonymity.

THE OPERATIONAL ENVIRONMENT

Phase of Flight

93% (448) of reports specified the phase of flight when the UAS was encountered. As expected, most incidents were reported during approach, descent, takeoff and climb.



Phase of flight distribution.
Source: STEADES Database

Further in-depth analysis of report narratives was completed to capture any further information regarding the operational context of the UAS encounter. To do so, some of the following information was extracted:

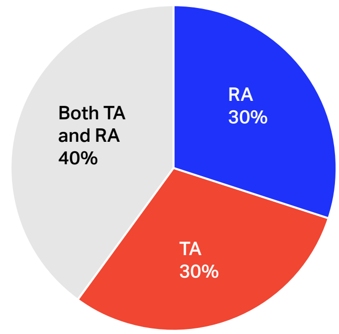
- Aircraft distance from the airport
- Aircraft altitude
- UAS/aircraft horizontal separation
- UAS/aircraft vertical separation

Aircraft Distance and Altitude from the Airport

Whereas 29% (139) of the reports indicated the aircraft distance from the airport at the time of the occurrence, 66% (318) of the reports provided the altitude of the aircraft at the time of the occurrence. The global average showed the aircraft approximately 6nm from the airport, at around 4,000ft.

At the same time, 41% (197) of the reports contained the reported horizontal separation, while 53% (255) of the reports listed the vertical separation between the UAS and the aircraft.

UAS Traffic Collision Avoidance System Events



TCAS events caused by UAS
Source: STEADES Database

Out of the total dataset, 10 events were found to have caused activation of the Traffic Collision Avoidance System (TACS). Of the 10 events, three were restricted to Traffic Advisories (TA), four events escalated from TA to Resolution Advisories (RA), while three caused immediate activation of a RA.

An example narrative is included:

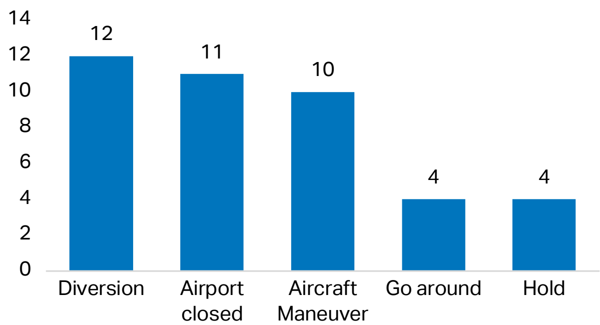
> *"On a 2-3 mile final, we received a TA for traffic immediately in front of us. While I flew the aircraft, [the First Officer] looked closely ahead of us and saw a UAV approx. 2-3ft in diameter that had the main body of yellow, with multiple rotors (at least 4) that emanated from the body. We estimate that it missed us by 100ft to 200ft and was exactly on the centerline of the ILS. It happened so fast that we had no time to avoid, but would have certainly caused (extensive?) damage to the aircraft had it impacted us. Had we observed it earlier, we would likely have taken evasive action. The TA we received had no altitude reported, just a yellow target on the screen. We passed exactly over the top of it. Had we hit, it would have been most likely in the nose/screen area. We were exactly lined up on the centerline of the runway, exactly on the localizer. After looking at Google, we saw a couple UAVs that looked similar; a 'Netra' UAV or 'Quadcopter' type of vehicle. It had no wings. I phoned tower with Chief Pilot and described the incident as well."*

Of the ten reports received detailing TCAS activation, the above narrative was one of the only ones that detailed an approximate size of the UAS.

Actions Taken by Flight Crew and Air Traffic Control

Out of 480 reports, 64% (305) of reports stated that Air Traffic Control (ATC) were aware of the UAS or had been previously informed by flight crew.

Depending on the airport and region of the UAS activity, ATC undertook different actions to counteract the UAS activity. These activities included closing the airport, aircraft holding, go-arounds and diversions.



Airport and flight crew actions following UAS activity.
Source: STEADES Database

Unplanned holding and diversions presented new risks to the operating aircraft and flight crew as evidenced by this narrative[4]:

> *"The crew were given an expected approach time by ATC and based on this they committed to destination. When subsequently the airport closed with undetermined delays [due to a drone being spotted] the crew gave ATC a minimum fuel advisory, an alternate was contacted, and a diversion arranged.*
>
> *The airport closure resulted in over 25 flight diversions stretching the resources far beyond the capacity available for normal operations at the alternate airport. A special project group has been formed to look into the required resources to handle additional diversions."*

Additional activity was also reported whereby attempts were made to try and locate the UAS operator. In none of narratives provided was it reported that the UAS operator was located.

Key Findings

- A total of 480 reports were found in the STEADES database related to UAS encounters from Q1 2012 to Q4 2016. In total, 472 UAS reports led to 91 encounters, 378 near collisions and 3 collisions.
- Data suggests that UAS reports in STEADES are under-representative of true global statistics.
- 64% of all UAS incidents occurred during the approach or initial climb phases of flight.
- The risk to flight operations does not lie purely in the risk of collision, but also:
  - ATC resources and diversion airports stretched to capacity as they respond to the illegal UAS activity
  - Risk of fuel starvation due to unexpected holding and subsequent diversions

Recommendations

- To consider the need for enhanced reporting requirements of UAS/civil aircraft encounters to develop a global dataset for analysis and reporting.
- To develop a global standardized classification system regarding the type of outcome/encounter with UAS (e.g., collision, near collision and encounter).
- To develop a global standardized classification system regarding the size of the UAS encountered, bearing in mind that flight crew are unlikely to describe a UAS by weight.

Present Day

IATA continues to work closely with ICAO, States and other key stakeholders on the integration of UAS into civilian airspace to ensure that commercial aviation and UAS can safely and efficiently coexist. Key components to achieve this include the development of effective safety and security risk reduction strategies and performance-based regulations governing the operation of UAS.

ICAO is working toward development of an international regulatory framework through Standards and Recommended Practices (SARPs), with supporting Procedures for Air Navigation Services (PANS) and guidance material, to underpin routine operation of UAS throughout the world in a safe, harmonized and seamless manner comparable to that of manned operations.

4 Narrative edited for clarity and anonymity.

IATA Bulletin No.: UAS1/2018
Date: 11 June 2018

Subject: Key considerations when protecting manned aviation from drones.

Background:

The use of Unmanned Aircraft Systems (UAS), often referred to as drones, is expanding rapidly and key aviation stakeholders (e.g. airports, aviation authorities) are considering how to mitigate the risk. One solution is to employ suitable technology with appropriate measures.

Anti-Unmanned Aircraft System (Anti-UAS) measures are a set of technological and operational tools that were developed, and are being used, to monitor, detect, identify and record inappropriate or dangerous UAS activities. These activities include the infringement of restrictive or sensitive airspace, or UAS operating dangerously close to manned aviation. These measures may include some countermeasures aimed to neutralize, or limit, potential risks posed by uncooperative UASs. These measures and associated technologies can be both beneficial and harmful to aircraft and ATM operations. Therefore, anti-UAS measures should only be implemented following an appropriate safety assessment taking into account potential impacts to all aviation stakeholders.

Anti-UAS Operational Measures:

Some States, airports and aviation agencies are considering the use of anti-UAS measures to manage safety and security risks posed by uncooperative UASs. Below are some examples of these anti-UAS measures and associated technologies.

Detection of UAS

One available technology is the use of a radio-frequency (RF) signal analyzer. This system is able to detect, monitor, and analyze all relevant radio frequencies and supporting techniques (i.e. frequency hopping) which are used to operate the UAS. The RF signal analyzer can be used in combination with a direction finder to locate the UAS operator. This technique is particularly applicable to FHSS (Frequency Hopping Spread-Spectrum) UASs operating at 2.4GHz frequency band.

For some UASs that are flying autonomously and may not have simultaneous radio-control links, there are systems such as uncooperative RADAR1, optical tracking (e.g. video and thermal tracking cameras) or acoustic technologies may be capable to detect these UASs.

Considerations and Suggestions

Counter and Anti-UAS measures should generally only be implemented within locations or airspace where there is a recognized safety and security risk that would justify any infrastructure and operational costs for anti-UAS measures. The areas of interest include the critical safety-sensitive areas around airports such as final approach, missed approach and departure corridors.

The use of anti-UAS measures should not cause unintended safety or operational hazards to aircraft or aviation infrastructures. For example, the jamming or spoofing[5] of GPS signals needs to be avoided as it may harmfully impact aircraft navigation systems as well as air traffic management systems - both of which heavily rely on functional, uninterrupted GPS signals. Implementation of anti-UAS measures must also be subject to a safety assessment and risk mitigation process in order to manage unintended risks.

In deciding in the deployment of anti-UAS measures, States, airports and aviation agencies are recommended to consider anti-UAS measures that will:

1. Support continuous monitoring of UAS activities;
2. Detect, identify and record UAS activities in a timely manner and, where capable, geo-locate the operator of the UAS.
3. Perform effective countermeasures that can be safely and legally activated in time to prevent a UAS from entering an area of interest.

Concurrently, anti-UAS measures should NOT:

1. Create unintended safety hazards and unmitigated risks to other aircraft and aviation infrastructures;
2. Infringe with local laws and regulations
3. Interfere with radio frequencies being used by aircraft, air traffic management (ATM) systems and other legally authorized applications, for example;
   - **a.** GPS/GNSS jammers and spoofing should not be used as anti-UAS measures as they can concurrently interfere with the operations of other aircraft. Moreover, technologies for protecting UASs against GPS/GNSS jamming and spoofing are being tested and expected to soon be commercially available.
   - **b.** RADAR technologies used for anti-UAS purposes, frequency usages by the Anti-UAS system and other RADAR-based systems used for ATM, such as primary surveillance RADARs for approach control and airport surface movements, need to be appropriately coordinated and empirically validated such that there will be no adverse impact to ATM system.
4. Result in UAS maneuvering unpredictably;
   - **a.** Technologies used to disrupt the command/control link between a UAS and its operator, must mitigate the safety risks associated with a UAS not being under anyone's positive control, in particular during a "lost link" stage.
   - **b.** During a "lost link" stage, some UASs are pre-programmed to perform specific maneuverings, such as "stay still", "return to base" and "land now". However, such pre-programming cannot always be guaranteed.

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5 Transmitting signals that imitate GPS signals with the intention to falsely navigate the recipient.

2016-2017 Incorrect Surface Lineup

In May 2018, an Operations Notice regarding "Incorrect Airport Surface Approaches and Landings" was issued. A review of data from various publicly available sources showed a potential increasing operational trend of approaches lined up with an incorrect surface, meaning an incorrect runway or a taxiway. Based on this information, IATA has explored the issue further and sees the need for greater awareness in the "Areas of Vulnerability" that can lead to these events. It should be noted that, although the attention on these events is often focused on specific operations, in most cases, deeper analysis shows that there can be latent conditions leading to the events. For this reason, IATA is working with stakeholders around the globe to better understand the relevant factors involved. Some leading organizations have also identified the same trend and have already taken practical steps to raise awareness on the issue.

In 2018, IATA's GADM department completed an analysis to better understand the magnitude of this issue. The analysis is subject to the disclaimer located in Addendum F.

This analysis was performed using STEADES data based on the following criteria:

- Date Range: Q1 2016 to Q4 2017 inclusive
- Phase of Flight: Approach
- Region of Location: Worldwide
- Word Search in Title and Summary: Line up, Lineup, Lined up, Lined-up, Approach, Runway / RWY, Localizer / ILS, Intercept, Align / Aligned, Parallel Taxiway / TWY, Landed on Taxiway / TWY

Analysis of incorrect lineup reporting

A review of the STEADES database produced 164 reports that were suitable for analysis, equal to one report per 156,088 flights, or also equivalent to around one report every four and a half days, thus confirming that incorrect surface lineups occur more frequently than previously understood.

Key findings

Parallel Runways

146 or 88% of the reports occurred while on approach to airports with parallel runways. Further, of these 146 reports, 68 stated that the incorrect surface lineup occurred on a visual approach to a parallel runway.

Report Narrative example: *"We understood our clearance to be the visual approach to 31 Left into ***. I'm quite sure this is what we read back to ATC. We were in the process of lining up with the extended RWY centerline approximately 15 miles out. We heard ATC clear another A/C for the visual 31 Left. *** was on a left base joining final when we queried the tower about which runway he was cleared for because the spacing looked tight. Tower said he was cleared 31L and we were cleared 31R. We corrected course visually and landed on 31R uneventfully"*

Late or Multiple Runway Changes

In 76 or 46% of reports, flight crew reported late (below top of descent) and/or multiple runway changes. The subsequent distraction and workload increase, resulted in a series of reported errors, including FMS reprogramming errors and ILS tuning errors or omissions.

Report Narrative example: *"We were given 3 runway changes into ***; 30L,30R,30L. We did ALL the checklists and boxed items for the changes. Except on the last and final change, that was very last minute [...] as a result of this late change, we missed changing the APP frequency".*

Expectation bias

In 58 or 35% of the reports, the flight crew reported some form of expectation bias:

- Missing an incorrectly inserted runway in the FMS during cross-check
- Not hearing a change of runway from ATC on the radio
- Visual expectation with runway layout or lighting configuration
- Setting the wrong runway in the FMS and not registering the change of runway when it was heard on the ATIS

Workload and distractions

A significant number of reports mentioned the following workload and distraction as further contributing factors:

- Radio frequency congestion
- Weather
- Managing aircraft technical issues
- Medical emergency
- Breach in the sterile cockpit below 10,000 ft
- Focusing on the vertical profile and energy management
- ATC shortcuts
- Fatigue

Wrong Airports

Five events reported lining up at the wrong airport, or on lights not located at the landing airport.

Air Traffic Control Factors

In 14 events, there was a high probability that the incorrect surface lineups were caused by ATC errors.

Night Operation

It was not possible to accurately determine how many of the approaches were conducted at night, since only 11 reports included information concerning time of day.

Notices to Airmen

In two events, NOTAM presentation was a factor.

Conclusions

- As can be expected, parallel runway operations carry the highest risk of lining up with an incorrect surface for landing. Visual approaches to parallel runways caused 41% of incorrect surface lineups in the data set.
- Late runway changes and the associated increase in workload and distraction was described as a contributing factor to incorrect surface lineups: the prevalence of expectation bias indicating that pilots are vulnerable to late changes to their briefed expected plan.
- The above factors were underscored by a series of distractions and workload increasing factors common to most approaches.

Possible mitigations

- Eliminate visual approaches to parallel runways and unnecessary late runway changes.
- Design a phraseology at a point in the descent and approach where the landing runway is confirmed and remains the same for the remainder for the flight.
- Emphasize the need to re-brief the approach procedure following the acceptance of a runway change and as part of this briefing, runway orientation should be discussed.
- Design an ATC coordination procedure so that all ATC units to be contacted before landing have the same understanding of the landing runway.
- Recognize the distraction and workload increase that a late runway change causes and designate a point beyond which it is no longer reasonably safe for a crew to accept a runway change.
- Training for visual approaches to parallel runways and late runway changes.
- Include in airline Operations Manuals a policy on the acceptance or non-acceptance of late runway changes and visual approaches.
- Improved presentation of significant NOTAMs.

GADM UPDATE

Change is coming!

In 2016, IATA's Global Aviation Data Management (GADM) Team sought industry feedback on the usability of our information-data exchange platform and their supporting functions. The feedback highlighted items requiring improvement, with the following key areas identified:

- Submission process
- Taxonomy
- Data Visualization

What has been done?

The GADM Sustainability Project was launched in response to this feedback with the objective of upgrading the GADM data-exchange systems and portfolio. The new system will blend the existing STEADES and GDDB databases into one system: The Incident Data Exchange (IDX). IDX shall be a flexible, scalable system, capable of integrating multiple data sources to support analyses. IDX shall house safety and security incident reports, producing output through a series of dashboards of safety and security performance indicators, as well as benchmarking capabilities at an airport, flight information region, state, regional and global level.

Additionally, a new safety and security event classification system has been completed and released. The IATA Safety Incident Taxonomy (ISIT) is the result of bringing together 120 industry safety professionals to create a taxonomy that can be applied across the aviation safety and security industry. Using multiple existing taxonomies as a framework and working with our enthusiastic project team we have created a linear four level taxonomy that we believe will allow us to capture global industry risk.

Next Steps

The GADM Team has reached out to the leading industry Safety Management System providers to identify partnering opportunities for automation, and streamlining of the data submission processes. In January 2019, a workshop was hosted at our headquarters in Montreal to assess the best approach to modernize our current data submission processes; this work is ongoing. We expect to complete our first round of User Acceptance Testing in mid-2019 with selected program members, with final go-live in late 2019.

Ultimately, the GADM team believes that the development of the ISIT, in combination with the enhanced infrastructure and systems, will improve the data's quality and program member's access to quality data analytics, further empowering program members to identify and target areas of operational risk.

The new Flight Data Exchange website

The FDX program has seen a significant expansion in the number of participants, growing from approximately 20 participants in 2016 to 69 participants as of 1 February 2019.

An expanding program coupled with growing needs of participants and internal stakeholders has been the driving criteria to reinvent the FDX program.

The end goal has been to provide both external and internal stakeholders with data that is valuable in the continued effort to mitigate safety risk.

The primary changes have been to redevelop the FDX website, which is now driven by industry approved SPIs allowing airlines to be more proactive in their safety analysis.

The new FDX platform was developed to be user-friendly and easy to navigate while providing the participants with improved data visualizations, benchmarking, personalization of views, refined filter criteria and the ability to compare data by aircraft type as well as contributing events.

For more information, please visit www.iata.org/gadm

10

GSIE Harmonized Accident Rate

In the spirit of promoting aviation safety, the Department of Transportation of the United States, the Commission of the European Union, the IATA and ICAO signed a Memorandum of Understanding (MoU) on a Global Safety Information Exchange (GSIE) on 28 September 2010 during the 37th Session of the ICAO Assembly. The objective of the GSIE is to identify information that can be exchanged between the parties to enhance risk reduction activities in the area of aviation safety.

The GSIE developed a harmonized accident rate in the beginning of 2011. This was accomplished through close cooperation between ICAO and IATA to align accident definitions, criteria and analysis methods used to calculate the harmonized rate, which is considered a key safety indicator for commercial aviation operations worldwide. The joint analysis includes accidents following the ICAO Annex 13 criteria for all typical commercial airline operations for scheduled and non-scheduled flights.

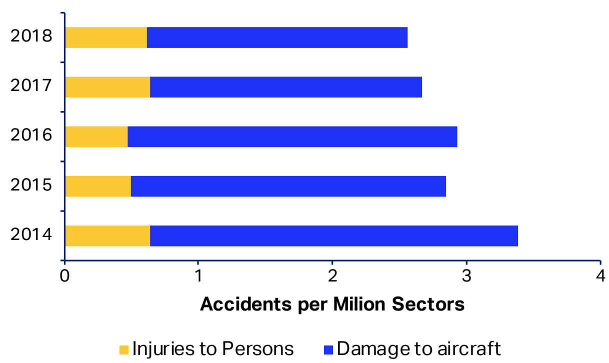
Starting in 2013, ICAO and IATA have increasingly harmonized the accident analysis process and have developed a common list of accident categories to facilitate the sharing and integration of safety data between the two organizations.

