SAFETY REPORT 2016

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Senior Vice-President Foreword

Gilberto Lopez Meyer
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Dear colleagues,

Safety is our industry's number one priority and our greatest success. In 2016 we saw continued progress toward making flying even safer, as the number of total accidents, fatal accidents and fatalities all declined against the five-year average. Sub-Saharan Africa was a particular bright spot, with zero fatal accidents and zero jet hull loss accidents. The region's turboprop safety performance continued to improve as well, with an accident rate of 3.31 (42% lower than its 2011-2015 yearly average). Clearly, the multi-year effort of aviation stakeholders to raise African safety standards is showing encouraging results.

However, at the global level, we experienced an increase in hull loss accidents measured against the prior five-year average, which tells that we still have much to do. The IATA 2016 Safety Report provides a roadmap to guide us towards those areas where our collaborative efforts can have the greatest impact on safety. And it should come as no surprise that once again, in terms of reducing operational risk, our three biggest opportunities are loss of control in flight (LOC-I), controlled flight into terrain (CFIT) and runway excursions (RE). Further, although accident rates are not a direct indicator, the IATA Global Aviation Data Management (GADM) program identified a challenge related to a rising number of resolution advisories in certain airspace, therefore risk of Mid-Air Collision (MAC) has also been added to the operational risk reduction strategy.

It also should be no surprise that the IATA Operational Safety Audit (IOSA) continues to be the benchmark standard for operational safety measurement. In 2016, the accident rate for IOSA members was nearly twice as good as for non-IOSA airlines and it was more than three times better over the previous five years. We are developing a digital strategy for IOSA that will transform business processes, program infrastructure and solutions in order to add additional value to the audits.

This year's Safety Report includes an expanded section on Cabin Safety. The rare but critical role that cabin crew play in emergency evacuations is well known, but cabin crew contribute to safe operations on every flight.

It is privilege to offer you this 53rd 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 Accident Classification Task Force (ACTF), the Cabin Operations Safety Task Force (COSTF), and all IATA staff involved for their cooperation and expertise essential for the creation of this report.

“A Safety Management System has value when properly implemented”

Chairman Foreword

Dr. Dieter Reisinger
Chairman ACTF

Welcome to the 2016 IATA Safety Report! Thank you for taking time to read these lines.

The good news from 2016 is that there was a significant drop in accident rates in sub-Saharan Africa. In fact, there were zero fatal accidents in the region in 2016! It is too early to tell whether such a low accident rate can be sustained in the region. However, it is safe to say that numerous IATA safety initiatives of the past had a focus in that region. It is very good news to see these initiatives are having a positive impact.

The other good news is the significant drop in turboprop accident rates. We are often asked why we differentiate between jet aircraft and turboprop aircraft. In the opinion of the Accident Classification Task Force (ACTF) and in the opinion of the original equipment manufacturers, the latest generation of turboprops match their jet-propelled counterparts when it comes to the level of engineering, technology and man-machine interface. Nevertheless, despite all of these similarities, the turboprop accident rates of previous decades have always been higher than the jet accident rates.

There is no definitive answer as to why this is, but it can be seen that turboprop operators who maintain the IATA Operational Safety Audit (IOSA) standard have an equally low accident rate when compared with IOSA certified jet operators. This is a clear indication that a Safety Management System (SMS) has value when properly implemented. In order to be able to conduct a safe operation, pilots, maintenance engineers, cabin crew and ground staff have to be embedded in an organization which uses well-established safety-enhancing methodologies. One area where SMS could be enhanced for turboprop operators is Flight Data Monitoring, which has been mandated and utilized by jet operators for many years, but is not required by the regulations for aircraft weighing less than 27 tons.

A strong safety culture is also a key element of an effective SMS and it is the responsibility of airline management to create such an environment within an organization. This is also an area where national regulators can influence operators towards robust selection criteria for post-holder appointments, ensuring that they have a comprehensive understanding of SMS principles and greater accountability for safety, in airline management structures.

The ACTF identified numerous latent conditions contributing to accidents. Latent conditions can be identified by an SMS and be addressed in a well-managed airline with a positive environment of continuous improvement. One of these latent conditions, which is a subjective observation, is pilot selection and training. Adopting industry best practice in recruitment and selection may yield great safety benefits as the global fleet expands.