Image courtesy of Bombardier

Harmonized Analysis of Accident

A total of 117 accidents were considered as part of the harmonized accident criteria in 2018. These comprise scheduled and non-scheduled commercial operations, including ferry flights for aircraft with an MTOW above 5700kg. The GSIE harmonized accident rate for the period from 2014 to 2018 is shown below. Since 2013, the accident rate has been broken down by operational safety component: accidents involving damage to aircraft with little or no injury to persons and accidents with serious or fatal injuries to persons.

GSIE Harmonized Accident Rate (accidents per million sectors)



Number of sectors flown
Source: Ascend – a FlightGlobal Advisory Service

Definitions and Methods

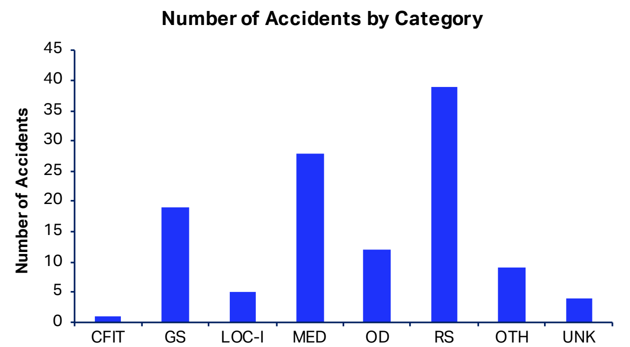
In order to build upon the harmonized accident rate presented in the last five safety reports, ICAO and IATA worked closely to develop a common taxonomy that would allow for a seamless integration of accident data between the two organizations. A detailed explanation of the harmonized accident categories and how they relate to the Commercial Aviation Safety Team/ICAO Common Taxonomy Team (CICTT) occurrence categories can be found in the table on the next page.

Accidents by Category

Differences between the approaches of the ICAO (CICTT Occurrence Categories) and IATA (Flight-crew centric Threat and Error Management Model) classification systems required the harmonization of the accident criteria to be used. The breakdown of accidents by harmonized category is shown below.

Full details of categories can be found in the table on the next page.

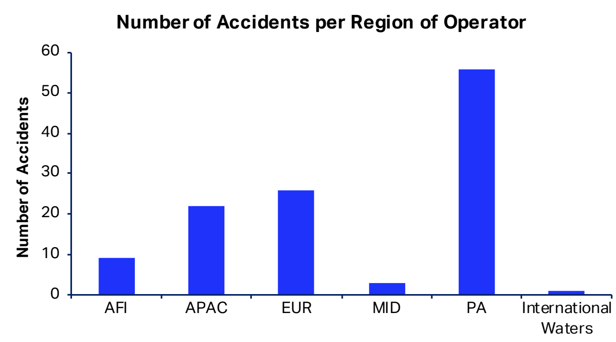
Accidents by Category

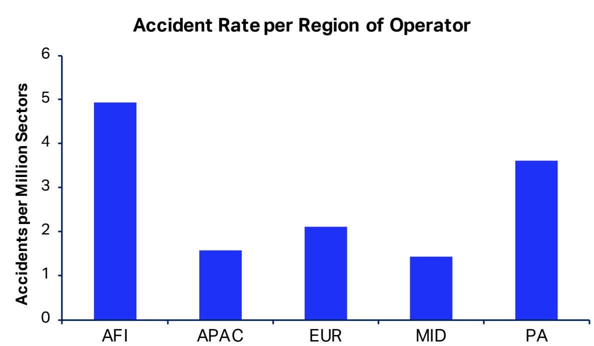


Note: One accident included in LOC-I was classified as CFIT by ACTG in January 2019. In February 2019, the interim ADREP report was generated and, based on this information, SISG classified the accident as LOC-I. ACTG will review the updated information in June 2019.

Accidents by Region of Occurrence

A harmonized regional analysis is provided by the ICAO RASG regions of occurrence. The number of accidents and harmonized accident rate by region are shown in the charts below.





Number of sectors flown
Source: Ascend – a FlightGlobal Advisory Service

Future Development

Both ICAO and IATA continue to work closely together and, through their respective expert groups, provide greater alignment in their analysis methods and metrics for the future. This ongoing work will be shared with GSIE participants, States, international organizations and safety stakeholders in the interest of promoting common, harmonized safety reporting at the global level.

GSIE HARMONIZED ACCIDENT CATEGORIES

Category	Description
Controlled Flight into Terrain (CFIT)	Includes all instances where the aircraft was flown into terrain in a controlled manner, regardless of the crew's situational awareness. Does not include undershoots, overshoots or collisions with obstacles on takeoff and landing, which are included in Runway Safety.
Loss of Control – In-flight (LOC-I)	Loss of control in-flight that is not recoverable.
Runway Safety (RS)	Includes runway excursions and incursions, undershoot/overshoot, tail strike and hard landing events.
Ground Safety (GS)	Includes ramp safety, ground collisions as well as all ground servicing, preflight, engine start/departure and arrival events. Taxi and towing events are also included.
Operational Damage (OD)	Damage sustained by the aircraft while operating under its own power. This includes in-flight damage, foreign object debris (FOD) and all system or component failures.
Injuries to and/or Incapacitation of Persons (MED)	All injuries or incapacitations sustained by anyone coming into direct contact with any part of the aircraft structure. Includes turbulence-related injuries, injuries to ground staff coming into contact with the structure, engines or control surfaces of the aircraft and on-board injuries or incapacitations and fatalities not related to unlawful external interference.
Other (OTH)	Any event that does not fit into the categories listed above.
Unknown (UNK)	Any event where the exact cause cannot be reasonably determined through information or inference, or when there are insufficient facts to make a conclusive decision regarding classification.

Category	CICTT* Occurrence Categories	IATA Classification End States
Controlled Flight into Terrain (CFIT)	CFIT, CTOL	CFIT
Loss of Control – In-flight (LOC-I)	LOC-I	LOC-I
Runway Safety (RS)	RE, RI, ARC, USOS	Runway Excursion, Runway Collision, Tail Strike, Hard Landing, Undershoot, Gear-up Landing / Gear Collapse
Ground Safety (GS)	G-COL, RAMP, LOC-G	Ground Damage
Operational Damage (OD)	SCF-NP, SCF-PP	In-flight Damage
Injuries to and/or Incapacitation of Persons (MED)	CABIN, MED, TURB	None (excluded from IATA Safety Report)
Other (OTH)	All other CICTT Occurrence Categories	All other IATA End States
Unknown (UNK)	UNK	Insufficient Data

* CAST/ICAO Common Taxonomy Team

Addendum A

Primary Contributing Factors – Section 4

2018 Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	2%
Ground Ops: SOPs & Checking	2%

THREATS

	Percentage Contribution
Gear/Tire	6%
Fatigue	2%
Inad overrun area/trench/ditch/prox of structures	2%
Operational Pressure	2%
Ground Events	2%
Extensive/Uncontained Engine Failure	2%
Wind/Wind shear/Gusty wind	2%
Fire/Smoke (Cockpit/Cabin/Cargo)	2%
Crew Incapacitation	2%
Traffic	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Ground Navigation	3%
SOP Intentional	2%
Automation	2%
SOP Unintentional	2%

2018 Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Unnecessary Weather Penetration	3%
Long/floated/bounced/firm/off-center/crabbed landing	3%
Vertical/Lateral/Speed Deviation	2%
Landing Gear	2%
Systems	2%
Flight Controls/Automation	2%
Controlled Flight Towards Terrain	2%
Abrupt Aircraft Control	2%

COUNTERMEASURES

	Percentage Contribution
Regulatory Oversight	2%
In-flight decision-making/contingency management	2%
Ground Ops: SOPs & Checking	2%

Note: The primary contributing factor frequency calculation is based on the total number of accidents in the year.

Addendum A

Top Contributing Factors – Section 4

2014-2018 Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	31%
Safety Management	27%
Flight Operations	21%
Flight Ops: SOPs & Checking	14%
Flight Ops: Training Systems	13%
Selection Systems	10%
Maintenance Operations	9%
Maintenance Ops: SOPs & Checking	8%
Design	7%
Management Decisions	6%
Ground Operations	3%
Technology & Equipment	3%
Ground Ops: SOPs & Checking	3%
Dispatch	3%
Ground Ops: Training Systems	2%
Change Management	2%
Dispatch Ops: SOPs & Checking	2%
Maintenance Ops: Training Systems	2%
Ops Planning & Scheduling	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	37%
SOP Adherence/SOP Cross-verification	31%
Callouts	12%
Pilot-to-Pilot Communication	10%
Automation	4%
Abnormal Checklist	3%
Ground Navigation	2%
Crew to External Communication	2%
Normal Checklist	2%
Systems/Radios/Instruments	2%
Briefings	2%
ATC	2%
Documentation	1%
Wrong Weight & Balance/Fuel Information	1%

2014-2018 Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	33%
Aircraft Malfunction	30%
Wind/Wind shear/Gusty wind	19%
Gear/Tire	16%
Airport Facilities	16%
Maintenance Events	13%
Poor visibility/IMC	13%
Thunderstorms	11%
Lack of Visual Reference	10%
Operational Pressure	8%
Contaminated runway/taxiway - poor braking action	8%
Ground-based nav aid malfunction or not available	7%
Nav Aids	7%
Ground Events	6%
Fatigue	6%
Optical Illusion/visual mis-perception	5%
Wildlife/Birds/Foreign Object	5%
Air Traffic Services	5%
Poor/faint marking/signs or runway/taxiway closure	4%
Fire/Smoke (Cockpit/Cabin/Cargo)	4%
Contained Engine Failure/Powerplant Malfunction	3%
Traffic	3%
Dispatch/Paperwork	3%
Inad overrun area/trench/ditch/prox of structures	3%
Airport perimeter control/fencing/wildlife control	3%
Extensive/Uncontained Engine Failure	3%
Icing Conditions	2%
Terrain/Obstacles	2%
Hydraulic System Failure	2%
Brakes	1%
MEL Item	1%
Crew Incapacitation	1%
Manuals/Charts/Checklists	1%
Avionics/Flight Instruments	1%
Spatial Disorientation/somatogravic illusion	1%
Flight Controls	1%

2014-2018 Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	24%
Vertical/Lateral/Speed Deviation	20%
Unstable Approach	15%
Continued Landing after Unstable Approach	12%
Unnecessary Weather Penetration	12%
Abrupt Aircraft Control	10%
Operation Outside Aircraft Limitations	9%
Engine	5%
Brakes/Thrust Reversers/Ground Spoilers	4%
Controlled Flight Towards Terrain	3%
Loss of aircraft control while on the ground	3%
Flight Controls/Automation	3%
Ramp movements	3%
Rejected Takeoff after V1	2%
Weight & Balance	1%
Landing Gear	1%
Unauthorized Airspace Penetration	1%
Runway/taxiway incursion	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	26%
Monitor / Cross-check	18%
In-flight decision-making/contingency management	11%
Leadership	11%
Captain should show leadership	9%
Taxiway / Runway Management	8%
FO is assertive when necessary	7%
Workload Management	5%
Communication Environment	5%
Automation Management	5%
Evaluation of Plans	3%
Inquiry	1%

Note: 53 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

2014-2018 Fatal Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Safety Management	54%
Regulatory Oversight	50%
Flight Operations	46%
Flight Ops: SOPs & Checking	39%
Selection Systems	25%
Flight Ops: Training Systems	21%
Management Decisions	14%
Dispatch	11%
Dispatch Ops: SOPs & Checking	11%
Technology & Equipment	11%
Ground Operations	7%
Ground Ops: SOPs & Checking	7%
Design	7%
Change Management	7%
Ops Planning & Scheduling	7%
Maintenance Ops: SOPs & Checking	4%
Ground Ops: Training Systems	4%
Maintenance Ops: Training Systems	4%
Maintenance Operations	4%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	61%
Manual Handling/Flight Controls	39%
Pilot-to-Pilot Communication	29%
Callouts	25%
Abnormal Checklist	18%
Systems/Radios/Instruments	11%
ATC	7%
Crew to External Communication	7%
Briefings	7%
Dispatch	4%
Automation	4%
Normal Checklist	4%
Documentation	4%
Wrong Weight & Balance/Fuel Information	4%

2014-2018 Fatal Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	46%
Aircraft Malfunction	43%
Lack of Visual Reference	25%
Poor visibility/IMC	25%
Operational Pressure	21%
Thunderstorms	21%
Contained Engine Failure/Powerplant Malfunction	18%
Fatigue	18%
Wind/Wind shear/Gusty wind	14%
Spatial Disorientation/somatogravic illusion	11%
Air Traffic Services	11%
Nav Aids	11%
Dispatch/Paperwork	11%
Ground-based nav aid malfunction or not available	11%
Icing Conditions	11%
Ground Events	7%
Terrain/Obstacles	7%
Avionics/Flight Instruments	7%
Maintenance Events	7%
Gear/Tire	4%
Hydraulic System Failure	4%
Manuals/Charts/Checklists	4%
MEL Item	4%
Extensive/Uncontained Engine Failure	4%
Structural Failure	4%
Crew Incapacitation	4%

2014-2018 Fatal Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Operation Outside Aircraft Limitations	32%
Vertical/Lateral/Speed Deviation	32%
Unnecessary Weather Penetration	29%
Controlled Flight Towards Terrain	25%
Abrupt Aircraft Control	18%
Continued Landing after Unstable Approach	14%
Unstable Approach	11%
Engine	11%
Long/floated/bounced/firm/off-center/crabbed landing	7%
Weight & Balance	4%
Systems	4%
Flight Controls/Automation	4%
Unauthorized Airspace Penetration	4%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	46%
Monitor/Cross-check	43%
Leadership	32%
In-flight decision-making/contingency management	29%
FO is assertive when necessary	29%
Communication Environment	25%
Captain should show leadership	25%
Workload Management	14%
Automation Management	11%
Evaluation of Plans	7%
Plans Stated	4%
Taxiway/Runway Management	4%
Inquiry	4%

Addendum A

Top Contributing Factors – Section 4

2014-2018 Nonfatal Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	29%
Safety Management	23%
Flight Operations	18%
Flight Ops: Training Systems	12%
Flight Ops: SOPs & Checking	11%
Maintenance Operations	9%
Maintenance Ops: SOPs & Checking	9%
Selection Systems	8%
Design	7%
Management Decisions	5%
Ground Operations	3%
Technology & Equipment	3%
Ground Ops: SOPs & Checking	2%
Ground Ops: Training Systems	2%
Maintenance Ops: Training Systems	2%
Dispatch	2%
Change Management	2%
Dispatch Ops: SOPs & Checking	1%
Ops Planning & Scheduling	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	36%
SOP Adherence/SOP Cross-verification	27%
Callouts	10%
Pilot-to-Pilot Communication	7%
Automation	4%
Ground Navigation	3%
Normal Checklist	2%
Abnormal Checklist	2%
Crew to External Communication	2%
Briefings	1%
ATC	1%
Wrong Weight & Balance/Fuel Information	1%
Documentation	1%
Systems/Radios/Instruments	1%

2014-2018 Nonfatal Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	32%
Aircraft Malfunction	29%
Wind/Wind shear/Gusty wind	19%
Gear/Tire	18%
Airport Facilities	17%
Maintenance Events	14%
Poor visibility/IMC	11%
Thunderstorms	10%
Contaminated runway/taxiway - poor braking action	9%
Lack of Visual Reference	8%
Nav Aids	6%
Ground Events	6%
Ground-based nav aid malfunction or not available	6%
Operational Pressure	6%
Optical Illusion/visual mis-perception	5%
Wildlife/Birds/Foreign Object	5%
Poor/faint marking/signs or runway/taxiway closure	5%
Fire/Smoke (Cockpit/Cabin/Cargo)	5%
Fatigue	4%
Air Traffic Services	4%
Traffic	3%
Airport perimeter control/fencing/wildlife control	3%
Inad overrun area/trench/ditch/prox of structures	3%
Extensive/Uncontained Engine Failure	3%
Dispatch/Paperwork	2%
Contained Engine Failure/Powerplant Malfunction	2%
Terrain/Obstacles	2%
Brakes	1%
Hydraulic System Failure	1%
Icing Conditions	1%
Crew Incapacitation	1%
Flight Controls	1%
MEL Item	1%
Manuals/Charts/Checklists	1%

2014-2018 Nonfatal Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	26%
Vertical/Lateral/Speed Deviation	19%
Unstable Approach	16%
Continued Landing after Unstable Approach	12%
Unnecessary Weather Penetration	10%
Abrupt Aircraft Control	9%
Operation Outside Aircraft Limitations	6%
Brakes/Thrust Reversers/Ground Spoilers	5%
Engine	4%
Loss of aircraft control while on the ground	3%
Ramp movements	3%
Flight Controls/Automation	3%
Rejected Takeoff after V1	2%
Controlled Flight Towards Terrain	1%
Weight & Balance	1%
Runway/taxiway incursion	1%
Landing Gear	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	23%
Monitor/Cross-check	15%
In-flight decision-making/contingency management	9%
Leadership	8%
Taxiway/Runway Management	8%
Captain should show leadership	7%
FO is assertive when necessary	4%
Workload Management	4%
Automation Management	4%
Communication Environment	2%
Evaluation of Plans	2%

Addendum A

Top Contributing Factors – Section 4

2014-2018 IOSA Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	23%
Flight Operations	20%
Safety Management	20%
Flight Ops: Training Systems	14%
Flight Ops: SOPs & Checking	14%
Maintenance Operations	11%
Maintenance Ops: SOPs & Checking	10%
Design	9%
Selection Systems	8%
Management Decisions	5%
Change Management	4%
Ground Operations	3%
Technology & Equipment	3%
Ops Planning & Scheduling	2%
Ground Ops: Training Systems	2%
Maintenance Ops: Training Systems	2%
Ground Ops: SOPs & Checking	2%
Cabin Ops: SOPs & Checking	1%
Cabin Operations	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	35%
SOP Adherence/SOP Cross-verification	30%
Callouts	14%
Pilot-to-Pilot Communication	13%
Automation	6%
Abnormal Checklist	5%
Ground Navigation	4%
Systems/Radios/Instruments	2%
Normal Checklist	2%
Briefings	2%
Ground Crew	1%
Wrong Weight & Balance/Fuel Information	1%
Documentation	1%
Crew to External Communication	1%

2014-2018 IOSA Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	30%
Aircraft Malfunction	29%
Gear/Tire	18%
Wind/Wind shear/Gusty wind	18%
Maintenance Events	17%
Poor visibility/IMC	13%
Airport Facilities	12%
Thunderstorms	10%
Ground Events	8%
Lack of Visual Reference	8%
Operational Pressure	8%
Fatigue	7%
Optical Illusion/visual mis-perception	6%
Fire/Smoke (Cockpit/Cabin/Cargo)	6%
Contaminated runway/taxiway - poor braking action	6%
Ground-based nav aid malfunction or not available	5%
Air Traffic Services	5%
Traffic	5%
Nav Aids	5%
Inad overrun area/trench/ditch/prox of structures	3%
Poor/faint marking/signs or runway/taxiway closure	3%
Wildlife/Birds/Foreign Object	3%
Extensive/Uncontained Engine Failure	3%
Manuals/Charts/Checklists	2%
Dispatch/Paperwork	2%
Contained Engine Failure/Powerplant Malfunction	2%
Hydraulic System Failure	2%
Terrain/Obstacles	2%
Avionics/Flight Instruments	1%
Spatial Disorientation/somatogravic illusion	1%
MEL Item	1%
Airport perimeter control/fencing/wildlife control	1%
Icing Conditions	1%
Brakes	1%

2014-2018 IOSA Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	23%
Long/floated/bounced/firm/off-center/crabbed landing	22%
Unstable Approach	15%
Abrupt Aircraft Control	13%
Continued Landing after Unstable Approach	12%
Unnecessary Weather Penetration	11%
Ramp movements	5%
Brakes/Thrust Reversers/Ground Spoilers	5%
Engine	5%
Controlled Flight Towards Terrain	5%
Loss of aircraft control while on the ground	4%
Flight Controls/Automation	4%
Operation Outside Aircraft Limitations	4%
Rejected Takeoff after V1	2%
Wrong taxiway/ramp/gate/hold spot	1%
Runway/taxiway incursion	1%
Weight & Balance	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	26%
Monitor/Cross-check	19%
Leadership	14%
In-flight decision-making/contingency management	11%
Captain should show leadership	12%
Communication Environment	8%
FO is assertive when necessary	8%
Automation Management	6%
Workload Management	6%
Taxiway/Runway Management	6%
Evaluation of Plans	1%

Note: 9 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

2014-2018 Non-IOSA Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	39%
Safety Management	34%
Flight Operations	22%
Flight Ops: SOPs & Checking	14%
Flight Ops: Training Systems	12%
Selection Systems	11%
Maintenance Operations	7%
Management Decisions	6%
Maintenance Ops: SOPs & Checking	6%
Dispatch	5%
Design	5%
Technology & Equipment	4%
Ground Ops: SOPs & Checking	4%
Dispatch Ops: SOPs & Checking	4%
Ground Operations	4%
Ground Ops: Training Systems	2%
Maintenance Ops: Training Systems	2%
Change Management	1%
Ops Planning & Scheduling	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	38%
SOP Adherence/SOP Cross-verification	32%
Callouts	10%
Pilot-to-Pilot Communication	6%
Crew to External Communication	4%
ATC	3%
Automation	2%
Normal Checklist	2%
Abnormal Checklist	2%
Briefings	2%
Documentation	2%
Wrong Weight & Balance/Fuel Information	2%
Systems/Radios/Instruments	2%
Ground Navigation	1%
Dispatch	1%
Misinterpreted Item on Paperwork	1%
Maintenance	1%

2014-2018 Non-IOSA Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	37%
Aircraft Malfunction	32%
Wind/Wind shear/Gusty wind	19%
Airport Facilities	19%
Gear/Tire	15%
Poor visibility/IMC	13%
Thunderstorms	12%
Lack of Visual Reference	12%
Maintenance Events	10%
Contaminated runway/taxiway - poor braking action	9%
Nav Aids	8%
Ground-based nav aid malfunction or not available	8%
Operational Pressure	8%
Wildlife/Birds/Foreign Object	6%
Poor/faint marking/signs or runway/taxiway closure	5%
Contained Engine Failure/Powerplant Malfunction	5%
Ground Events	5%
Fatigue	5%
Airport perimeter control/fencing/wildlife control	5%
Icing Conditions	4%
Air Traffic Services	4%
Dispatch/Paperwork	4%
Optical Illusion/visual mis-perception	3%
Terrain/Obstacles	3%
Crew Incapacitation	2%
Extensive/Uncontained Engine Failure	2%
Inad overrun area/trench/ditch/prox of structures	2%
Fire/Smoke (Cockpit/Cabin/Cargo)	2%
Hydraulic System Failure	2%
Flight Controls	2%
Spatial Disorientation/somatogravic illusion	2%
Brakes	2%
Avionics/Flight Instruments	2%
MEL Item	2%
Primary Flight Controls	1%
Secondary Flight Controls	1%
Traffic	1%
Structural Failure	1%

2014-2018 Non-IOSA Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	26%
Vertical/Lateral/Speed Deviation	18%
Unstable Approach	15%
Operation Outside Aircraft Limitations	14%
Unnecessary Weather Penetration	12%
Continued Landing after Unstable Approach	12%
Abrupt Aircraft Control	8%
Engine	4%
Brakes/Thrust Reversers/Ground Spoilers	3%
Controlled Flight Towards Terrain	2%
Loss of aircraft control while on the ground	2%
Landing Gear	2%
Flight Controls/Automation	2%
Unauthorized Airspace Penetration	2%
Weight & Balance	2%
Rejected Takeoff after V1	2%
Runway/taxiway incursion	1%
Systems	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	26%
Monitor/Cross-check	18%
In-flight decision-making/contingency management	12%
Taxiway/Runway Management	9%
Leadership	8%
FO is assertive when necessary	6%
Captain should show leadership	5%
Workload Management	5%
Evaluation of Plans	5%
Automation Management	3%
Communication Environment	2%
Inquiry	2%
Plans Stated	1%
SOP Briefing/Planning	1%

Note: 44 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Controlled Flight into Terrain

LATENT CONDITIONS

	Percentage Contribution
Flight Operations	83%
Regulatory Oversight	83%
Flight Ops: SOPs & Checking	67%
Safety Management	67%
Technology & Equipment	50%
Selection Systems	50%
Flight Ops: Training Systems	33%
Management Decisions	33%

THREATS

	Percentage Contribution
Meteorology	67%
Lack of Visual Reference	67%
Poor visibility/IMC	67%
Nav Aids	50%
Ground-based nav aid malfunction or not available	50%
Operational Pressure	33%
Wind/Wind shear/Gusty wind	33%
Fatigue	33%
Airport Facilities	17%
Air Traffic Services	17%
Dispatch/Paperwork	17%
Manuals/Charts/Checklists	17%
Spatial Disorientation/somatogravic illusion	17%
Terrain/Obstacles	17%
Poor/faint marking/signs or runway/taxiway closure	17%
Thunderstorms	17%

Controlled Flight into Terrain

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	100%
Manual Handling/Flight Controls	33%
Callouts	33%
Briefings	17%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	50%
Unnecessary Weather Penetration	50%
Continued Landing after Unstable Approach	33%
Unstable Approach	33%
Engine	17%
Operation Outside Aircraft Limitations	17%
Long/floated/bounced/firm/off-center/crabbed landing	17%
Abrupt Aircraft Control	17%

COUNTERMEASURES

	Percentage Contribution
Monitor/Cross-check	83%
Overall Crew Performance	67%
In-flight decision-making/contingency management	50%
Leadership	50%
FO is assertive when necessary	50%
Captain should show leadership	33%
Communication Environment	17%
Automation Management	17%

Note: four accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Loss of Control – In-flight

LATENT CONDITIONS

	Percentage Contribution
Flight Operations	47%
Safety Management	47%
Flight Ops: SOPs & Checking	42%
Regulatory Oversight	37%
Flight Ops: Training Systems	26%
Selection Systems	21%
Change Management	11%
Ground Ops: SOPs & Checking	11%
Ground Operations	11%
Ops Planning & Scheduling	11%
Dispatch	11%
Dispatch Ops: SOPs & Checking	11%
Maintenance Operations	5%
Management Decisions	5%
Maintenance Ops: SOPs & Checking	5%
Maintenance Ops: Training Systems	5%
Design	5%
Ground Ops: Training Systems	5%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	53%
Manual Handling/Flight Controls	42%
Pilot-to-Pilot Communication	32%
Abnormal Checklist	26%
Callouts	21%
Systems/Radios/Instruments	16%
Automation	11%
Normal Checklist	5%

Loss of Control – In-flight

THREATS

	Percentage Contribution
Aircraft Malfunction	53%
Meteorology	47%
Contained Engine Failure/Powerplant Malfunction	32%
Lack of Visual Reference	21%
Poor visibility/IMC	16%
Wind/Wind shear/Gusty wind	16%
Icing Conditions	16%
Thunderstorms	16%
Spatial Disorientation/somatogravic illusion	11%
Avionics/Flight Instruments	11%
Operational Pressure	11%
Maintenance Events	11%
Fatigue	11%
Ground Events	11%
Manuals/Charts/Checklists	5%
Nav Aids	5%
Gear/Tire	5%
MEL Item	5%
Terrain/Obstacles	5%
Dispatch/Paperwork	5%
Air Traffic Services	5%
Ground-based nav aid malfunction or not available	5%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Operation Outside Aircraft Limitations	37%
Vertical/Lateral/Speed Deviation	26%
Unnecessary Weather Penetration	21%
Abrupt Aircraft Control	16%
Engine	11%
Flight Controls/Automation	11%
Long/floated/bounced/firm/off-center/crabbed landing	5%
Weight & Balance	5%
Systems	5%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	47%
Monitor/Cross-check	32%
Leadership	26%
In-flight decision-making/contingency management	21%
FO is assertive when necessary	21%
Captain should show leadership	21%
Communication Environment	16%
Workload Management	16%
Automation Management	5%

Note: six accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Top Contributing Factors – Section 4

Mid-Air Collision

At least three accidents are required before the accident classification is provided. This category only contained one accident in the past five years.

Addendum A

Top Contributing Factors – Section 4

Runway/Taxiway Excursion

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	43%
Safety Management	41%
Flight Operations	23%
Flight Ops: Training Systems	18%
Flight Ops: SOPs & Checking	14%
Selection Systems	11%
Change Management	5%
Technology & Equipment	4%
Design	4%
Management Decisions	2%
Ops Planning & Scheduling	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	45%
SOP Adherence/SOP Cross-verification	43%
Callouts	20%
Pilot-to-Pilot Communication	14%
Automation	7%
ATC	4%
Normal Checklist	4%
Crew to External Communication	4%
Abnormal Checklist	2%
Ground Navigation	2%
Briefings	2%

Runway/Taxiway Excursion

THREATS

	Percentage Contribution
Meteorology	59%
Airport Facilities	45%
Wind/Wind shear/Gusty wind	30%
Contaminated runway/taxiway - poor braking action	30%
Poor visibility/IMC	23%
Thunderstorms	21%
Aircraft Malfunction	18%
Fatigue	13%
Lack of Visual Reference	13%
Operational Pressure	11%
Nav Aids	9%
Poor/faint marking/signs or runway/taxiway closure	9%
Ground-based nav aid malfunction or not available	9%
Inad overrun area/trench/ditch/prox of structures	7%
Optical Illusion/visual mis-perception	7%
Contained Engine Failure/Powerplant Malfunction	5%
Air Traffic Services	5%
Icing Conditions	4%
Airport perimeter control/fencing/wildlife control	4%
Wildlife/Birds/Foreign Object	4%
MEL Item	4%
Terrain/Obstacles	4%
Crew Incapacitation	4%
Gear/Tire	2%
Manuals/Charts/Checklists	2%
Hydraulic System Failure	2%
Fire/Smoke (Cockpit/Cabin/Cargo)	2%
Flight Controls	2%
Maintenance Events	2%
Brakes	2%
Primary Flight Controls	2%

Runway/Taxiway Excursion

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	43%
Vertical/Lateral/Speed Deviation	25%
Unstable Approach	20%
Continued Landing after Unstable Approach	20%
Unnecessary Weather Penetration	20%
Brakes/Thrust Reversers/Ground Spoilers	13%
Abrupt Aircraft Control	9%
Loss of aircraft control while on the ground	7%
Operation Outside Aircraft Limitations	7%
Engine	5%
Flight Controls/Automation	4%
Rejected Takeoff after V1	4%
Unauthorized Airspace Penetration	2%

COUNTERMEASURES

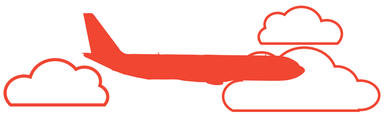
	Percentage Contribution
Overall Crew Performance	39%
Taxiway/Runway Management	27%
Monitor/Cross-check	23%
In-flight decision-making/contingency management	20%
Leadership	14%
Captain should show leadership	11%
FO is assertive when necessary	11%
Workload Management	9%
Automation Management	5%
Communication Environment	4%
Evaluation of Plans	4%
SOP Briefing/Planning	2%

Note: 17 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

In-flight Damage



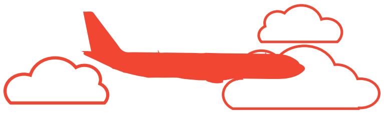
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	16%
Design	13%
Maintenance Ops: SOPs & Checking	9%
Safety Management	9%
Maintenance Operations	9%
Management Decisions	6%
Flight Ops: SOPs & Checking	3%
Ground Ops: Training Systems	3%
Ground Operations	3%
Ground Ops: SOPs & Checking	3%
Flight Operations	3%

THREATS

	Percentage Contribution
Aircraft Malfunction	47%
Extensive/Uncontained Engine Failure	22%
Maintenance Events	22%
Wildlife/Birds/Foreign Object	19%
Fire/Smoke (Cockpit/Cabin/Cargo)	16%
Meteorology	16%
Thunderstorms	13%
Airport Facilities	9%
Gear/Tire	9%
Contaminated runway/taxiway - poor braking action	6%
Ground Events	6%
Dispatch/Paperwork	3%
Structural Failure	3%
Brakes	3%
Airport perimeter control/fencing/wildlife control	3%
Air Traffic Services	3%

In-flight Damage



FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	13%
Pilot-to-Pilot Communication	3%
Systems/Radios/Instruments	3%
Callouts	3%
Automation	3%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Unnecessary Weather Penetration	9%
Operation Outside Aircraft Limitations	6%
Abrupt Aircraft Control	3%

COUNTERMEASURES

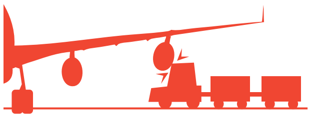
	Percentage Contribution
Captain should show leadership	3%
Automation Management	3%
In-flight decision-making/contingency management	3%
Leadership	3%
Evaluation of Plans	3%
Communication Environment	3%

Note: three accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Ground Damage



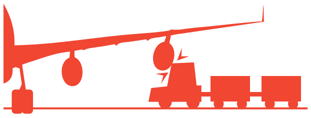
LATENT CONDITIONS

	Percentage Contribution
Ground Operations	26%
Regulatory Oversight	22%
Safety Management	17%
Ground Ops: SOPs & Checking	17%
Ground Ops: Training Systems	17%
Maintenance Operations	13%
Flight Ops: SOPs & Checking	9%
Flight Operations	9%
Design	9%
Maintenance Ops: SOPs & Checking	9%
Flight Ops: Training Systems	4%

THREATS

	Percentage Contribution
Ground Events	52%
Traffic	30%
Aircraft Malfunction	22%
Maintenance Events	17%
Fire/Smoke (Cockpit/Cabin/Cargo)	13%
Airport Facilities	9%
Secondary Flight Controls	4%
Meteorology	4%
Hydraulic System Failure	4%
Brakes	4%
Gear/Tire	4%
Operational Pressure	4%
Inad overrun area/trench/ditch/prox of structures	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Wind/Wind shear/Gusty wind	4%
Flight Controls	4%
Optical Illusion/visual mis-perception	4%

Ground Damage



FLIGHT CREW ERRORS

	Percentage Contribution
Ground Navigation	17%
Manual Handling/Flight Controls	9%
SOP Adherence/SOP Cross-verification	4%
Abnormal Checklist	4%
Callouts	4%
Ground Crew	4%
Crew to External Communication	4%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Ramp movements	26%
Loss of aircraft control while on the ground	9%
Brakes/Thrust Reversers/Ground Spoilers	9%
Wrong taxiway/ramp/gate/hold spot	4%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	17%
Taxiway/Runway Management	13%
Captain should show leadership	4%
Leadership	4%
Monitor/Cross-check	4%

Note: five accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Undershoot

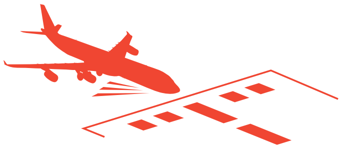
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	44%
Safety Management	33%
Flight Ops: SOPs & Checking	22%
Flight Operations	22%
Management Decisions	11%
Technology & Equipment	11%

THREATS

	Percentage Contribution
Meteorology	89%
Wind/Wind shear/Gusty wind	56%
Poor visibility/IMC	56%
Ground-based nav aid malfunction or not available	44%
Nav Aids	44%
Optical Illusion/visual mis-perception	33%
Lack of Visual Reference	33%
Poor/faint marking/signs or runway/taxiway closure	22%
Operational Pressure	22%
Thunderstorms	22%
Airport Facilities	22%
Air Traffic Services	11%

Undershoot



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	56%
SOP Adherence/SOP Cross-verification	56%
Pilot-to-Pilot Communication	22%
Callouts	11%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	56%
Unnecessary Weather Penetration	44%
Unstable Approach	33%
Continued Landing after Unstable Approach	33%
Long/floated/bounced/firm/off-center/crabbed landing	11%

COUNTERMEASURES

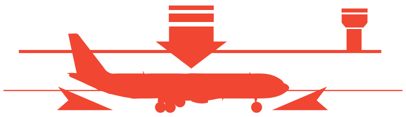
	Percentage Contribution
Overall Crew Performance	33%
Monitor/Cross-check	22%
FO is assertive when necessary	11%
Automation Management	11%
Communication Environment	11%
Leadership	11%

Note: two accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Hard Landing



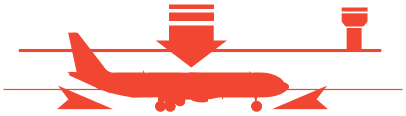
LATENT CONDITIONS

	Percentage Contribution
Flight Operations	30%
Flight Ops: Training Systems	28%
Regulatory Oversight	21%
Safety Management	16%
Selection Systems	14%
Flight Ops: SOPs & Checking	14%
Technology & Equipment	5%
Management Decisions	5%
Dispatch Ops: SOPs & Checking	2%
Dispatch	2%

THREATS

	Percentage Contribution
Meteorology	42%
Wind/Wind shear/Gusty wind	30%
Thunderstorms	14%
Lack of Visual Reference	9%
Poor visibility/IMC	9%
Optical Illusion/visual mis-perception	7%
Operational Pressure	7%
Nav Aids	7%
Ground-based nav aid malfunction or not available	7%
Fatigue	5%
Airport Facilities	5%
Poor/faint marking/signs or runway/taxiway closure	5%
Dispatch/Paperwork	2%
Aircraft Malfunction	2%
Gear/Tire	2%

Hard Landing



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	81%
SOP Adherence/SOP Cross-verification	37%
Callouts	9%
Automation	5%
Pilot-to-Pilot Communication	5%
Maintenance	2%
Crew to External Communication	2%
Normal Checklist	2%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	58%
Unstable Approach	42%
Vertical/Lateral/Speed Deviation	40%
Abrupt Aircraft Control	33%
Continued Landing after Unstable Approach	28%
Unnecessary Weather Penetration	9%
Operation Outside Aircraft Limitations	9%
Engine	7%
Loss of aircraft control while on the ground	5%
Flight Controls/Automation	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	35%
Monitor/Cross-check	21%
In-flight decision-making/contingency management	7%
Leadership	5%
Automation Management	5%
Captain should show leadership	5%
Evaluation of Plans	2%
Workload Management	2%
Taxiway/Runway Management	2%

Note: one accident was not classified due to insufficient data; this accidents was subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Gear-up Landing/Gear Collapse

LATENT CONDITIONS

	Percentage Contribution
Maintenance Operations	34%
Maintenance Ops: SOPs & Checking	32%
Regulatory Oversight	22%
Design	20%
Safety Management	20%
Maintenance Ops: Training Systems	7%
Management Decisions	5%
Flight Ops: Training Systems	2%
Dispatch Ops: SOPs & Checking	2%
Cabin Ops: SOPs & Checking	2%
Selection Systems	2%
Cabin Operations	2%
Flight Operations	2%
Dispatch	2%
Ops Planning & Scheduling	2%