Chairman Foreword, Cont'd

So far the good news, now comes the frustrating part of our work: the lack of timely and thorough accident investigations in too much of the world. The travelling public has a right to know and the industry can only learn and improve if such information is made publicly available. Over the past years ACTF has recommended that the International Civil Aviation Organization (ICAO) not only encourage states to carry out timely accident investigations, but actually maintain a close relationship with those states who are unable to comply. In order to improve an ultra-low risk transport system such as aviation, learning from timely and accurate aviation accident investigations is essential. From over 1,000 accidents in the past 10 years, approximately 300 were investigated and a sizeable proportion of the 300 investigations were not exhaustive.

Not only are accident investigations not conducted, but were it not for the manufacturers and public sources, ACTF would not have enough factual information to derive meaningful safety statistics. Furthermore, some states choose not to invite manufacturers to take part in their investigation.

As part of ACTF´s internal quality check we look back in time and re-classify accidents based on official accident reports. It is a great concern that in many cases final reports are not published. ICAO should review this and consider taking the lead to identify regions which need support when it comes to aviation accident investigations.

The ACTF has spent considerable time and effort to put the statistics and recommendations together. I thank the Vice Chair and all members, in particular our new members, for their support. A big thank you also to the manufacturers and also to the IATA team members who finally produce this report! It is a pleasure and a privilege to work with this group of dedicated experts who have one common desire – to help make our skies even safer!

Safety Report 2016 Executive Summary

The IATA Safety Report is the flagship safety document produced by IATA since 1964. It provides the industry with critical information derived from the analysis of aviation accidents to understand safety risks in the industry and propose mitigation strategies.

SUMMARY RESULTS

This report is focused on the commercial air transport industry; it therefore uses more restrictive criteria than the International Civil Aviation Organization (ICAO) Annex 13 accident definitions. In total, 65 accidents met the IATA accident criteria in 2016.

A joint chapter with ICAO providing analysis of the accidents that met the broader harmonized Global Safety Information Exchange (GSIE) criteria is also provided in Section 10 of this report. The criteria used by IATA excludes injury-only accidents with no damage to the aircraft.

	Total Number of Accidents		Total Accident Rate		Hull Loss Rate		Fatal Accident Rate		Number of Fatal Accidents		Number of Fatalities	
	Jet	TP	Jet	TP	Jet	TP	Jet	TP	Jet	TP	Jet	TP
2016	42	23	1.25	3.31	0.39	1.15	0.15	0.72	5	5	206	62
2015	45	23	1.44	3.39	0.32	1.18	0.00	0.59	0	4	0	136
Previous 5 Year Average (2011-2015)	43	39	1.46	5.66	0.37	2.84	0.16	1.32	4	9	241	131

TP = Turboprop

General Analysis

Over the last ten years the world's commercial aviation system industry has improved its overall safety performance by 54%, with an accident rate in 2016 of 1.61 accidents per million sectors, compared to 3.53 in 2007. The 2016 accident rate[1], which includes all accidents, was 10% lower than in 2015. However, this overall positive performance was counterbalanced by an increase in the number of fatalities, fatal accidents and hull losses versus the previous year.

With a total number of fatalities at 268, 2016 represented an increase of 97% over 2015. Of the ten fatal accidents in 2016 (six more than in 2015) six of these accidents were on cargo flights. On the positive side, 2016 is still below the previous five year average of 371 fatalities per year.

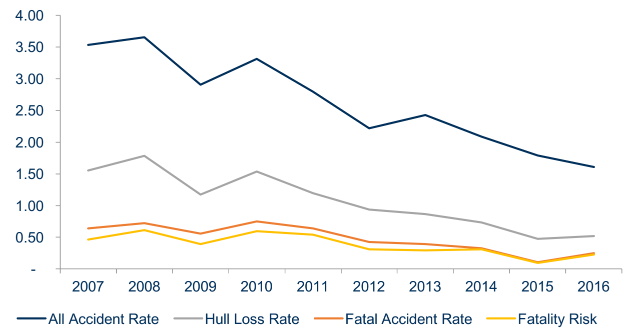
The year 2016 also saw great improvement in Africa, with an overall accident rate of 2.30 and a continuing downward trend in turboprop accidents, with a rate of 3.31 (42% lower than its 2011-2015 yearly average).

The loss of EgyptAir 804 with the deaths of all 66 on board is included in the accident statistics; the causal factors of the accident are still under investigation. Also included is the crash of LaMia 2933 in which 71 on board perished. The aircraft was a charter flight that was transporting a soccer team to an upcoming match.

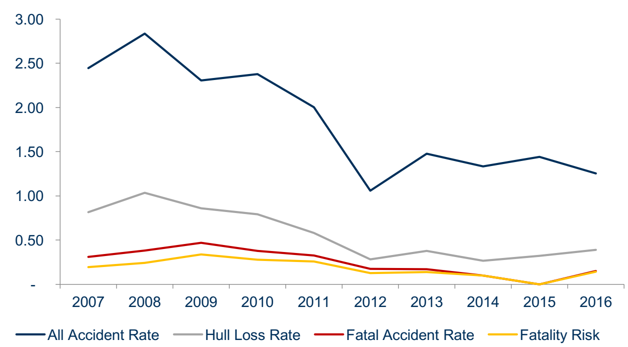
It is important to note that the Safety Report's overall fatality count only focuses on fatalities caused to people on board the aircraft, not on the ground or other aircraft not fitting into the accident criteria. Also, the Safety Report excludes accidents caused by acts of unlawful interference, as these are considered security not safety issues.

1 Any accident rate metric in this report is to be considered the 'number of accidents per 1 million sectors', unless stated otherwise.

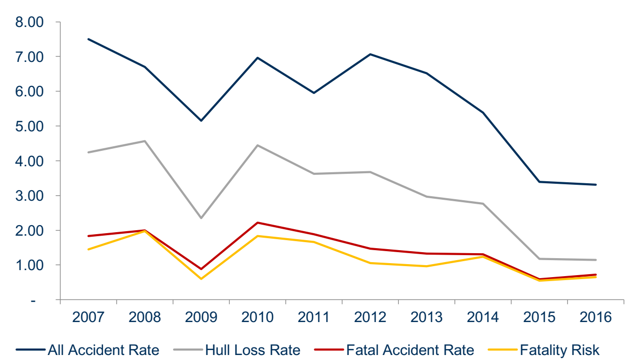
Jet and Turboprop | Accidents per Million Sectors