THREATS

	Percentage Contribution
Aircraft Malfunction	88%
Gear/Tire	88%
Maintenance Events	49%
Hydraulic System Failure	5%
Airport Facilities	2%
Nav Aids	2%
Wind/Wind shear/Gusty wind	2%
Ground-based nav aid malfunction or not available	2%
Meteorology	2%
Operational Pressure	2%
Inad overrun area/trench/ditch/prox of structures	2%
Dispatch/Paperwork	2%
Thunderstorms	2%
Poor visibility/IMC	2%

Gear-up Landing/Gear Collapse

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	2%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Landing Gear	5%
Unnecessary Weather Penetration	2%
Long/floated/bounced/firm/off-center/crabbed landing	2%
Vertical/Lateral/Speed Deviation	2%
Operation Outside Aircraft Limitations	2%
Unstable Approach	2%

COUNTERMEASURES

	Percentage Contribution
In-flight decision-making/contingency management	2%

Note: height accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Tail Strike

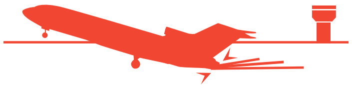
LATENT CONDITIONS

	Percentage Contribution
Flight Operations	24%
Regulatory Oversight	12%
Flight Ops: Training Systems	12%
Flight Ops: SOPs & Checking	12%
Dispatch	6%
Change Management	6%
Safety Management	6%

THREATS

	Percentage Contribution
Meteorology	35%
Wind/Wind shear/Gusty wind	29%
Fatigue	12%
Dispatch/Paperwork	12%
Poor visibility/IMC	6%
Terrain/Obstacles	6%
Nav Aids	6%
Ground Events	6%
Ground-based nav aid malfunction or not available	6%
Lack of Visual Reference	6%

Tail Strike



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	88%
SOP Adherence/SOP Cross-verification	53%
Pilot-to-Pilot Communication	18%
Callouts	12%
Documentation	12%
Wrong Weight & Balance/Fuel Information	12%
Systems/Radios/Instruments	6%
Normal Checklist	6%
Automation	6%
Misinterpreted Item on Paperwork	6%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	59%
Vertical/Lateral/Speed Deviation	29%
Unstable Approach	29%
Continued Landing after Unstable Approach	24%
Weight & Balance	12%
Operation Outside Aircraft Limitations	12%
Abrupt Aircraft Control	12%
Flight Controls/Automation	6%
Unnecessary Weather Penetration	6%
Brakes/Thrust Reversers/Ground Spoilers	6%

COUNTERMEASURES

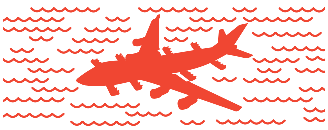
	Percentage Contribution
Monitor/Cross-check	41%
Overall Crew Performance	35%
Leadership	29%
Captain should show leadership	29%
In-flight decision-making/contingency management	18%
Workload Management	18%
Automation Management	18%
FO is assertive when necessary	12%
Communication Environment	12%
Evaluation of Plans	6%

Note: one accident was not classified due to insufficient data; this accident was subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Off-Airport Landing/Ditching



LATENT CONDITIONS

	Percentage Contribution
Management Decisions	100%
Dispatch	100%
Flight Operations	100%
Safety Management	100%
Regulatory Oversight	100%
Selection Systems	100%

THREATS

	Percentage Contribution
—	—

FLIGHT CREW ERRORS

	Percentage Contribution
—	—

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
—	—

COUNTERMEASURES

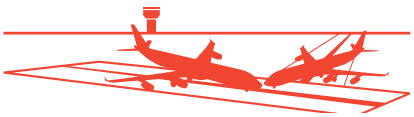
	Percentage Contribution
—	—

Note: one accident was not classified due to insufficient data; this accident was subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Runway Collision



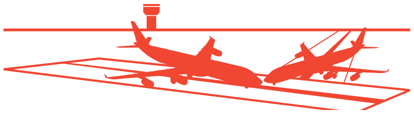
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	60%
Safety Management	30%
Flight Ops: Training Systems	10%
Management Decisions	10%
Maintenance Operations	10%
Flight Operations	10%
Maintenance Ops: SOPs & Checking	10%

THREATS

	Percentage Contribution
Wildlife/Birds/Foreign Object	40%
Airport perimeter control/fencing/wildlife control	40%
Airport Facilities	40%
Meteorology	30%
Air Traffic Services	30%
Poor visibility/IMC	30%
Lack of Visual Reference	20%
Wind/Wind shear/Gusty wind	20%
Traffic	10%
Terrain/Obstacles	10%
Contaminated runway/taxiway - poor braking action	10%
Optical Illusion/visual mis-perception	10%
Icing Conditions	10%

Runway Collision



FLIGHT CREW ERRORS

	Percentage Contribution
Callouts	10%
ATC	10%
Ground Navigation	10%
Crew to External Communication	10%
Briefings	10%
SOP Adherence/SOP Cross-verification	10%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Runway/taxiway incursion	20%
Ramp movements	10%
Vertical/Lateral/Speed Deviation	10%

COUNTERMEASURES

	Percentage Contribution
Inquiry	10%
Overall Crew Performance	10%
Monitor/Cross-check	10%

Note: all of the accidents were classified.

Addendum A

Top Contributing Factors – Section 4

Jet Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	28%
Safety Management	27%
Flight Operations	20%
Flight Ops: Training Systems	14%
Flight Ops: SOPs & Checking	12%
Maintenance Operations	10%
Maintenance Ops: SOPs & Checking	9%
Selection Systems	9%
Design	9%
Ground Operations	4%
Management Decisions	3%
Technology & Equipment	3%
Dispatch	3%
Change Management	3%
Ground Ops: SOPs & Checking	3%
Ground Ops: Training Systems	2%
Dispatch Ops: SOPs & Checking	2%
Ops Planning & Scheduling	2%
Maintenance Ops: Training Systems	1%
Cabin Operations	1%
Cabin Ops: SOPs & Checking	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	39%
SOP Adherence/SOP Cross-verification	31%
Callouts	13%
Pilot-to-Pilot Communication	11%
Automation	5%
Abnormal Checklist	3%
Normal Checklist	3%
Ground Navigation	3%
Crew to External Communication	2%
Systems/Radios/Instruments	2%
Wrong Weight & Balance/Fuel Information	2%
Briefings	2%
Documentation	2%
ATC	1%
Ground Crew	1%
Dispatch	1%
Misinterpreted Item on Paperwork	1%
Maintenance	1%

Jet Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	33%
Aircraft Malfunction	27%
Maintenance Events	17%
Wind/Wind shear/Gusty wind	17%
Airport Facilities	16%
Gear/Tire	14%
Thunderstorms	12%
Poor visibility/IMC	11%
Contaminated runway/taxiway - poor braking action	11%
Lack of Visual Reference	9%
Ground Events	8%
Operational Pressure	7%
Fatigue	7%
Optical Illusion/visual mis-perception	5%
Nav Aids	5%
Air Traffic Services	5%
Ground-based nav aid malfunction or not available	5%
Traffic	4%
Fire/Smoke (Cockpit/Cabin/Cargo)	4%
Wildlife/Birds/Foreign Object	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Extensive/Uncontained Engine Failure	3%
Dispatch/Paperwork	3%
Hydraulic System Failure	2%
Inad overrun area/trench/ditch/prox of structures	2%
Icing Conditions	2%
Terrain/Obstacles	2%
MEL Item	2%
Brakes	2%
Flight Controls	1%
Spatial Disorientation/somatogravic illusion	1%
Airport perimeter control/fencing/wildlife control	1%
Crew Incapacitation	1%
Manuals/Charts/Checklists	1%
Avionics/Flight Instruments	1%
Contained Engine Failure/Powerplant Malfunction	1%
Secondary Flight Controls	1%
Primary Flight Controls	1%

Jet Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	26%
Vertical/Lateral/Speed Deviation	21%
Unstable Approach	16%
Continued Landing after Unstable Approach	13%
Unnecessary Weather Penetration	11%
Abrupt Aircraft Control	10%
Operation Outside Aircraft Limitations	7%
Brakes/Thrust Reversers/Ground Spoilers	5%
Ramp movements	4%
Engine	3%
Flight Controls/Automation	3%
Loss of aircraft control while on the ground	2%
Weight & Balance	2%
Controlled Flight Towards Terrain	2%
Rejected Takeoff after V1	1%
Unauthorized Airspace Penetration	1%
Wrong taxiway/ramp/gate/hold spot	1%
Runway/taxiway incursion	1%
Systems	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	27%
Monitor/Cross-check	17%
Leadership	11%
Taxiway/Runway Management	10%
In-flight decision-making/contingency management	9%
Captain should show leadership	9%
FO is assertive when necessary	7%
Automation Management	6%
Workload Management	6%
Communication Environment	4%
Evaluation of Plans	2%
Inquiry	1%
Plans Stated	1%
SOP Briefing/Planning	1%

Note: 22 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Turboprop Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	36%
Safety Management	27%
Flight Operations	24%
Flight Ops: SOPs & Checking	18%
Selection Systems	11%
Flight Ops: Training Systems	11%
Management Decisions	11%
Maintenance Operations	6%
Maintenance Ops: SOPs & Checking	6%
Technology & Equipment	4%
Maintenance Ops: Training Systems	4%
Ground Operations	2%
Dispatch	2%
Ground Ops: Training Systems	2%
Design	2%
Ground Ops: SOPs & Checking	2%
Ops Planning & Scheduling	1%
Change Management	1%
Dispatch Ops: SOPs & Checking	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	31%
SOP Adherence/SOP Cross-verification	30%
Callouts	8%
Pilot-to-Pilot Communication	7%
Abnormal Checklist	5%
Briefings	2%
Crew to External Communication	2%
Automation	2%
ATC	2%
Ground Navigation	1%
Systems/Radios/Instruments	1%
Normal Checklist	1%

Turboprop Aircraft Accidents

THREATS

	Percentage Contribution
Aircraft Malfunction	39%
Meteorology	34%
Wind/Wind shear/Gusty wind	22%
Gear/Tire	20%
Poor visibility/IMC	17%
Airport Facilities	14%
Ground-based nav aid malfunction or not available	11%
Nav Aids	11%
Contained Engine Failure/Powerplant Malfunction	10%
Lack of Visual Reference	10%
Thunderstorms	10%
Operational Pressure	8%
Wildlife/Birds/Foreign Object	6%
Airport perimeter control/fencing/wildlife control	6%
Maintenance Events	5%
Poor/faint marking/signs or runway/taxiway closure	5%
Fire/Smoke (Cockpit/Cabin/Cargo)	4%
Dispatch/Paperwork	4%
Optical Illusion/visual mis-perception	4%
Inad overrun area/trench/ditch/prox of structures	4%
Fatigue	4%
Terrain/Obstacles	4%
Air Traffic Services	4%
Ground Events	2%
Icing Conditions	2%
Extensive/Uncontained Engine Failure	1%
Contaminated runway/taxiway - poor braking action	1%
Structural Failure	1%
Spatial Disorientation/somatogravic illusion	1%
Crew Incapacitation	1%
Avionics/Flight Instruments	1%
Manuals/Charts/Checklists	1%

Turboprop Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	19%
Vertical/Lateral/Speed Deviation	19%
Unnecessary Weather Penetration	13%
Unstable Approach	13%
Operation Outside Aircraft Limitations	12%
Continued Landing after Unstable Approach	11%
Abrupt Aircraft Control	11%
Engine	7%
Controlled Flight Towards Terrain	7%
Loss of aircraft control while on the ground	5%
Rejected Takeoff after V1	2%
Brakes/Thrust Reversers/Ground Spoilers	2%
Landing Gear	2%
Runway/taxiway incursion	1%
Unauthorized Airspace Penetration	1%
Flight Controls/Automation	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	24%
Monitor/Cross-check	20%
In-flight decision-making/contingency management	14%
Leadership	10%
Captain should show leadership	7%
FO is assertive when necessary	6%
Communication Environment	6%
Workload Management	5%
Evaluation of Plans	4%
Automation Management	2%
Taxiway/Runway Management	2%
Inquiry	1%

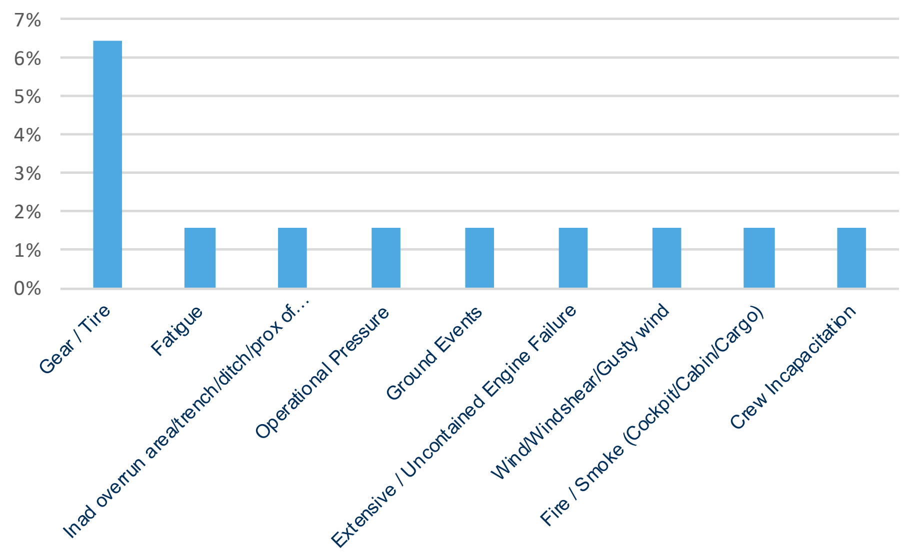
Note: 31 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum B

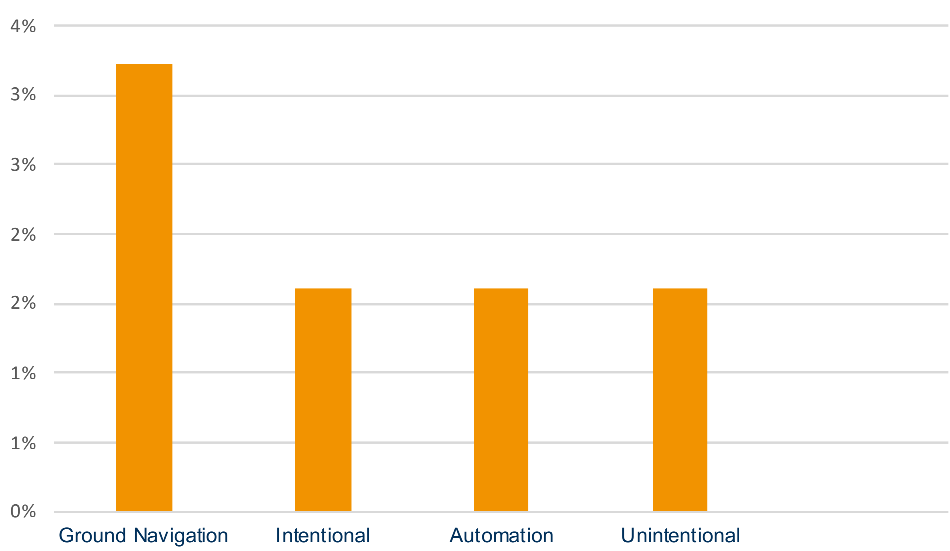
2018 Primary Contributing Factors

Accident Primary Contributing Factors Distribution

THREATS

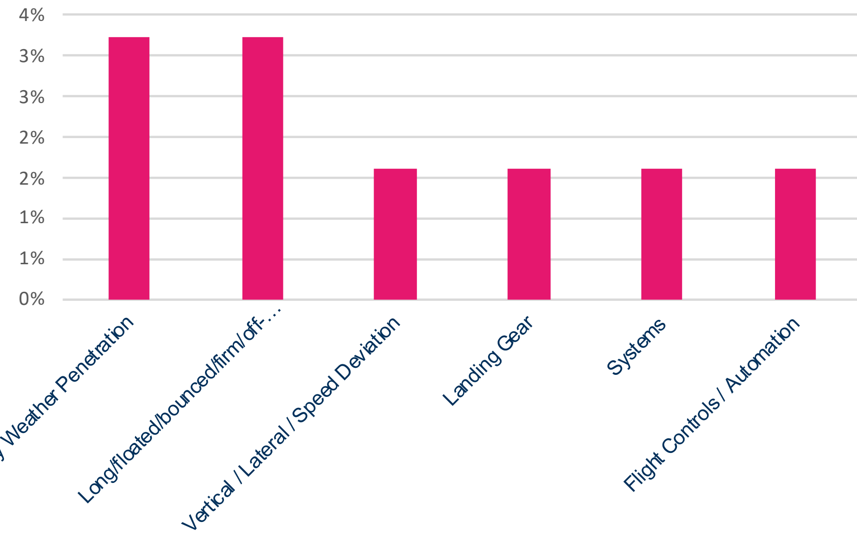


FLIGHT CREW ERRORS

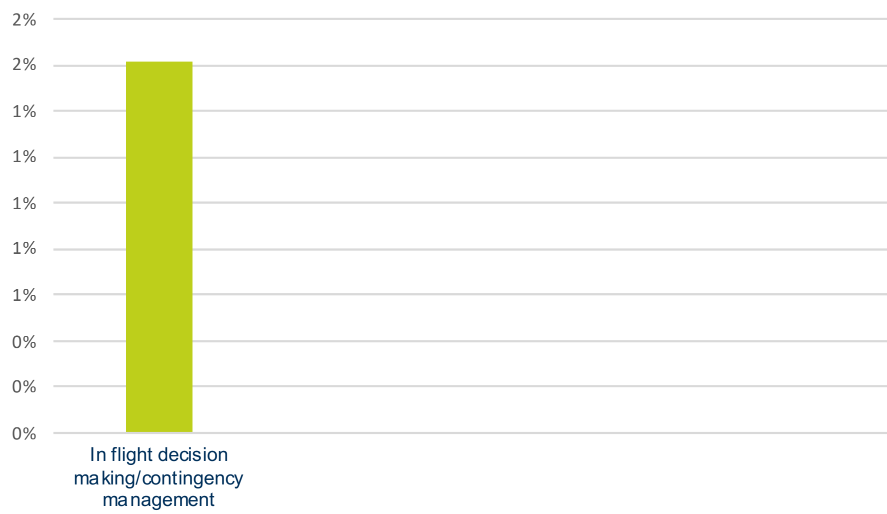


Accident Primary Contributing Factors Distribution

UNDESIRED AIRCRAFT STATE



COUNTERMEASURES

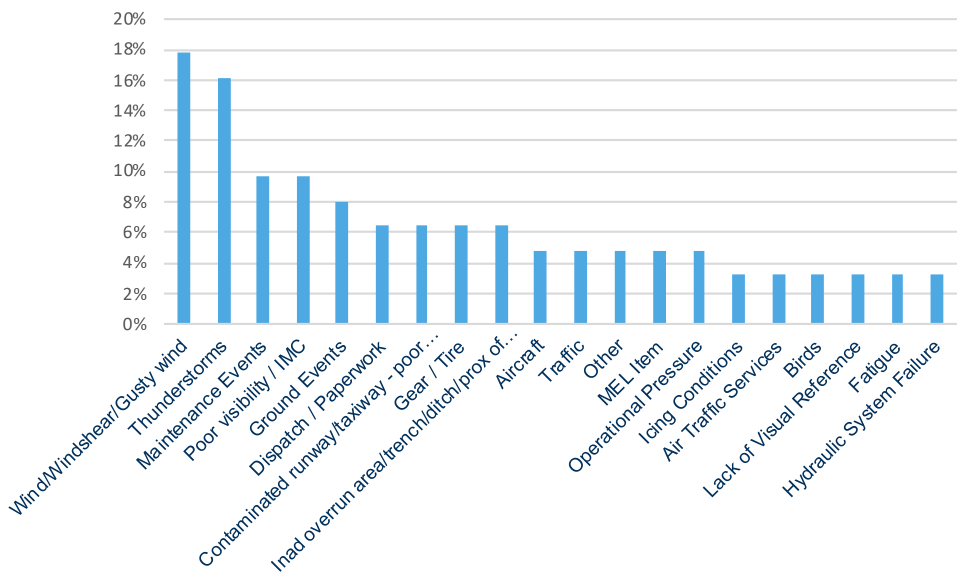


LATENT CONDITIONS

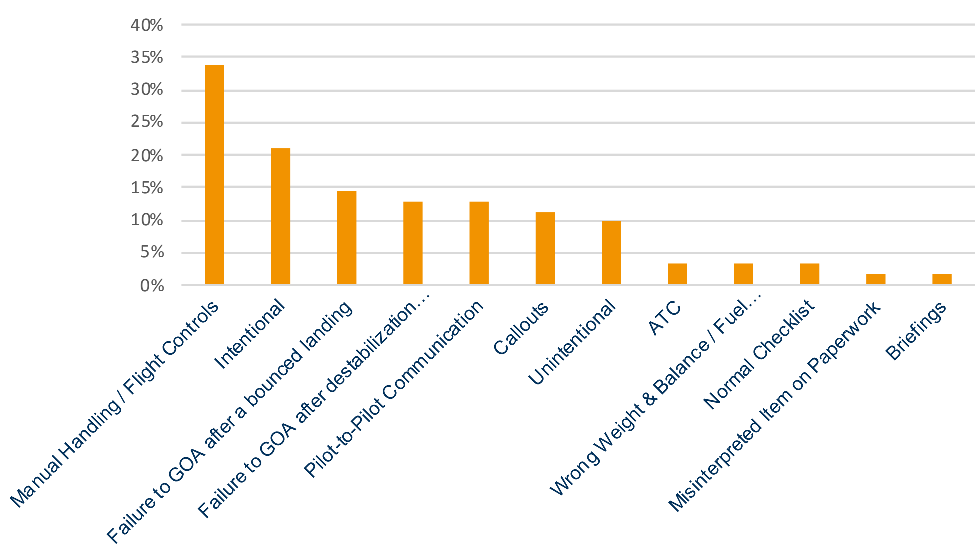
2018 Secondary Contributing Factors

Accident Secondary Contributing Factors Distribution

THREATS

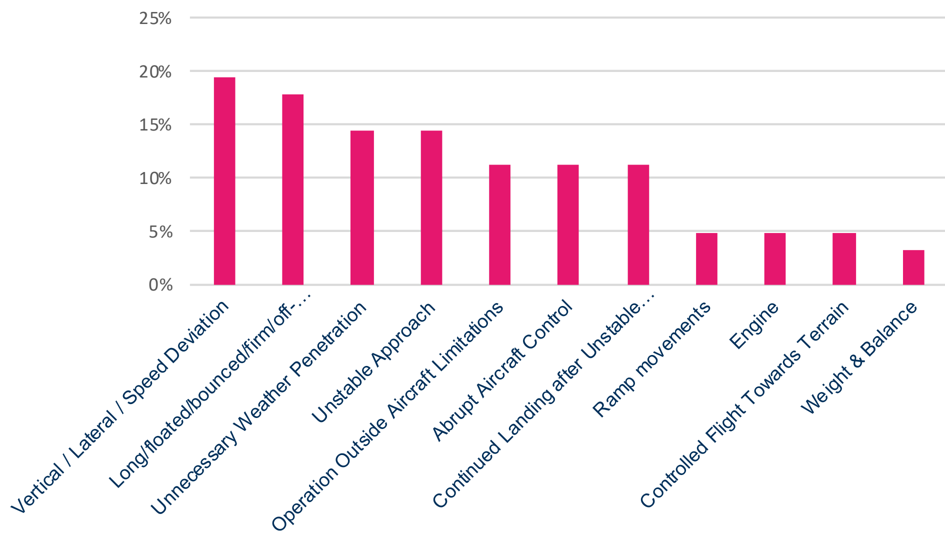


FLIGHT CREW ERRORS

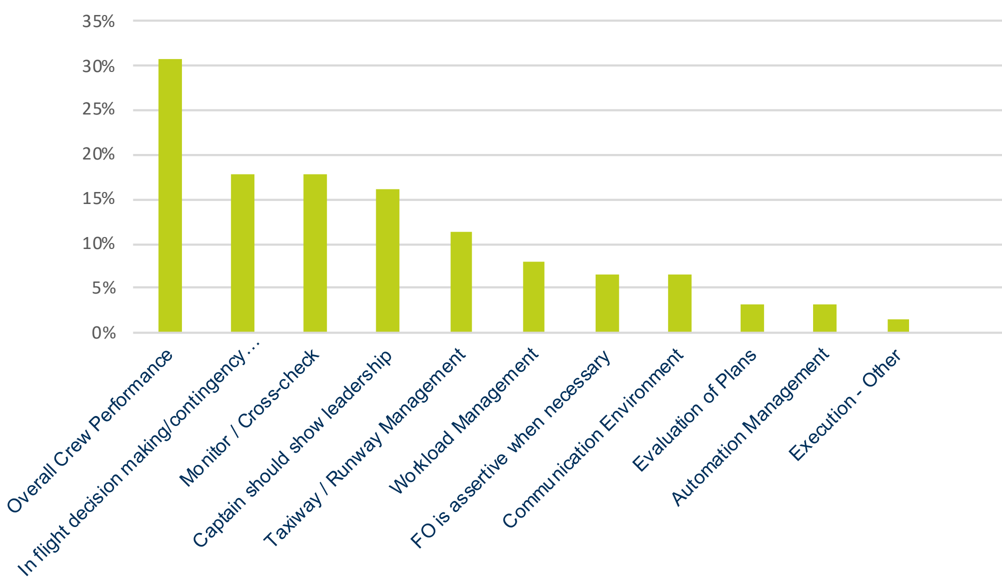


Accident Secondary Contributing Factors Distribution

UNDESIRED AIRCRAFT STATE

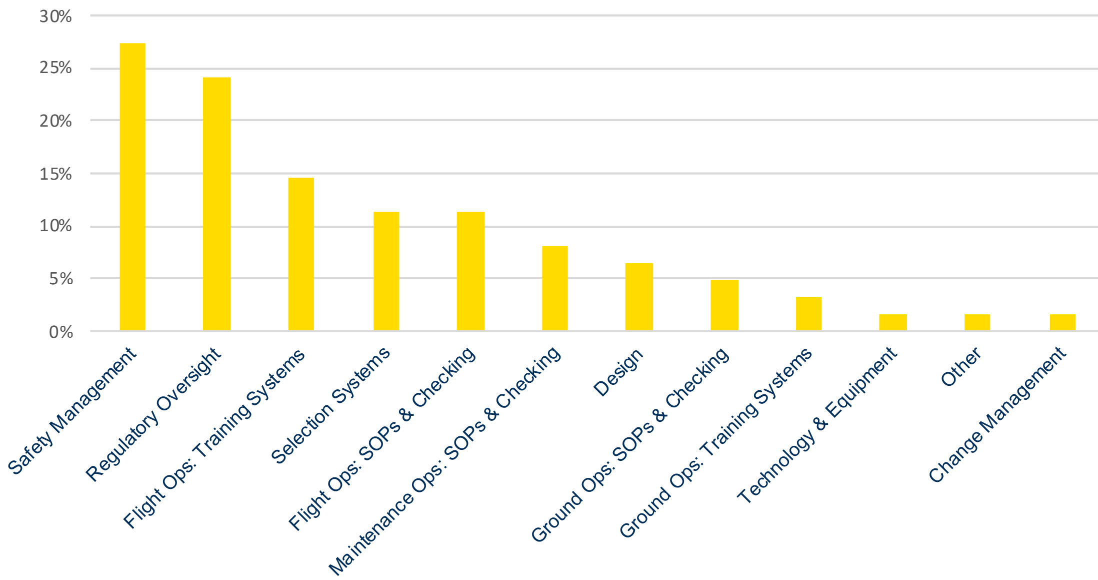


COUNTERMEASURES



Accident Secondary Contributing Factors Distribution

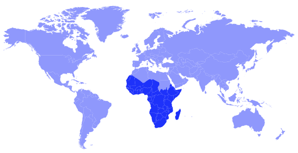
LATENT CONDITIONS



Addendum C

Top Contributing Factors – Section 5

Africa Aircraft Accidents



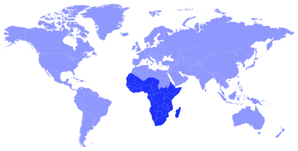
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	45%
Safety Management	35%
Maintenance Operations	10%
Maintenance Ops: SOPs & Checking	10%
Management Decisions	10%
Technology & Equipment	5%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	20%
SOP Adherence/SOP Cross-verification	10%
Ground Navigation	5%
ATC	5%
Callouts	5%
Pilot-to-Pilot Communication	5%
Crew to External Communication	5%

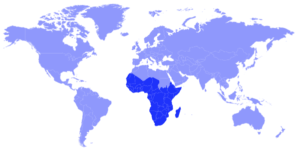
Africa Aircraft Accidents



THREATS

	Percentage Contribution
Aircraft Malfunction	35%
Airport Facilities	30%
Gear/Tire	25%
Nav Aids	15%
Ground-based nav aid malfunction or not available	15%
Meteorology	15%
Maintenance Events	15%
Airport perimeter control/fencing/wildlife control	10%
Wildlife/Birds/Foreign Object	10%
Ground Events	10%
Poor/faint marking/signs or runway/taxiway closure	10%
Contaminated runway/taxiway - poor braking action	10%
Poor visibility/IMC	10%
Wind/Wind shear/Gusty wind	10%
Extensive/Uncontained Engine Failure	5%
Thunderstorms	5%
Lack of Visual Reference	5%
Hydraulic System Failure	5%
Crew Incapacitation	5%
Flight Controls	5%
Secondary Flight Controls	5%

Africa Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	25%
Vertical/Lateral/Speed Deviation	20%
Unnecessary Weather Penetration	10%
Continued Landing after Unstable Approach	5%
Ramp movements	5%
Brakes/Thrust Reversers/Ground Spoilers	5%
Unstable Approach	5%
Loss of aircraft control while on the ground	5%
Unauthorized Airspace Penetration	5%
Abrupt Aircraft Control	5%

COUNTERMEASURES

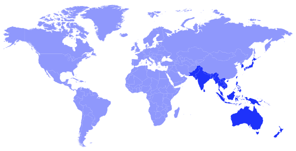
	Percentage Contribution
Overall Crew Performance	20%
In-flight decision-making/contingency management	15%
Leadership	10%
Taxiway/Runway Management	10%
Captain should show leadership	10%
FO is assertive when necessary	5%
Workload Management	5%
Monitor/Cross-check	5%

Note: 21 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum C

Top Contributing Factors – Section 5

Asia/Pacific Aircraft Accidents



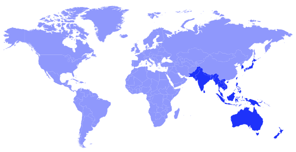
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	49%
Safety Management	35%
Flight Operations	24%
Flight Ops: Training Systems	20%
Flight Ops: SOPs & Checking	13%
Selection Systems	13%
Maintenance Operations	7%
Maintenance Ops: SOPs & Checking	6%
Design	4%
Technology & Equipment	3%
Change Management	3%
Maintenance Ops: Training Systems	1%
Management Decisions	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	46%
SOP Adherence/SOP Cross-verification	41%
Callouts	17%
Pilot-to-Pilot Communication	17%
Ground Navigation	6%
Crew to External Communication	6%
Abnormal Checklist	4%
Automation	3%
ATC	3%
Briefings	3%
Systems/Radios/Instruments	1%
Ground Crew	1%
Maintenance	1%

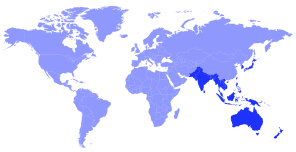
Asia/Pacific Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	30%
Airport Facilities	20%
Aircraft Malfunction	18%
Poor visibility/IMC	14%
Nav Aids	11%
Thunderstorms	11%
Lack of Visual Reference	11%
Ground-based nav aid malfunction or not available	11%
Maintenance Events	10%
Poor/faint marking/signs or runway/taxiway closure	10%
Wind/Wind shear/Gusty wind	8%
Operational Pressure	8%
Contaminated runway/taxiway - poor braking action	7%
Fire/Smoke (Cockpit/Cabin/Cargo)	6%
Fatigue	6%
Gear/Tire	6%
Optical Illusion/visual mis-perception	6%
Air Traffic Services	6%
Contained Engine Failure/Powerplant Malfunction	6%
Ground Events	4%
Inad overrun area/trench/ditch/prox of structures	4%
Wildlife/Birds/Foreign Object	4%
Terrain/Obstacles	3%
Traffic	3%
Crew Incapacitation	3%
Airport perimeter control/fencing/wildlife control	3%
Avionics/Flight Instruments	1%
Dispatch/Paperwork	1%
Manuals/Charts/Checklists	1%
Extensive/Uncontained Engine Failure	1%

Asia/Pacific Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	28%
Vertical/Lateral/Speed Deviation	27%
Unstable Approach	25%
Continued Landing after Unstable Approach	21%
Abrupt Aircraft Control	11%
Unnecessary Weather Penetration	10%
Operation Outside Aircraft Limitations	7%
Ramp movements	7%
Controlled Flight Towards Terrain	6%
Engine	4%
Brakes/Thrust Reversers/Ground Spoilers	4%
Runway/taxiway incursion	3%
Flight Controls/Automation	3%
Unauthorized Airspace Penetration	1%
Loss of aircraft control while on the ground	1%

COUNTERMEASURES

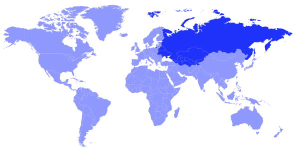
	Percentage Contribution
Overall Crew Performance	30%
Monitor/Cross-check	21%
Leadership	17%
FO is assertive when necessary	11%
Captain should show leadership	11%
Taxiway/Runway Management	10%
In-flight decision-making/contingency management	7%
Communication Environment	6%
Automation Management	6%
Workload Management	4%
Inquiry	1%

Note: six accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum C

Top Contributing Factors – Section 5

Commonwealth of Independent States (CIS) Aircraft Accidents



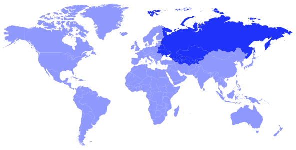
LATENT CONDITIONS

	Percentage Contribution
Safety Management	30%
Regulatory Oversight	22%
Flight Ops: SOPs & Checking	17%
Flight Operations	17%
Ground Ops: SOPs & Checking	9%
Ground Operations	9%
Dispatch	4%
Ground Ops: Training Systems	4%
Dispatch Ops: SOPs & Checking	4%
Maintenance Operations	4%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	43%
SOP Adherence/SOP Cross-verification	39%
Normal Checklist	4%
Pilot-to-Pilot Communication	4%
Systems/Radios/Instruments	4%
Documentation	4%
Wrong Weight & Balance/Fuel Information	4%
Callouts	4%

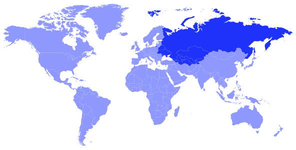
Commonwealth of Independent States (CIS) Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	57%
Airport Facilities	30%
Wind/Wind shear/Gusty wind	26%
Aircraft Malfunction	26%
Thunderstorms	26%
Poor visibility/IMC	22%
Contaminated runway/taxiway - poor braking action	17%
Contained Engine Failure/Powerplant Malfunction	13%
Operational Pressure	13%
Lack of Visual Reference	13%
Icing Conditions	9%
MEL Item	9%
Dispatch/Paperwork	9%
Maintenance Events	9%
Gear/Tire	9%
Optical Illusion/visual mis-perception	9%
Ground Events	9%
Air Traffic Services	9%
Nav Aids	4%
Spatial Disorientation/somatogravic illusion	4%
Terrain/Obstacles	4%
Ground-based nav aid malfunction or not available	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Wildlife/Birds/Foreign Object	4%
Airport perimeter control/fencing/wildlife control	4%
Fire/Smoke (Cockpit/Cabin/Cargo)	4%
Inad overrun area/trench/ditch/prox of structures	4%

Commonwealth of Independent States (CIS) Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	35%
Unnecessary Weather Penetration	26%
Unstable Approach	13%
Abrupt Aircraft Control	9%
Continued Landing after Unstable Approach	9%
Vertical/Lateral/Speed Deviation	9%
Weight & Balance	4%
Systems	4%
Operation Outside Aircraft Limitations	4%
Brakes/Thrust Reversers/Ground Spoilers	4%

COUNTERMEASURES

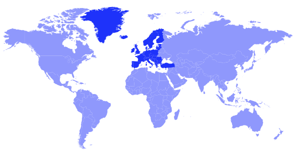
	Percentage Contribution
Overall Crew Performance	26%
In-flight decision-making/contingency management	13%
Taxiway/Runway Management	13%
Monitor/Cross-check	9%
Evaluation of Plans	4%

Note: five accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum C

Top Contributing Factors – Section 5

Europe Aircraft Accidents



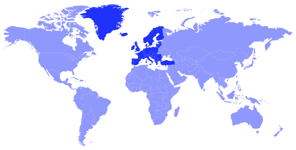
LATENT CONDITIONS

	Percentage Contribution
Flight Operations	23%
Flight Ops: Training Systems	20%
Flight Ops: SOPs & Checking	14%
Regulatory Oversight	11%
Safety Management	9%
Selection Systems	9%
Ground Operations	9%
Maintenance Operations	7%
Maintenance Ops: SOPs & Checking	7%
Design	5%
Technology & Equipment	5%
Ground Ops: Training Systems	5%
Ground Ops: SOPs & Checking	5%
Change Management	5%
Dispatch Ops: SOPs & Checking	2%
Dispatch	2%
Management Decisions	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	43%
SOP Adherence/SOP Cross-verification	36%
Callouts	16%
Automation	9%
Pilot-to-Pilot Communication	5%
Abnormal Checklist	5%
Systems/Radios/Instruments	2%