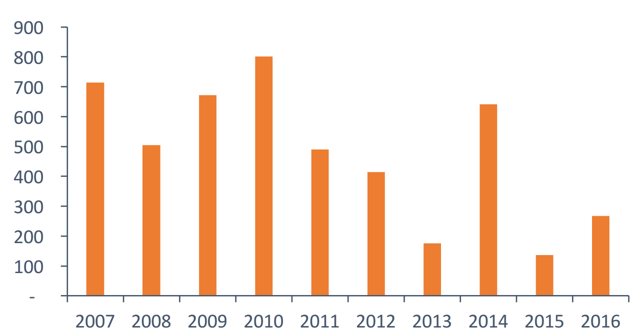
Jet | Accidents per Million Sectors



Turboprop | Accidents per Million Sectors



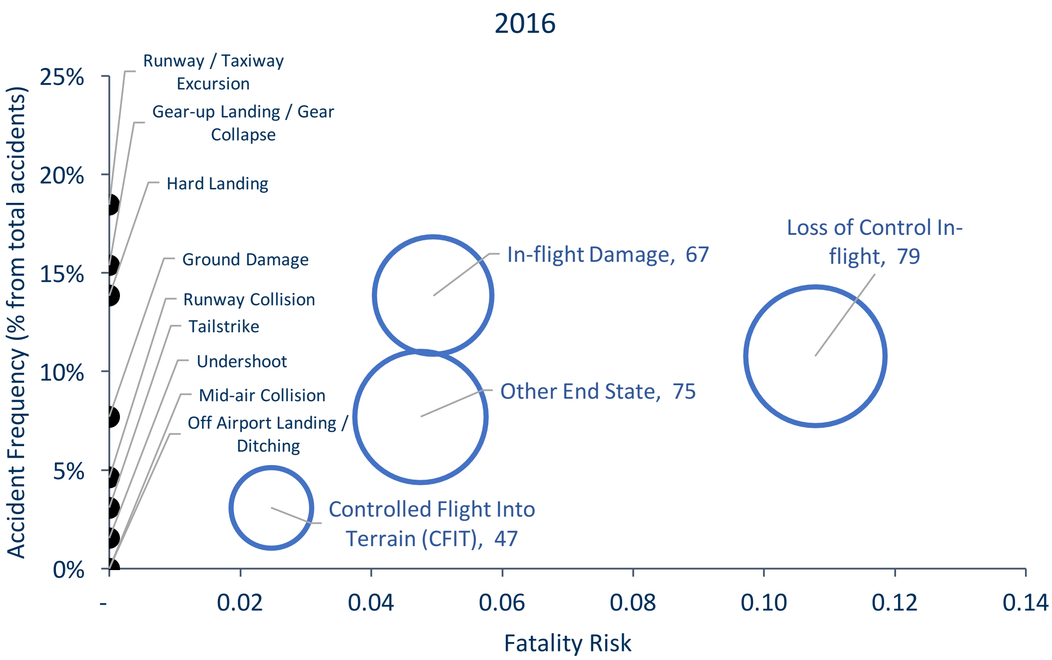
Number of Fatalities



Accident Categories

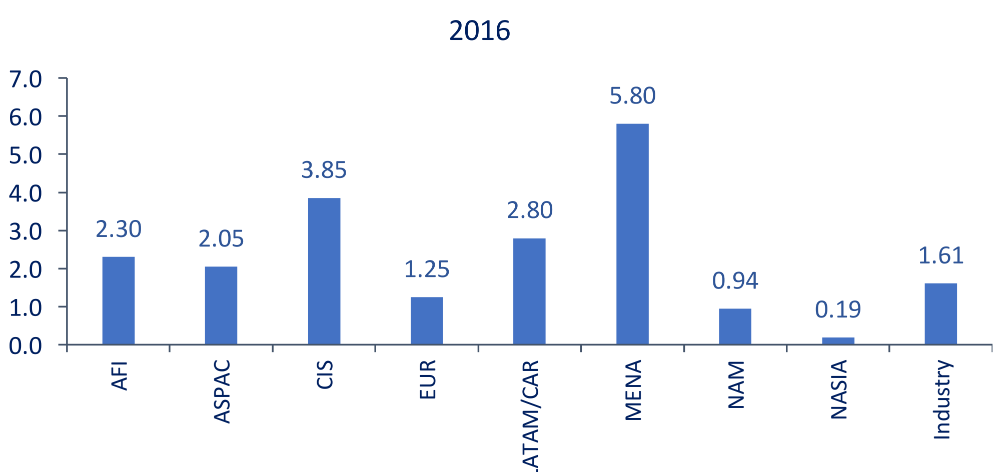
Runway/Taxiway Excursion was the accident category that occurred the most in 2016, at 19% of the total, followed by Gear-up Landing/Gear Collapse at 16%. Loss of Control In-flight (LOC-I) was the accident category that contributed not only to most of the fatalities overall, but also to a higher ratio of people who perished compared to the number of people on board (represented by the Fatality Risk metric shown in the graph below). An in-depth analysis of each of the accident categories is given in Section 4.

The graph below shows that Controlled Flight into Terrain (CFIT), In-Flight Damage, Loss of Control in-Flight (LOC-I) and 'Other End State' were the accident categories to experience fatalities in 2016, with LOC-I contributing 11% of the accidents and taking the lives of 79 people. LOC-I exposed passengers and crew to the highest risk of a catastrophic accident with no survivors, at a rate of about 0.11 accidents per million sectors. This translates into an exposure of one catastrophic accident for every 9.1 million sectors.



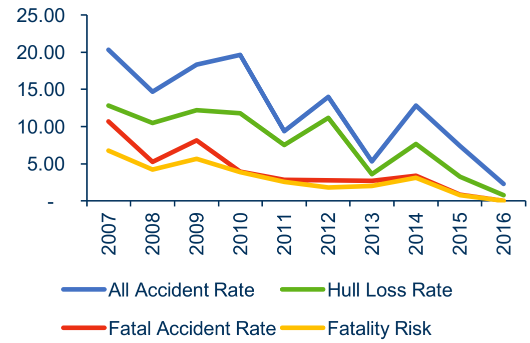
Regional Analysis

Middle East and North Africa (MENA), the Commonwealth of Independent States (CIS) and Latin America and the Caribbean (LATAM/CAR) had the highest accident rates in 2016 at, respectively, 5.80, 3.85 and 2.80 accidents per million sectors, while North America (NAM) and North Asia (NASIA) had the lowest rates, at 0.94 and 0.19 accidents per million sectors, respectively.