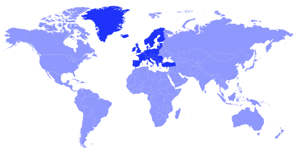
Europe Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	36%
Aircraft Malfunction	30%
Wind/Wind shear/Gusty wind	27%
Gear/Tire	20%
Fatigue	14%
Ground Events	11%
Operational Pressure	9%
Lack of Visual Reference	9%
Thunderstorms	9%
Maintenance Events	7%
Poor visibility/IMC	7%
Airport Facilities	7%
Extensive/Uncontained Engine Failure	5%
Contaminated runway/taxiway - poor braking action	5%
Traffic	5%
Optical Illusion/visual mis-perception	5%
Avionics/Flight Instruments	2%
Brakes	2%
Manuals/Charts/Checklists	2%
Air Traffic Services	2%
Hydraulic System Failure	2%
MEL Item	2%
Icing Conditions	2%
Inad overrun area/trench/ditch/prox of structures	2%
Fire/Smoke (Cockpit/Cabin/Cargo)	2%
Wildlife/Birds/Foreign Object	2%

Europe Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	27%
Long/floated/bounced/firm/off-center/crabbed landing	25%
Unstable Approach	18%
Continued Landing after Unstable Approach	16%
Abrupt Aircraft Control	14%
Unnecessary Weather Penetration	11%
Loss of aircraft control while on the ground	5%
Engine	5%
Operation Outside Aircraft Limitations	5%
Controlled Flight Towards Terrain	2%
Brakes/Thrust Reversers/Ground Spoilers	2%
Landing Gear	2%
Flight Controls/Automation	2%

COUNTERMEASURES

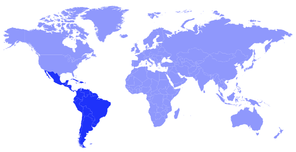
	Percentage Contribution
Overall Crew Performance	32%
Monitor/Cross-check	23%
In-flight decision-making/contingency management	11%
Captain should show leadership	7%
Leadership	7%
Automation Management	7%
Taxiway/Runway Management	5%
FO is assertive when necessary	2%
Communication Environment	2%

Note: four accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum C

Top Contributing Factors – Section 5

Latin America & the Caribbean Aircraft Accidents



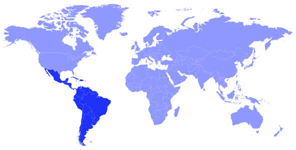
LATENT CONDITIONS

	Percentage Contribution
Safety Management	39%
Regulatory Oversight	39%
Flight Operations	25%
Selection Systems	21%
Dispatch	18%
Flight Ops: SOPs & Checking	18%
Management Decisions	14%
Maintenance Ops: SOPs & Checking	11%
Dispatch Ops: SOPs & Checking	11%
Design	11%
Maintenance Operations	11%
Flight Ops: Training Systems	7%
Cabin Operations	4%
Ops Planning & Scheduling	4%
Maintenance Ops: Training Systems	4%
Cabin Ops: SOPs & Checking	4%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence/SOP Cross-verification	21%
Manual Handling/Flight Controls	18%
Callouts	11%
Wrong Weight & Balance/Fuel Information	7%
Documentation	7%
Pilot-to-Pilot Communication	7%
Abnormal Checklist	4%
Dispatch	4%
Systems/Radios/Instruments	4%
ATC	4%
Normal Checklist	4%
Misinterpreted Item on Paperwork	4%
Crew to External Communication	4%
Briefings	4%

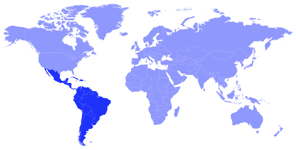
Latin America & the Caribbean Aircraft Accidents



THREATS

	Percentage Contribution
Aircraft Malfunction	43%
Maintenance Events	29%
Airport Facilities	21%
Gear/Tire	21%
Meteorology	21%
Dispatch/Paperwork	14%
Operational Pressure	11%
Contaminated runway/taxiway - poor braking action	11%
Poor visibility/IMC	11%
Thunderstorms	11%
Wind/Wind shear/Gusty wind	7%
Wildlife/Birds/Foreign Object	7%
Hydraulic System Failure	7%
Airport perimeter control/fencing/wildlife control	7%
Lack of Visual Reference	7%
Ground-based nav aid malfunction or not available	7%
Nav Aids	7%
Optical Illusion/visual mis-perception	4%
Contained Engine Failure/Powerplant Malfunction	4%
Fatigue	4%
Ground Events	4%
Inad overrun area/trench/ditch/prox of structures	4%
Fire/Smoke (Cockpit/Cabin/Cargo)	4%
Manuals/Charts/Checklists	4%
Traffic	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Air Traffic Services	4%
Brakes	4%

Latin America & the Caribbean Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Unnecessary Weather Penetration	14%
Operation Outside Aircraft Limitations	14%
Long/floated/bounced/firm/off-center/crabbed landing	11%
Weight & Balance	7%
Unstable Approach	4%
Abrupt Aircraft Control	4%
Vertical/Lateral/Speed Deviation	4%
Landing Gear	4%
Controlled Flight Towards Terrain	4%
Ramp movements	4%
Rejected Takeoff after V1	4%
Brakes/Thrust Reversers/Ground Spoilers	4%
Engine	4%

COUNTERMEASURES

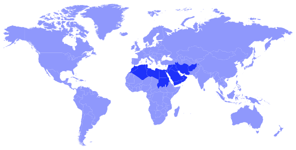
	Percentage Contribution
Overall Crew Performance	18%
In-flight decision-making/contingency management	18%
Monitor/Cross-check	11%
Captain should show leadership	7%
Leadership	7%
FO is assertive when necessary	7%
Taxiway/Runway Management	7%
Workload Management	7%
Evaluation of Plans	4%
Communication Environment	4%
Inquiry	4%
Plans Stated	4%

Note: seven accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum C

Top Contributing Factors – Section 5

Middle East & North Africa Aircraft Accidents



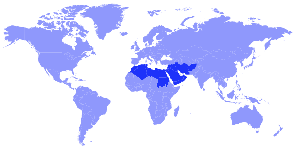
LATENT CONDITIONS

	Percentage Contribution
Safety Management	42%
Flight Ops: SOPs & Checking	26%
Design	26%
Flight Operations	26%
Regulatory Oversight	26%
Selection Systems	16%
Maintenance Operations	16%
Maintenance Ops: SOPs & Checking	16%
Flight Ops: Training Systems	11%
Management Decisions	5%
Maintenance Ops: Training Systems	5%
Ops Planning & Scheduling	5%
Technology & Equipment	5%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	37%
SOP Adherence/SOP Cross-verification	26%
Callouts	26%
Automation	11%
Abnormal Checklist	11%
Pilot-to-Pilot Communication	11%
Normal Checklist	5%
Briefings	5%

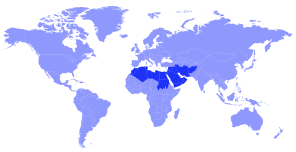
Middle East & North Africa Aircraft Accidents



THREATS

	Percentage Contribution
Aircraft Malfunction	47%
Maintenance Events	32%
Gear/Tire	32%
Meteorology	26%
Poor visibility/IMC	16%
Wind/Wind shear/Gusty wind	16%
Lack of Visual Reference	11%
Operational Pressure	11%
Contained Engine Failure/Powerplant Malfunction	5%
Contaminated runway/taxiway - poor braking action	5%
Spatial Disorientation/somatogravic illusion	5%
Terrain/Obstacles	5%
Brakes	5%
Air Traffic Services	5%
Fatigue	5%
Avionics/Flight Instruments	5%
Airport Facilities	5%
Icing Conditions	5%
Fire/Smoke (Cockpit/Cabin/Cargo)	5%
Ground Events	5%

Middle East & North Africa Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	21%
Operation Outside Aircraft Limitations	21%
Engine	16%
Brakes/Thrust Reversers/Ground Spoilers	11%
Abrupt Aircraft Control	11%
Vertical/Lateral/Speed Deviation	11%
Loss of aircraft control while on the ground	11%
Unnecessary Weather Penetration	11%
Rejected Takeoff after V1	5%
Flight Controls/Automation	5%
Controlled Flight Towards Terrain	5%
Unstable Approach	5%
Continued Landing after Unstable Approach	5%

COUNTERMEASURES

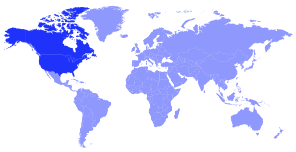
	Percentage Contribution
Monitor/Cross-check	26%
Overall Crew Performance	21%
Leadership	16%
Captain should show leadership	16%
Taxiway/Runway Management	16%
FO is assertive when necessary	16%
In-flight decision-making/contingency management	11%
Communication Environment	11%
Workload Management	5%
SOP Briefing/Planning	5%
Automation Management	5%
Evaluation of Plans	5%

Note: two accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum C

Top Contributing Factors – Section 5

North America Aircraft Accidents



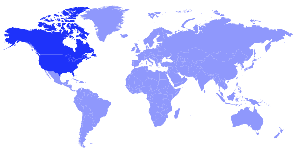
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	19%
Flight Operations	17%
Maintenance Operations	13%
Maintenance Ops: SOPs & Checking	13%
Safety Management	13%
Design	10%
Management Decisions	10%
Flight Ops: SOPs & Checking	10%
Ground Operations	6%
Flight Ops: Training Systems	6%
Ground Ops: SOPs & Checking	6%
Ground Ops: Training Systems	6%
Technology & Equipment	6%
Maintenance Ops: Training Systems	4%
Change Management	2%
Ops Planning & Scheduling	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	23%
SOP Adherence/SOP Cross-verification	21%
Pilot-to-Pilot Communication	6%
Automation	4%
Callouts	4%
Normal Checklist	4%
Systems/Radios/Instruments	2%
Briefings	2%
Ground Navigation	2%

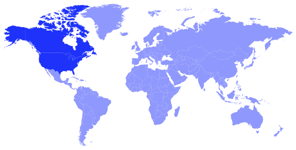
North America Aircraft Accidents



THREATS

	Percentage Contribution
Aircraft Malfunction	38%
Meteorology	35%
Wind/Wind shear/Gusty wind	25%
Gear/Tire	21%
Maintenance Events	13%
Poor visibility/IMC	13%
Lack of Visual Reference	10%
Airport Facilities	6%
Fire/Smoke (Cockpit/Cabin/Cargo)	6%
Wildlife/Birds/Foreign Object	6%
Extensive/Uncontained Engine Failure	6%
Air Traffic Services	6%
Ground Events	6%
Fatigue	6%
Nav Aids	6%
Optical Illusion/visual mis-perception	6%
Ground-based nav aid malfunction or not available	6%
Traffic	6%
Thunderstorms	4%
Terrain/Obstacles	4%
Icing Conditions	4%
Contaminated runway/taxiway - poor braking action	4%
Flight Controls	2%
Structural Failure	2%
Operational Pressure	2%
Spatial Disorientation/somatogravic illusion	2%
Dispatch/Paperwork	2%
Inad overrun area/trench/ditch/prox of structures	2%
Primary Flight Controls	2%

North America Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical/Lateral/Speed Deviation	17%
Long/floated/bounced/firm/off-center/crabbed landing	17%
Unstable Approach	8%
Continued Landing after Unstable Approach	6%
Operation Outside Aircraft Limitations	6%
Rejected Takeoff after V1	4%
Brakes/Thrust Reversers/Ground Spoilers	4%
Flight Controls/Automation	4%
Unnecessary Weather Penetration	4%
Abrupt Aircraft Control	4%
Wrong taxiway/ramp/gate/hold spot	2%
Engine	2%
Loss of aircraft control while on the ground	2%
Controlled Flight Towards Terrain	2%

COUNTERMEASURES

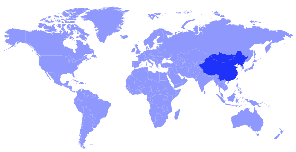
	Percentage Contribution
Overall Crew Performance	17%
Monitor/Cross-check	13%
In-flight decision-making/contingency management	10%
Leadership In-flight decision-making/contingency management	8%
Workload Management	8%
Captain should show leadership	8%
Automation Management	6%
Evaluation of Plans	6%
Communication Environment	6%
FO is assertive when necessary	4%
Taxiway/Runway Management	2%

Note: seven accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum C

Top Contributing Factors – Section 5

North Asia Aircraft Accidents



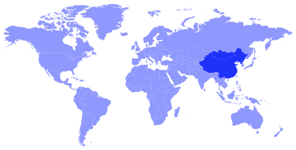
LATENT CONDITIONS

	Percentage Contribution
Flight Operations	50%
Flight Ops: Training Systems	50%
Flight Ops: SOPs & Checking	30%
Selection Systems	30%
Safety Management	20%
Regulatory Oversight	20%
Management Decisions	10%
Ops Planning & Scheduling	10%
Change Management	10%

THREATS

	Percentage Contribution
Meteorology	70%
Wind/Wind shear/Gusty wind	60%
Thunderstorms	50%
Aircraft Malfunction	20%
Poor visibility/IMC	20%
Gear/Tire	10%
Ground-based nav aid malfunction or not available	10%
Operational Pressure	10%
Airport Facilities	10%
Nav Aids	10%
Contaminated runway/taxiway - poor braking action	10%

North Asia Aircraft Accidents



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	70%
SOP Adherence/SOP Cross-verification	40%
Pilot-to-Pilot Communication	20%
Abnormal Checklist	10%
Automation	10%
Normal Checklist	10%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Abrupt Aircraft Control	50%
Vertical/Lateral/Speed Deviation	50%
Unstable Approach	40%
Long/floated/bounced/firm/off-center/crabbed landing	40%
Operation Outside Aircraft Limitations	40%
Unnecessary Weather Penetration	30%
Continued Landing after Unstable Approach	30%
Engine	20%
Controlled Flight Towards Terrain	10%
Flight Controls/Automation	10%
Loss of aircraft control while on the ground	10%

COUNTERMEASURES

	Percentage Contribution
Monitor/Cross-check	60%
Overall Crew Performance	60%
Workload Management	30%
Leadership	20%
In-flight decision-making/contingency management	10%
Captain should show leadership	10%
Evaluation of Plans	10%
Communication Environment	10%
FO is assertive when necessary	10%
Automation Management	10%

Note: one accident was not classified due to insufficient data; this accident was subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum D

Top Contributing Factors – Section 6

Cargo Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	32%
Safety Management	27%
Flight Operations	18%
Flight Ops: SOPs & Checking	14%
Selection Systems	9%
Technology & Equipment	7%
Maintenance Operations	7%
Management Decisions	7%
Maintenance Ops: SOPs & Checking	7%
Design	5%
Dispatch	5%
Ground Ops: SOPs & Checking	2%
Ground Ops: Training Systems	2%
Flight Ops: Training Systems	2%
Maintenance Ops: Training Systems	2%
Ground Operations	2%
Dispatch Ops: SOPs & Checking	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling/Flight Controls	36%
SOP Adherence/SOP Cross-verification	30%
Callouts	7%
Automation	5%
Pilot-to-Pilot Communication	2%
Abnormal Checklist	2%
Systems/Radios/Instruments	2%

Cargo Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	39%
Aircraft Malfunction	39%
Wind/Wind shear/Gusty wind	27%
Airport Facilities	20%
Gear/Tire	20%
Lack of Visual Reference	18%
Poor visibility/IMC	14%
Fatigue	11%
Operational Pressure	9%
Maintenance Events	7%
Thunderstorms	7%
Contained Engine Failure/Powerplant Malfunction	7%
Contaminated runway/taxiway - poor braking action	7%
Poor/faint marking/signs or runway/taxiway closure	7%
Nav Aids	5%
Optical Illusion/visual mis-perception	5%
Airport perimeter control/fencing/wildlife control	5%
Ground-based nav aid malfunction or not available	5%
Wildlife/Birds/Foreign Object	5%
Terrain/Obstacles	2%
Spatial Disorientation/somatogravic illusion	2%
Ground Events	2%
Dispatch/Paperwork	2%
Structural Failure	2%
Brakes	2%
Inad overrun area/trench/ditch/prox of structures	2%
Avionics/Flight Instruments	2%
Air Traffic Services	2%
Extensive/Uncontained Engine Failure	2%

Cargo Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed landing	32%
Vertical/Lateral/Speed Deviation	23%
Continued Landing after Unstable Approach	16%
Unstable Approach	16%
Unnecessary Weather Penetration	11%
Operation Outside Aircraft Limitations	9%
Abrupt Aircraft Control	7%
Controlled Flight Towards Terrain	7%
Engine	5%
Brakes/Thrust Reversers/Ground Spoilers	5%
Weight & Balance	2%
Flight Controls/Automation	2%
Rejected Takeoff after V1	2%
Loss of aircraft control while on the ground	2%
Landing Gear	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	25%
Monitor/Cross-check	18%
In-flight decision-making/contingency management	14%
FO is assertive when necessary	7%
Leadership	7%
Automation Management	7%
Captain should show leadership	5%
Taxiway/Runway Management	5%
Workload Management	5%
Evaluation of Plans	5%

Note: 21 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum E

Fatality Risk

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 crewmember 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 full 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.

Fatality Risk (cont'd)

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 if 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 high 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).

Finally, as seen throughout the report, the aviation industry is reaching a point where the fatality risk and the fatal accident rate are converging. Much work has been done in improving aviation safety worldwide and, in most cases, the fatal accident rate has been declining over the years. The convergence of fatality risk and fatal accident rate may indicate, although it is not possible to confirm, that the accident prevention efforts have been effective in mitigating the causes of most accidents. Even as accident rates reach historic lows, the work of safety professionals across the commercial aviation industry continues to be as important today as it was in the past.

Addendum F

STEADES Analysis Disclaimer

The information contained in Section 7 - Cabin Safety and in Section 9 – STEADES Analysis of this publication is subject to constant review in the light of changing government requirements and regulations. No subscriber or other reader should act on the basis of any such information without referring to applicable laws and regulations and/or without taking appropriate professional advice. Although every effort has been made to ensure accuracy, the IATA shall not be held responsible for any loss or damage caused by errors, omissions, misprints or misinterpretation of the contents hereof.

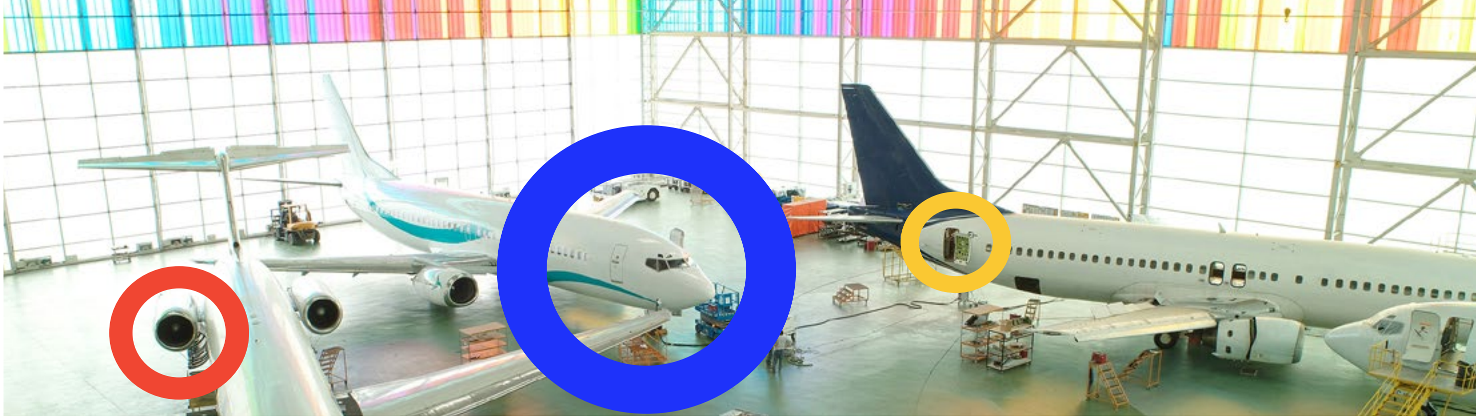
Furthermore, the IATA expressly disclaims any and all liability to any person or entity, whether a purchaser of this publication or not, in respect of anything done or omitted, and the consequences of anything done or omitted, by any such person or entity in reliance on the contents of this publication.