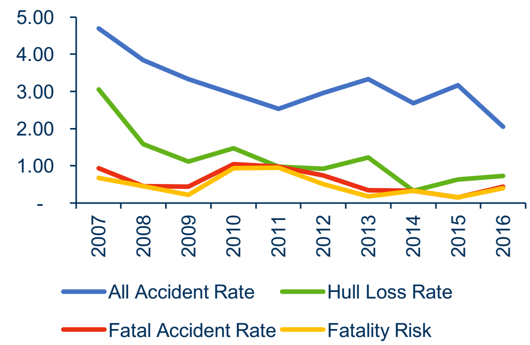
Africa (AFI)

The African region saw its best performance of the past 10 years, with its accident rate in 2016 reducing by 89% when compared to 2007. The downward trend is also observed in the other safety metrics used in this report.



Asia Pacific (ASPAC)

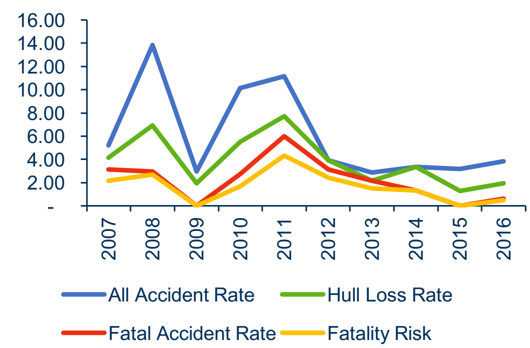
The overall accident rate in Asia Pacific in 2016 was 35% lower when compared to 2015, from 3.16 to 2.05. This was counterbalanced by the increase of hull loss and fatal accidents.



Commonwealth of Independent States (CIS)

After a period of high volatility in the accident rate between 2007 and 2012, the accident rate has stabilized at approximately 3.4 accidents per million sectors since 2012, with a slight upward trend.

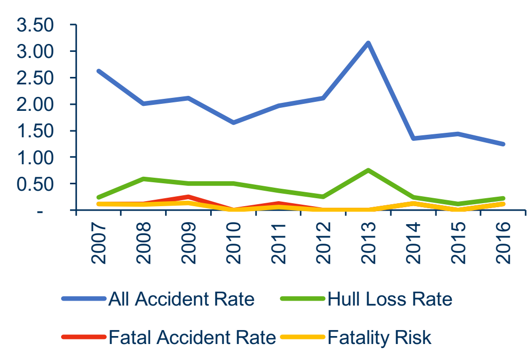
The hull loss and fatal accident rates have experienced an overall decrease since 2011, with zero fatal accidents in 2015. 2016 saw this rate increase to 0.64.



Europe (EUR)

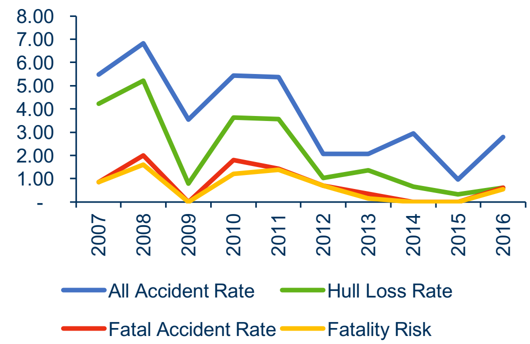
The overall accident rate in Europe is fairly stable (no apparent up/downward trend), at approximately 1.35 accidents per million sectors since 2014. The rate in 2016 was 1.25.

Similar behavior is observed in the rate of hull losses and fatal accidents. The hull loss rate in 2016 was of 0.11, while the fatal accident rate was of 0.23.



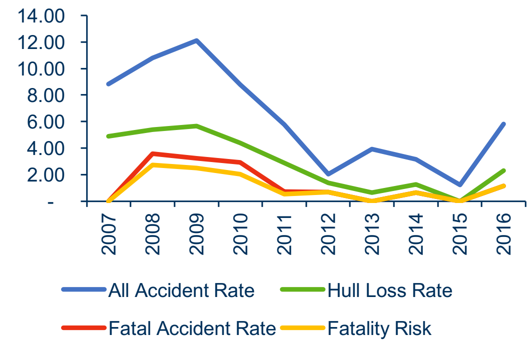
Latin America & the Caribbean (LATAM/CAR)

The region saw an increase in the overall accident rate (2.80 in 2016 compared to 0.97 in 2015) as it also experienced 2 fatal accidents, after two consecutive years without any fatality.



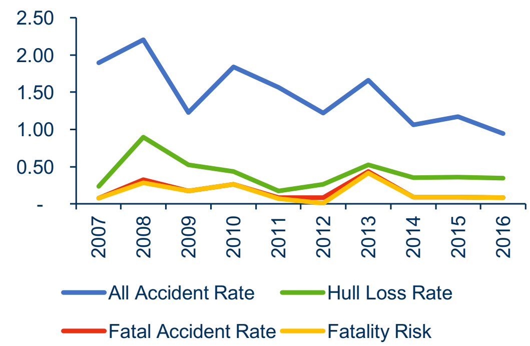
Middle East and North Africa (MENA)

The region had the highest accident rate in 2016 at 5.80 since 2012. Similar behaviour was observed for its fatal and hull loss accident rates, at 1.16 and 2.32 respectively.



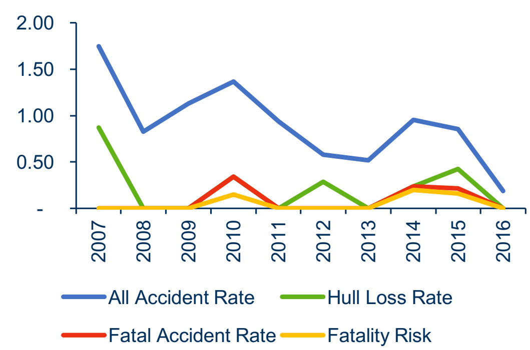
North America (NAM)

The accident rate in the North American region has been in constant decline over the last 10 years, but the hull loss and fatal accident rates have stabilized over the last 3 years, averaging at 0.34 hull losses and 0.09 fatal accidents per 1 million sectors since 2014.



North Asia (NASIA)

North Asia had the lowest overall accident rate in 2016, at 0.19 accidents per million sectors. There were no fatalities in 2016.



Cargo Accidents

The sector information was not available for accident rates to be calculated. This is as a result of the complexities in splitting the flight count into the different types of operation. Therefore, the cargo section (see Section 6) focuses mainly on counts and percent distributions. The IATA team responsible for the accident database is working towards including cargo accident rates in future reports.

Cabin Safety

Measurement of cabin safety is a difficult task as it encompasses multiple aspects including but not limited to, service of hot food and drink, security, handling of unruly passengers, turbulence, medical emergencies, contagious diseases, cabin baggage and enforcement of safety regulations. The biggest part of the role of cabin crew is to prevent any situation from worsening and evolving into an incident or an accident, so cabin safety remains an underlying factor rather than a cause.

As well as analysis of accidents demonstrating the cabin end states and the actions of the cabin crew after an accident, for the first time this report includes top level analysis of two of the key safety issues in the cabin – the management of smoke and fire incidents and the carriage of portable electronic devices powered by lithium batteries.

Deeper analysis to support this information is available to member airlines through the Global Aviation Data Management website. The information in this report highlights that cabin crew successfully identified and managed these incidents to a satisfactory conclusion using the training, awareness and equipment provided to them.

Using data from incident reports helps identify incident rates and set objective targets and Safety Performance Indicators. By benchmarking against industry rates, an operator can set Safety Performance Targets more effectively and manage risks to an acceptable level. Further information on Safety Management Systems (SMS) within Cabin Operations is included in the IATA Cabin Operations Best Practices Guide.

IATA continues 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 (www.iata.org/cabin-safety-conference) continues to grow and has become a renowned and useful event for delegates to network, learn of recent updates and initiatives as well as attend learning workshops to increase their understanding of regulations and policies.

STEADES Air Traffic Services (ATS) Analysis

The IATA Safety Group (SG) requested that IATA Global Aviation Data Management (GADM) produce an analysis and assess Air Traffic Service (ATS) performance based on STEADES reports. This database is comprised of de-identified safety incident reports from over 198 participating airlines worldwide.

The analysis goal was to identify areas of ATS and flight crew performance that could negatively impact safety, focusing on a high level global view utilizing all of the reports and in-depth analysis on a smaller number of random reports.

The analysis is available in Section 9 of this report.

IOSA

The IATA Operational Safety Audit (IOSA) program 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. The total accident rate for IOSA carriers in 2016 was nearly half the rate for non-IOSA operators. As such, IOSA has become a global standard, recognized well beyond IATA membership.

ACTF Discussions and Recommendations

The Accident Classification Task Force (ACTF) met in June 2016 and in January 2017, reviewing each accident and assigning the classifications that are used in this report. While causal factors tend not to change dramatically from one year to the next, some key areas do arise. The ACTF has identified a few of these areas of concern that need to be addressed by industry stakeholders. Section 8 contains guidelines on some specific accident categories and a summary of the ACTF recommendations and discussion points is found on page 129 of this report.