The analyses are conducted on Air Safety Reports (ASR) and Cabin Safety Reports (CSR) held in IATA's Safety Trend Evaluation, Analysis & Data Exchange System (STEADES) database. The STEADES database is comprised of de-identified safety incident reports from over 200 participating airlines throughout the world, with an annual reporting rate now exceeding 200,000 reports/year. The STEADES database incorporates a number of quality control processes that assure analysis results.

ASR and CSR data submissions to STEADES is a dynamic process. Data can vary from one quarter to the next, meaning that not all participant's data is incorporated each quarter. This can be due to a participant not submitting data (due to a technical problem) or IATA not incorporating the submitted data (due to data format technical issues or data not meeting IATA's data quality standards). IATA accounts for this in the calculation of sectors (number of flights) to ensure that rate-based information is meaningful, and IATA uses other quality processes to recover missing data. Due to these factors, rate-based comparisons are preferable to a comparison of the number of reports. The reader should also be mindful that the data and rates presented here are based on events reported by flight and cabin crew and therefore influenced by airline reporting cultures. The analyses cannot confirm if events associated with the categories analyzed were solicited equally among all participating airlines nor if such events were reported routinely or underreported by flight crew.

> Turboprop operations accounted for 18% of all sectors flown last year, yet represented 24% of all accidents and 45% of all fatal accidents.

A1



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 TakeoffWeight (MTOW) of at least 5,700 kg (12,540 lbs).
- 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.

Crewmember: 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 crewmember 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 crewmember 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 crewmember to a non-survivable accident. A full-loss equivalent is related to the percentage of people onboard who perished. Please refer to Addendum E 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.

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, please 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 his or her 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 crewmember. 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 International Civil Aviation Organization (ICAO) Annex 13 definition is unrelated to cost and includes many incidents in which the financial consequences are minimal.

Unmanned Aircraft System: Defined by ICAO as an aircraft and its associated elements that are operated without a pilot on board.

Unstable Approach: Approach where the IATA Accident Classification Technical Group (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 Preflight 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 Engine Start/Depart 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. Initial Climb 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 'En Route Climb' 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 'En Route Climb' or 'Cruise' 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 Approach 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 'Initial Climb').

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 "Go-around" 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 'Taxi-out' 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 'Engine Start/Depart' phase. *Note:* the Arrival/Engine Shutdown 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 'Preflight' 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 'Flight Planning' 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 'Taxi-out' 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

1. LATENT CONDITIONS (CONT'D)

Technology and Equipment	↗ Available safety equipment not installed (EGPWS, predictive wind shear, TCAS/ACAS, etc.)
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
	↗ 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., ILS)
	↗ 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	↗ 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 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 ↗ PF 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 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. An undesired aircraft state 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 V1
	↗ Controlled flight towards terrain
	↗ Other
Ground Navigation	↗ Proceeding towards 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 & 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: ▪ Pro-active: In-flight decision-making ▪ Re-active: 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

> In 2018, LOC-I and CFIT accounted for 8% of all accidents, but resulted in 84% of the total onboard fatalities.

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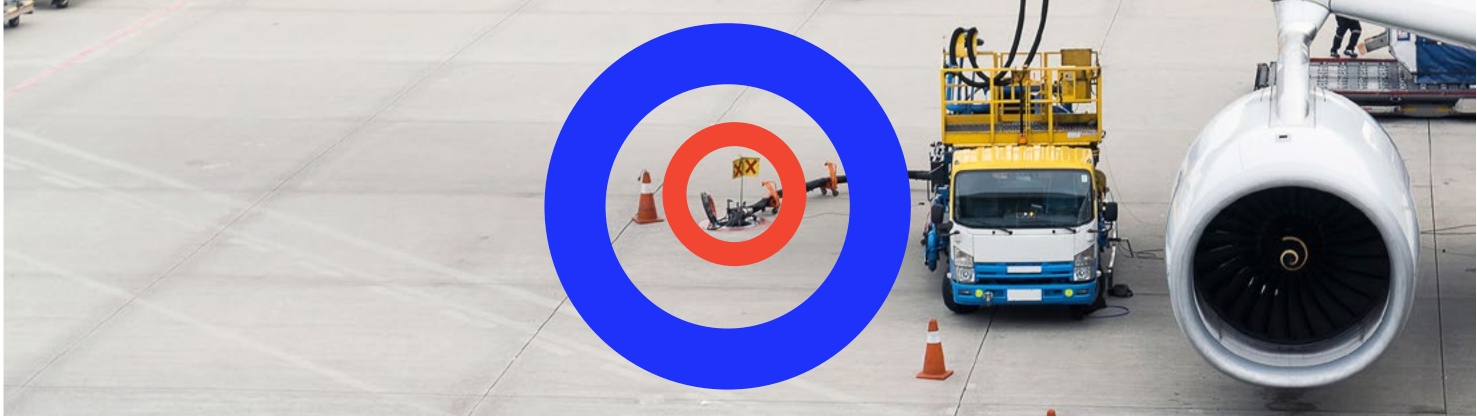

Annex 3 – Accidents Summary

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
18-01-05	Boeing	B737-800	C-FDMB	WestJet	Toronto International Airport, Canada	AES	Passenger	Jet	Substantial Damage	Substantial damage in a ground collision accident between two aircrafts
18-01-09	Embraer	EMB110 Bandeirante	C6-MIC	Pineapple Air	GOVERNOR'S HARBOUR, Bahamas	LND	Passenger	Turboprop	Substantial Damage	The aircraft suffered a gear collapse on landing
18-01-10	Fairchild (Swearingen)	Metro	N561UP	Ameriflight	ROCK SPRINGS, SWETWATER COUNTY, WY, USA	TXI	Freighter	Turboprop	Substantial Damage	The aircraft suffered a loss of control on ground
18-01-10	De Havilland (Bombardier)	Dash 8-400	SP-EQG	LOT Polish Airlines	Warsaw Frederic Chopin Airport, Poland	LND	Passenger	Turboprop	Substantial Damage	The nose landing gear failed to extend upon landing
18-01-13	Boeing	B737-800	TC-CPF	Pegasus	Trabzon, Turkey	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a runway excursion on landing
18-02-11	Antonov	An 148-100	RA-61704	Saratov Airlines	Stepanovskoye, Russia	CRZ	Passenger	Jet	Hull Loss	The aircraft was destroyed after impacting terrain
18-02-16	Fokker	Fokker 100	EP-FQF	Qeshm Airlines	Mashhad Shahid Hashemi Nejad, Iran	LND	Passenger	Jet	Substantial Damage	The aircraft performed a forced landing when the left main landing gear failed to deploy
18-02-18	ATR	ATR 72	EP-ATS	Iran Aseman Airlines	En Route - Iran	CRZ	Passenger	Turboprop	Hull Loss	The aircraft was totally destroyed after impacting a mountainside
18-02-20	Boeing (Douglas)	MD 83	5N-SRI	Dana Air	Port Harcourt, Nigeria	LND	Passenger	Jet	Substantial Damage	The aircraft sufferred a runway overrun on landing
18-03-04	Boeing	B737-300	9S-ASG	Serve Air	LUBUMBASHI, Democratic Republic of the Congo	LND	Freighter	Jet	Substantial Damage	The aircraft suffered a runway excursion and nose gear collapse on landing
18-03-12	De Havilland (Bombardier)	Dash 8-400	S2-AGU	US-Bangla Airlines	KATHMANDU, Nepal	LND	Passenger	Turboprop	Hull Loss	The aircraft crashed crashed while approaching to land
18-03-15	Antonov	An-12	RA-11130	Kosmos Airlines	YAKUTSK, Russia	TOF	Freighter	Turboprop	Substantial Damage	The aircraft suffered a cargo shift upon departure
18-03-17	Canadair (Bombardier)	CRJ-200	C-FDJA	Jazz	Montreal International Airport, Canada	PRF	Passenger	Jet	Substantial Damage	The aircraft suffered a ground collision with a service vehicle
18-03-27	Airbus	A319	G-EZMK	EasyJet	MURCIA, SAN JAVIER, Spain	TOF	Passenger	Jet	Substantial Damage	Rejected takeoff due to bird strikes into both engines

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
18-03-28	Boeing	B767-300, B737-700	4X-EAK, D-ABLB	El Al, Germania	TEL-AVIV, BEN GURION AIRPORT, Israel	ESD	Passenger	Jet	Substantial Damage	Substantial damage in a ground collision accident between two aircrafts
18-03-29	Fairchild (Swearingen)	Metro	CP-2459	Amaszonas	RIBERALTA, Bolivia	LND	Passenger	Turboprop	Substantial Damage	The aircraft suffered a runway excursion after aborting takeoff
18-04-01	Airbus	A321	VN-A353	Vietnam Airlines	Hanoi, Noibai International, Vietnam	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a tail strike on landing
18-04-09	Hawker Beechcraft	Beechcraft 200 Super King Air	LN-NOA	Airwing	STAVANGER, SOLA airport, Norway	LND	Freighter	Turboprop	Substantial Damage	The aircraft suffered a gear-up landing
18-04-17	De Havilland (Bombardier)	Dash 8-400	G-JECX	Flybe	Newquay, United Kingdom	LND	Passenger	Turboprop	Substantial Damage	The aircraft suffered a tail strike on landing
18-04-17	Boeing	B737-700	N772SW	Southwest Airlines	En Route - USA	ICL	Passenger	Jet	Substantial Damage	The aircraft sufferred an uncontained engine failure during intial climb with one fatality on board as a consequence
18-04-18	Airbus	A330-300	N806NW	Delta Air Lines	HARTSFIELD - JACKSON ATLANTA INTERNATIONAL, USA	ICL	Passenger	Jet	Substantial Damage	The aircraft suffered an engine fire during initial climb
18-04-20	Boeing (Douglas)	MD 83	N807WA	World Atlantic Airlines	Alexandria International Airport, USA	LND	Passenger	Jet	Substantial Damage	The aircraft suffered the collapse of right main gear during landing rollout
18-04-29	Hawker Beechcraft	B1900	N172GA	Alpine Air	SIOUX FALLS Regional Airport, USA	TXO	Freighter	Turboprop	Substantial Damage	The aircraft suffered a landing gear collapse upon starting taxing-out
18-04-29	Boeing	B737-800	PK-LOO	Lion Air	Gorontalo - Jalaluddin, Indonesia	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a runway excursion on landing
18-05-02	Boeing	B737-800	OO-JAY	TUI fly	MARRAKECH, Morocco	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a tail strike on landing
18-05-03	Boeing	B737-300	CP-2815	BoA	Sucre - Juana Azurduy de Padilla, Bolivia	TOF	Passenger	Jet	Substantial Damage	The aircraft encountered a hail storm during takeoff
18-05-13	Airbus	A330-300, A321-200	HL7792, TC-JMM	Asiana Airlines, Turkish airlines	ISTANBUL/ATATURK, Turkey	TXI	Passenger	Jet	Substantial Damage	Substantial damage in a ground collision accident between two aircraft
18-05-18	Boeing	B737-200	XA-UHZ	Global Air	Havana - Jose Marti International, Cuba	TOF	Passenger	Jet	Hull Loss	The aircraft lost height and crashed shortly after takeoff
18-05-21	Airbus	A330-200	TC-OCH	Onurair	Jeddah - King Abdul Aziz Int'l, Saudi Arabia	LND	Passenger	Jet	Substantial Damage	The aircraft landed without nose gear
18-05-25	Boeing	B737-200	PK-JRM	Jayawijaya Dirgantara	Wamena, Indonesia	LND	Freighter	Jet	Substantial Damage	The aircraft sufferred a runway veer off on landing
18-06-08	BAE Systems	BAE 146-100	RP-C5255	Skyjet	BUSUANGA, Philippines	LND	Passenger	Jet	Substantial Damage	The aircraft sufferred a runway excursion on landing
18-06-10	Boeing	B737-800	N276EA	Swift Air	IRAKLION/NIKOS KAZANTZAKIS, Greece	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a tail strike on landing

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
18-06-12	Airbus	A321	RP-C9925	Philippine Airlines	Manila - Ninoy Aquino International, Philippines	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
18-06-14	Boeing (Douglas)	MD 83	UR-CPR	Bravo Airways	Kiev/ZHULIANY, Ukraine	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a runway excusrion on landing
18-06-24	Aircraft Industries (LET)	Let L-410	3X-AAK	Eagle Air	En Route - Guinea	CRZ	Freighter	Turboprop	Hull Loss	The aircraft crashed and it was totally destroyed
18-06-29	Boeing	B777-300	HL7573	Korean Air	NARITA International Airport, Japan	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a main gear axle fracture on landing
18-07-16	Boeing	B737-800	LV-HQY	Flybondi	IGUAZU, CATARATAS DEL IGUAZU, Argentina	TOF	Passenger	Jet	Substantial Damage	The aircraft suffered a tail strike on takeoff
18-07-26	Boeing	B757-200	UP-B5705	SCAT	ALMATY, Kazakhstan	GOA	Passenger	Jet	Substantial Damage	The aircraft suffered a tail strike on go-around
18-07-27	Boeing	B767-300	N641GT	Atlas Air	Portsmouth - Pease International, USA	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
18-07-28	ATR	ATR 72	YJ-AV71	Air Vanuatu	Port Vila - Bauerfield International, Vanuatu	LND	Passenger	Turboprop	Substantial Damage	The aircraft suffered a runway excursion on landing
18-07-31	Embraer	E190	XA-GAL	Aeromexico Connect	Durango - Guadalupe Victoria, Mexico	TOF	Passenger	Jet	Hull Loss	The aircraft veered off and overran runway after rejected takeoff and burst into flames
18-08-09	Boeing	B787-800, B777-300	CN-RGT, TC-JJZ	Royal Air Maroc, Turkish Airlines	ISTANBUL/ATATURK, Turkey	TXO	Passenger	Jet	Substantial Damage	Substantial damage in a ground collision accident between two aircraft
18-08-16	Boeing	B737-800	B-5498	Xiamen Airlines	Manila - Ninoy Aquino International, Philippines	LND	Passenger	Jet	Substantial Damage	The aircraft sufferred a runway excursion on landing
18-08-28	Airbus	A320-200	B-6952	Capital Airlines	Macau International, Macau	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
18-09-01	Boeing	B737-800	VQ-BJI	Utair	Sochi-Adler, Russia	LND	Passenger	Jet	Hull Loss	The aircraft suffered a runway excursion on landing
18-09-01	BAE Systems	BAE Jetstream 41	9N-AHW	Yeti Airlines	Kathmandu - Tribhuvan International, Nepal	LND	Passenger	Turboprop	Substantial Damage	The aircraft suffered a runway excursion on landing
18-09-09	Aircraft Industries (LET)	Let L-410	UR-TWO	SlavAir Company	Yirol, South Sudan	APR	Passenger	Turboprop	Hull Loss	The aircraft crashed close to the destination airport
18-09-26	Boeing	B737-800	S2-AJA	US-Bangla Airlines	Chittagong - Patenga, Bangladesh	LND	Passenger	Jet	Substantial Damage	The aircraft landed without nose gear
18-09-28	Boeing	B737-800	P2-PXE	Air Niugini	WENO ISLAND, Micronesia	APR	Passenger	Jet	Hull Loss	The aircraft touched down in sea short of runway
18-10-10	Sukhoi	Superjet 100-95	RA-89011	Yakutia Airlines	YAKUTSK, Russia	LND	Passenger	Jet	Substantial Damage	The aircraft overran the runway on landing
18-10-12	Boeing	B737-800	VT-AYD	Air India Express	TIRUCHCHIRAPPALLI, India	TOF	Passenger	Jet	Substantial Damage	The aircraft impacted localizer antenna and wall on departure
18-10-29	Boeing	B737-800	PK-LQP	Lion Air	En Route - Java Sea	ICL	Passenger	Jet	Hull Loss	The aircraft lost height and crashed into Java Sea

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
18-10-31	Airbus	A330-300, A330-200	N817NW, F-GZCI	Delta Air Lines, Air France	PARIS-CHARLES DE GAULLE, France	TXO	Passenger	Jet	Substantial Damage	Substantial damage in a ground collision during taxi
18-11-07	Boeing	B747-400	N908AR	Sky Lease Cargo	HALIFAX, Canada	LND	Freighter	Jet	Hull Loss	The aircraft suffered a runway excursion on landing
18-11-09	Boeing	B757-200	N524AT	Fly Jamaica	Georgetown - Cheddi Jagan Int'l, Guyana	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a runway excursion on landing
18-11-22	Boeing	B737-500	OB-2041-P	Peruvian Air Line	La Paz - El Alto International, Bolivia	LND	Passenger	Jet	Substantial Damage	Main landing gear collapsed upon landing
18-11-28	Boeing	B787-800	VT-ANE	Air India	Stockholm - Arlanda, Sweden	TXI	Passenger	Jet	Substantial Damage	The aircraft sufferred a ground collision
18-11-29	Airbus	A321-200	VN-A653	VietJet Air	BUON MA THUOT, Vietnam	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
18-12-04	Airbus	A320-200	SX-EMY	Ellinair	ATHINAI/ELEFTHERIOS VENIZELOS, Greece	TXI	Passenger	Jet	Substantial Damage	The aircraft suffered a ground colision with passenger jetway
18-12-11	Boeing	B777-300	C-FITW	Air Canada	Hong Kong - Chep Lap Kok, Hong Kong	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a tail strike on landing
18-12-14	Airbus	A321	VQ-BCE	Ural Airlines	Ufa, Russia	TOF	Passenger	Jet	Substantial Damage	The aircraft suffered a tail strike on departure
18-12-20	Antonov	An-26	9S-AGB	Gomair	Kinshasa - N`Djili Int'l, Democratic Republic of the Congo	DST	Freighter	Turboprop	Hull Loss	The aircraft impacted terrain short of runway

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Annex 4 – Table of Sectors

This table provides a breakdown of the sectors used in the production of rates for this report by aircraft type and year. It is up-to-date as at the time of report production.