Summary of Changes from the 2015 Safety Report

After major changes applied last year to the layout and formatting of the report following feedback from a survey, the 2016 Safety Report remains the same in format and layout to the 2015 Safety Report.

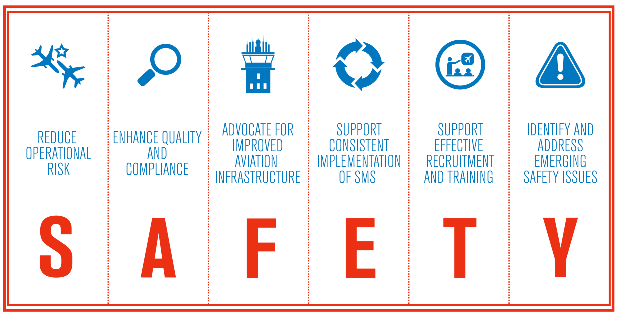
The ACTF has reviewed the definition used for Runway Collision accidents. A revision of historical accidents was performed with this more strict definition, so that this accident category could be more accurately captured.

In order to account for potential latency in the reporting of accidents, a process has been put in place whereby IATA's accident database is regularly updated with accidents that may have subsequently come to light. Each of these accidents is reviewed by the Accident Classification Task Force (ACTF - see membership in Section 1) as part of its classification work. Therefore, accident counts (and accident rates) may vary when compared to previous reports.

IATA Safety Strategy

The IATA Six-Point Safety Strategy - 2013, was developed with much input and consultation by the IATA Safety Group, and was endorsed by IATA's Operations Committee (OPC) in October 2013. This strategy is a living document, subject to continuous review and revision to remain current and relevant.

IATA continues to use this safety strategy to drive its action towards an integrated, data-driven approach for 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 will work 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 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.

REDUCE OPERATIONAL RISK

IATA has identified four primary areas of risks: Loss of Control In-Flight (LOC-I), Controlled Flight into Terrain (CFIT), Runway Excursion (RE) and Mid-Air Collision (MAC). In the last five years LOC-I and CFIT generally resulted in fatalities, whereas, RE occurred more often, but resulted in far fewer fatalities and MAC accounted for 0.5% of total accidents. Although accident rates are not a direct indicator, the IATA safety exchange programs point to the fact that this is an area that warrants attention, therefore Mid-Air Collision has been added.

Almost all LOC-I and CFIT accidents lead to both fatalities and hull losses, while other accident categories generated mainly damage to aircraft. In the last five years RE was 26% of all accidents and the most common cause of a hull loss, but only six percent (6%) of Runway / Taxiway Excursion accidents caused fatalities during the period (2012 – 2016).

IATA continues to prioritize action in these four areas: reducing the number of LOC-I and CFIT accidents, improving runway safety and reducing the risk of mid-air collision. All of these actions will contribute to the main priority of IATA to continually reduce the global accident fatality rate.

As stakeholders work to address the issues discussed above, it is important that the industry continues to dedicate resources to areas that safety data shows will be most effective in reducing the risk of an accident. In 2016, efforts continued to reduce the operational risk of runway excursions (RE), loss of control in flight (LOC-I), controlled flight into terrain (CFIT) and mid-air collision (MAC).

Loss of Control In-Flight

Loss of control in flight is not a common accident, but it has the highest number of fatalities. LOC-I accounted for just eight percent (8%) of accidents in the five years from 2012 through 2016, but 90% of those LOC-I accidents resulted in fatalities. IATA has embarked on a number of initiatives to increase the attention devoted to this important area:

- IATA has developed guidance material and best practice to support the awareness and mitigation of LOC-I occurrences and provided easy access to these materials on a LOC-I webpage; IATA has published its 1st Edition of the Environmental Factors Affecting Loss of Control In-Flight: Best Practice for Threat Recognition & Management; the aim of this document is to provide a point of reference for the understanding and mitigation of the risk of LOC-I as a result of the environmental factors encountered in flight.
- IATA Training and Licensing with the support of the Pilot Training Task Force (PTTF) provided Guidance Material and Best Practices for the Implementation of Upset Prevention and Recovery Training (UPRT) to help address factors contributing to LOC-I.

- IATA Training and Licensing Department has supported several ICAO UPRT workshops around the world during 2016.
- IATA continues to further develop guidance material and best practice to support the awareness and mitigation of LOC-I occurrences.
- Through regional workshops, outreach and awareness initiatives, IATA shares LOC-I information, hazards, threats and mitigation strategy.