MANUFACTURER	MODEL	2014	2015	2016	2017	2018
Airbus	A300	158,384	143,485	144,683	144,205	152,439
Airbus	A310	53,113	43,018	33,672	24,291	23,823
Airbus	A318	106,084	97,842	91,665	94,673	103,619
Airbus	A319	2,280,969	2,306,185	2,281,543	2,215,512	2,228,237
Airbus	A320	5,638,440	6,204,016	6,669,403	6,823,019	6,986,449
Airbus	A321	1,325,017	1,542,421	1,834,125	2,130,165	2,303,342
Airbus	A330	900,134	976,326	1,014,361	1,073,681	1,138,552
Airbus	A340	145,916	128,331	114,831	101,171	99,892
Airbus	A350	49	5,009	31,738	114,356	223,144
Airbus	A380	71,207	89,214	107,284	118,311	126,195
Aircraft Industries (LET)	410	121,446	121,400	118,875	115,331	96,881
Antonov	An-12	4,626	3,676	3,485	4,574	4,846
Antonov	An-124	5,970	5,909	6,477	7,210	7,266
Antonov	An-140	1,876	864	555	552	663
Antonov	An-148	14,879	20,638	22,188	25,506	19,710
Antonov	An-158	7,587	8,573	10,729	6,920	1,208
Antonov	An-22	–	–	33	76	77
Antonov	An-225	30	48	48	48	38
Antonov	An-24	31,625	32,415	31,858	28,478	31,248
Antonov	An-26	19,098	19,102	19,981	20,528	20,425

MANUFACTURER	MODEL	2014	2015	2016	2017	2018
Antonov	An-28	3,762	3,725	3,512	3,195	2,693
Antonov	An-3	695	692	697	695	546
Antonov	An-30	942	860	782	780	516
Antonov	An-32	5,500	5,122	4,754	5,428	4,407
Antonov	An-38	2,445	1,600	1,584	977	526
Antonov	An-72 / An-74	3,569	3,373	3,318	3,306	3,457
ATR	ATR 42	335,452	313,383	328,012	345,593	354,108
ATR	ATR 72	1,162,241	1,172,052	1,286,489	2,107,233	2,820,435
Avro	RJ100	179,748	149,402	140,214	110,119	105,014
BAE Systems	146	51,296	45,300	37,519	42,599	40,841
BAE Systems	ATP	29,607	27,288	20,055	19,816	–
BAE Systems	Jetstream 31	257,240	249,877	223,443	212,402	224,332
BAE Systems	Jetstream 41	88,782	72,516	65,614	75,713	81,966
BAE Systems (Hawker Siddeley)	748	12,653	11,448	11,586	11,160	10,551
Boeing	717	266,898	264,908	296,841	296,152	306,355
Boeing	727	42,243	36,665	32,790	28,359	23,554
Boeing	737	9,247,746	9,425,968	10,045,969	10,821,381	12,085,135
Boeing	747	338,175	324,932	306,252	320,886	299,743
Boeing	757	690,191	594,873	554,719	561,654	620,969
Boeing	767	809,573	663,517	707,923	887,704	808,834
Boeing	777	860,714	929,188	1,004,147	1,076,998	1,063,132
Boeing	787	119,228	207,211	293,411	387,184	474,344
Boeing (Douglas)	DC-10	45,264	40,596	35,098	31,252	28,255
Boeing (Douglas)	DC-3	8,186	9,466	10,077	9,306	9,296
Boeing (Douglas)	DC-8	981	455	205	233	186
Boeing (Douglas)	DC-9	33,904	32,095	32,499	30,067	30,115
Boeing (Douglas)	MD-11	95,669	80,662	75,972	74,935	76,246
Boeing (Douglas)	MD-80	614,688	589,616	582,682	581,174	501,442
Boeing (Douglas)	MD-90	108,547	109,502	103,160	92,784	83,923
Bombardier	C Series	–	–	2,761	31,496	397,739
Canadair (Bombardier)	CRJ	2,300,017	2,222,927	2,277,215	2,259,712	2,374,499

MANUFACTURER	MODEL	2014	2015	2016	2017	2018
Canadair (Bombardier)	CL-415	2,744	2,864	2,871	2,866	2,864
CASA / IAe	212	30,305	30,523	33,089	31,972	32,343
CASA / IAe	235	6,525	7,090	7,102	7,092	7,090
Comac	ARJ21	–	233	3,275	5,745	13,957
Convair	580	37,331	36,194	32,130	27,606	27,429
Convair	640	4,872	4,943	4,883	4,601	4,961
De Havilland (Bombardier)	DHC-6	779,340	807,489	834,320	833,945	855,121
De Havilland (Bombardier)	DHC-7	44,708	35,836	23,995	21,040	27,983
De Havilland (Bombardier)	DHC-8	1,608,270	1,603,448	1,829,595	1,699,214	1,679,555
De Havilland (Bombardier)	DHC-5	1,547	1,084	986	–	282
Embraer	110 Bandeirante	53,285	56,582	57,464	55,456	57,752
Embraer	120 Brasilia	175,641	93,477	87,661	85,267	145,995
Embraer	135	203,439	221,310	226,347	204,854	201,677
Embraer	140	111,320	40,591	31,140	16,185	83,110
Embraer	145	1,054,844	821,456	721,520	687,586	820,027
Embraer	170	326,566	321,732	293,214	277,377	209,970
Embraer	175	389,442	476,608	626,154	760,991	566,546
Embraer	190	884,012	917,167	874,052	942,551	964,769
Embraer	195	217,987	245,287	274,794	292,013	301,311
Evektor EV-55 Outback	EV55	–	–	–	–	3,302
Fairchild (Swearingen)	Metro	764,169	737,233	727,050	685,390	672,121
Fairchild Dornier	228	185,722	179,860	180,409	183,591	187,682
Fairchild Dornier	328	66,788	61,899	60,867	56,386	64,695
Fairchild Dornier	328JET	54,767	55,419	53,572	53,624	48,068
Fokker	100	182,038	156,617	136,843	125,055	119,911
Fokker	50	74,883	64,422	70,025	128,347	187,218
Fokker	70	56,567	54,868	48,010	53,285	39,884
Fokker	F27	6,502	4,015	3,184	3,571	4,058
Fokker	F28	457	357	357	357	357
Gippsland Aeronautics	N22B / N24A Nomad	306	420	446	446	447
Grumman	G73 Turbo Mallard	5,946	5,945	5,966	5,946	5,945

MANUFACTURER	MODEL	2014	2015	2016	2017	2018
Gulfstream Aerospace (Grumman)	G-I	5,828	4,754	4,531	4,489	4,488
Harbin	Y12	15,754	16,732	16,317	17,263	18,655
Hawker Beechcraft	1900	1,021,905	985,125	947,560	908,600	896,551
Hawker Beechcraft	C99	205,163	204,464	201,472	198,735	197,497
Ilyushin	Il-114	1,107	1,108	1,110	1,107	364
Ilyushin	Il-18	2,192	2,036	2,282	1,930	3,276
Ilyushin	Il-62	2,819	2,199	2,284	2,479	2,658
Ilyushin	Il-76	20,702	19,267	18,061	18,417	19,022
Ilyushin	Il-96	3,938	3,859	4,209	4,165	5,020
Lockheed Martin	L-182 / L-282 / L-382 (L-100) Hercules	25,145	25,594	24,572	23,983	23,172
NAMC	YS-11	3,720	3,721	3,452	4,276	3,876
Saab	2000	53,744	52,346	44,927	45,851	34,492
Saab	340	303,306	283,438	270,087	283,453	289,218
Shorts	330	12,662	9,767	5,869	4,152	5,872
Shorts	360	61,569	55,906	57,620	59,162	59,857
Shorts	Skyvan (SC-7)	8,711	8,755	8,253	8,003	7,358
Sukhoi	Superjet 100	33,615	61,979	86,552	109,465	151,743
Tupolev	Tu-134	14,304	14,066	12,469	10,916	9,039
Tupolev	Tu-154	18,872	13,193	10,023	6,435	8,358
Tupolev	Tu-204 / Tu-214	11,770	10,881	9,640	10,570	11,440
Xian	MA-60	9,280	9,531	10,046	11,017	11,396
Yakovlev	Yak-40	26,630	23,637	22,766	23,080	25,304
Yakovlev	Yak-42 / Yak-142	20,612	19,933	16,129	13,291	12,769

Source: Ascend - A Flightglobal Advisory Service

LIST OF ACRONYMS/ABBREVIATIONS

Accident Category Abbreviation

Abbreviation	Full Name
RWY/TWY EXC	Runway/Taxiway Excursion
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
CFIT	Controlled Flight into Terrain
TAILSTRIKE	Tail Strike
UNDERSHOOT	Undershoot
OTHER	Other End State
OFF AIRP LDG	Off-Airport Landing
MID-AIR COLL	Mid-Air Collision
RWY COLL	Runway Collision

List of Acronyms

Acronym	Meaning
A4E	Airlines for Europe
A/C	Aircraft
AAPA	Association of Asia Pacific Airlines
ACI	Airports Council International
ACSTF	Aviation Cyber Security Task Force
ACTG	Accident Classification Technical Group
ADREP	Accident/Incident Data Reporting
AFI	Africa
AHM	Airport Handling Manual
AIG	Accident Investigation Group
ALAR	Approach and Landing Accidents
ALoSP	Acceptable Level of Safety Performance
ALTA	Asociación Latinoamericana y del Caribe de Transporte Aéreo
AMDAR	Aircraft Meteorological Data Relay

List of Acronyms (Cont'd)

Acronym	Meaning
ANSPs	Air Navigation Service Providers
AOC	Air Operator Certificate
APAC	Asia-Pacific
APRAST	Asia-Pacific Regional Aviation Safety Team
APV	Safety Team
ARC	Abnormal Runway Contact
ASIAS	Aviation Safety Information Analysis and Sharing
ASPAC	Asia-Pacific
ASR	Annual Safety Report
ASR	Air Safety Report
ASRT	Annual Safety Report Team
ATC	Air Traffic Control
ATIS	Automatic Terminal Information System
ATM	Air Traffic Management
ATMB	Air Traffic Management Bureau
ATOs	Approved Training Organizations
ATS	Air Traffic Services
AVSEC	Aviation Security
BIRD	Bird Strike
CAAM	Civil Aviation Administration of Mongolia
CAAS	Civil Aviation Authority of Singapore
CAAT	Civil Aviation Authority of Thailand
CABIN	Cabin Safety Events
CANPA	Continuous Angle Non-Precision Approaches
CANSO	Civil Air Navigation Services Organization
CAST	Commercial Aviation Safety Team
CAUC	Civil Aviation University of China
CBT	Competence-based Training
CBT	Computer-based Training
CBTA	Competency-based Training and Assessment
CBTA-TF	Competency-based Training and Assessment Task Force
CFIT	Controlled Flight into Terrain
CICTT	CAST/ICAO Common Taxonomy Team
CIS	Commonwealth of Independent States
CMA	Continuous Monitoring Approach
CoPA	Charter of Professional Auditors
COSTG	Cabin Operations Safety Technical Group

List of Acronyms (Cont'd)

Acronym	Meaning
CRM	Crew Resource Management
CSR	Cabin Safety Report
CST	Collaborative Safety Teams
CTOL	Collision with obstacle(s) during takeoff and landing
DAA	Detect and Avoid
DAQCP	De-Icing/Anti-Icing Quality Control Pool
DCS	Departure Control System
DME	Distance Measuring Equipment
EASA	European Aviation Safety Agency
EBT	Evidence-based Training
ECA	European Cockpit Association
EGPWS	Enhanced Ground Proximity Warning System
EHA	European Helicopter Association
EI	Effective Implementation
ESI	Emerging Safety Concerns
EU	European Union
EUR	Europe Region
FAA	Federal Aviation Administration (of the USA)
FDM	Flight Data Monitoring
FDX	Flight Data eXchange
FHSS	Frequency Hopping Spread-Spectrum
FL	Flight Level
FLE	Full-Loss Equivalents
FLTOPSP	Flight Operations Panel Cargo Safety Subgroup
FMS	Flight Management System
FMTF	Fatigue Management Task Force
FMTG	Fatigue Management Technical Group
F-NI	Fire/Smoke - non-impact
FO	First Officer
FOD	Foreign Object Debris
FOPs	Flight Operations
FOQA	Flight Operations Quality Assurance
FRMS	Fatigue Risk Management System
FSO	Fundamentals of Safety Oversight
FTL	Flight Time Limitations
GADM	Global Aviation Data Management
GASeP	Global Aviation Security Plan

List of Acronyms (Cont'd)

Acronym	Meaning
GASP	Global Aviation Safety Plan
G-COL	Ground Collision
GDDB	Ground Damage Database
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRF	Global Reporting Format
GRSAP	Global Runway Safety Action Plan
GS	Ground Safety
GSE	Ground Support Equipment
GSIE	Global Safety Information Exchange
GSPs	Ground Service Providers
HF	Human Factors
HITG	Hazard Identification Technical Group
IAC	Interstate Aviation Committee
IATA	International Air Transport Association
IATF	IATA Airline Training Fund
ICAO	International Civil Aviation Organization
IDQP	IATA Drinking Water Quality Pool
IDX	Incident Data Exchange
IEs	Instructors and Evaluators
IFALPA	International Federation of Air Line Pilots' Association
IFATCA	International Federation of Air Traffic Controllers' Associations
IFQP	IATA Fuel Quality Pool
IGOM	IATA Ground Operations Manual
ILS	Instrument Landing Systems
IMX	Integrated Management Solution
IOSA	IATA Operational Safety Audit
IRM	Issue Review Meeting
ISAGO	IATA Safety Audit for Ground Operations
ISIT	IATA Safety Incident Taxonomy
ISSA	IATA Standard Safety Assessment
LATAM	Latin-America
LATAM/CAR	Latin-America and Caribbean
LHDs	Large Height Deviations
LOC-G	Loss of Control - Ground
LOC-I	Loss of Control - In-flight
MAC	Mid-Air Collision

List of Acronyms (Cont'd)

Acronym	Meaning
MED	Injuries to and/or Incapacitation of Persons
MEL	Minimum Equipment List
MENA	Middle Eastern and North Africa
MF	Xiamen Airlines
MID	Middle East
MoU	Memorandum of Understanding
MPL	Multi-Crew Pilot License
MTOW	Maximum Takeoff Weight
NAM	North America
NASIA	North Asia
NAT	North Atlantic
NDB	Non-Directional Beacon
NOTAM	Notice To Airmen
OD	Operational Damage
OEMs	Original Equipment Manufacturers
OPC	Operations Committee
OPS	Operations
OTH	Other
PA	Pan-America
PANS	Procedures for Air Navigation Services
PANS-TRG	Procedures for Air Navigation Services - Training
PAT	Pilot Aptitude Testing
PBBs	Passenger Boarding Bridges
PBN	Performance-based Navigation
PED	Personal Electronic Device
PKX	Beijing Daxing International Airport
RA	Resolution Advisories
RAMP	Ground Handling
RAs	Resolution Advisories
RASG	Regional Aviation Safety Group
RASG-EUR	Regional Aviation Safety Group – Europe
RASG–PA	Regional Aviation Safety Group – Pan-America
RCG	Regional Coordinating Group
RE	Runway Excursion
RF	Radio-frequency
RI	Runway Incursion
RNAV	Area Navigation

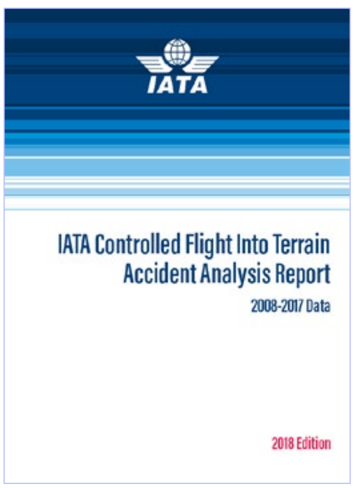
List of Acronyms (Cont'd)

Acronym	Meaning
RNP	Required Navigation Performance
RPAS	Remotely Piloted Aircraft Systems
RS	Runway Safety
RSTs	Runway Safety Teams
RVSM	Reduced Vertical Separation Minimum
SARPs	Standards and Recommended Practices
SCF-NP	System/Component Failure or Malfunction (Non-Powerplant)
SCF-PP	System/Component Failure or Malfunction (Powerplant)
SEC	Security risks with impact on safety
SEG	Security Group
SEIs	Safety Enhancement Initiatives
SFO	Safety and Flight Operations
SG	Safety Group
SGI	Somatogravic Illusion
SIEP	Safety Information Exchange Program
SMP	Safety Management Panel
SMS	Safety Management System
SOPs	Standard Operating Procedure
SPIs	Safety Performance Indicators
SSCs	Significant Safety Concerns
SSP	State Safety Program
STEADES	Safety Trends Evaluation, Analysis and Data Exchange System
TA	Traffic Advisories
TAWS	Terrain Awareness Warning System
TCAS	Traffic Alert and Collision Avoidance System
TCO	Third Country Operator
TEM	Threat and Error Management
TSA	Transport Security Administration
TURB	Turbulence Encounter
UAS	Undesired Aircraft State
UAS	Unmanned Aircraft Systems
UNK	Unknown
UPRT	Upset Prevention and Recovery Training
USOAP	Universal Safety Oversight Audit Program
USOS	Undershoot/Overshoot
WMO	Word Meteorological Organization

Safety Resources

Guidance Material
Performance assessment of pilot compliance to Traffic Alert and Collision Avoidance System (TCAS) using Flight Data Monitoring (FDM)

This guide is written jointly by IATA and EUROCONTROL is based on the ICAO provisions and other applicable regulations. It recommends that operators establish procedures detailing how their flight crew should operate TCAS and respond to RAs.



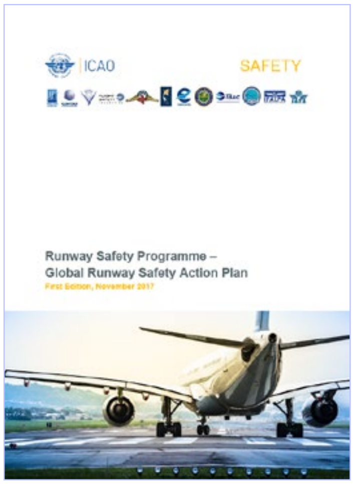
Controlled Flight into Terrain Accident Analysis Report

This interactive PDF report is organized in a way to provide dynamic environment data from 47 CFIT accidents that occurred over the last 10 years, spanning from 2008 through 2017. This report contains embedded interactive Excel graphs and is written to support a user-friendly methodology to analyze and visualize CFIT accident data and to identify patterns, trends, comparisons between data selections.

Unstable Approaches
Risk Mitigation Policies, Procedures and Best Practices
3rd Edition

This document was jointly written by IATA, CANSO, IFATCA and IFALPA, to address the problems surrounding unstable approaches, a major contributor to accidents. This publication emphasizes the importance of pilots, air traffic controllers and airport staff working together along with regulators, training organizations and international trade associations to agree on measures and procedures to reduce unstable approaches.

Safety Resources



Global Runway Safety Action Plan

At the second Global Runway Safety Symposium, the global runway safety partners agreed and launched the Global Runway Safety Action Plan. This plan provides recommended actions for all runway safety stakeholders, including airports, aircraft manufactures, operators, States, and ANSPs to apply runway safety enhancement and risk reduction measures, with an overall goal of reducing the global runway safety accident rates.

Best Practices Guide
Cabin interior retrofits and entry into service program

This guidance has been created with input from IATA's Engineering and Maintenance team alongside airlines and cabin safety professionals. It aims to address operational safety issues within aircraft cabin interior retrofit programs.

Cabin Operations Safety Best Practices Guide

This guidance includes all aspects of cabin safety regulation and Safety Management and gives examples of risk assessments used to determine airline safety policy.

This guide is provided free of charge to IATA members. Any member airline who has not received a copy should contact cabin_safety@iata.org

Non-member airlines and other entities may purchase a copy for USD99 from the IATA store.

Safety Resources

IATA Turbulence Program

As of December 2018, IATA, has developed a turbulence sharing platform (IATA Turbulence Aware) 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 Turbulence Aware system is to provide airline pilots and airline operation center personnel with real-time, very detailed turbulence awareness and support a global industry shift towards data-driven turbulence mitigation. Full details on the program can be obtained here or by contacting the IATA Turbulence Program team.

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