Together with the industry, IATA continues to address LOC-I threats in airline operations and has made progress in preventing such accidents and saving lives.

Controlled Flight into Terrain

The IATA Accident Database shows that CFIT is not the most frequent of accident categories. However, the high fatality risk of these accidents means that CFIT accounts for a substantial number of fatalities. The 67 CFIT accidents between 2005 and 2014 caused 1,346 fatalities and a 99% hull loss rate.

In order to address this, IATA conducted a study of terrain awareness warning system capability and human factors occurring in CFIT accidents between 2005 and 2014. This survey and associated report was commissioned to identify accident commonalities and lessons from the findings.

The study finds that, where fitted, the GPWS/EGPWS performed as designed but not always in a manner that could have prevented the accident. Poor pilot response was found to contribute to the CFIT accidents with a functioning terrain warning system. In these cases, the system provided adequate time to react to a hazard, but the flight crew delayed their response or made an inadequate avoidance maneuver.

Multiple human performance deficiencies and undesirable behaviors were indicated in all accidents under review and these constituted by far the largest group of factors in the accident set. Situational Awareness was found to be deficient in all cases, which is to be expected. Poor crew resource management and sub-optimal interaction between the pilots was also a frequent contributing factor, as was procedural non-compliance.

The objective of this study was to create recommendations for industry to mitigate CFIT accidents. A total of sixteen recommendations were made.

Runway Safety

Runway excursion, undershoot, runway incursion, hard landing and tail strike are persistent problem affecting the industry worldwide. Runway / taxiway excursion is the most frequent accident category type.

In 2016, a runway/taxiway excursion was the most frequently occurring category of accident, making up 19% of the total, but none of them were fatal. Although runway excursions are the most common type of accident, the associated fatality rate was less than one percent (1%) of the total accident fatalities in the last five years.

IATA recognizes the need for continued improvement in runway safety, which is one of the industry's principal risk areas.

IATA has embarked on the following series of programs:

1. IATA has developed reports and guidance material establishing best practices to support the mitigation of runway safety occurrences. Unstable approaches can lead to an incident or accident in the runway environment. To address this, the 2nd edition of Unstable Approaches: Risk Mitigation Policies, Procedures & Best Practices has been collaboratively written by IATA, CANSO, IFATCA and IFALPA. It addresses prevention and recovery from an unstable approach. Enhancing overall awareness of contributing factors and outcomes of an unstable approach, together with some proven prevention strategies, it provides a reference based upon the guidance of aircraft manufacturers and identified industry best practice, against which to review operational policy, procedures and training.
2. IATA continues to work with international organizations to analyze and develop mitigation strategies to reduce the number of runway excursions.
3. Through outreach and awareness initiatives, IATA shares information and lessons learned on runway safety issues, hazards and effective solutions with all industry stakeholders.

Together with the industry, IATA will continue to focus its efforts, attention and resources to reduce risk in the runway safety arena.

Fatigue Risk / Fatigue Management

Flight crew and cabin crew member fatigue is now acknowledged as a hazard that predictably degrades various types of human performance and can contribute to aviation accidents and incidents. Fatigue is inevitable in 24/7 operations because the human brain and body function optimally with unrestricted sleep at night. Therefore, as fatigue cannot be eliminated, it must be managed.

Fatigue management refers to the methods by which operators and operational personnel address the safety implications of fatigue. ICAO Standards and Recommended Practices (SARPs) support two distinct approaches: the prescriptive fatigue management approach and the Fatigue Risk Management System (FRMS) approach.

Under a prescriptive fatigue management approach, operations must remain within prescribed limits established by the regulator for flight time, flight duty periods, duty periods and rest periods. In addition, the operator manages fatigue hazards using the SMS processes that are in place for managing other types of hazards.

The FRMS approach represents an opportunity for operators to use advances in scientific knowledge to improve safety and increase operational flexibility. An FRMS is a specialized system that uses SMS principles and processes to specifically identify and manage crew member fatigue as a hazard.

With FRMS, the operator must identify and assess potential fatigue risks prior to conducting operations under the FRMS as well as identifying and assessing actual fatigue risks proactively during operations. Having an FRMS still requires having maximum limits, but these are proposed by the operator and must be approved by the regulator.

With the support of the IATA Fatigue Management Task Force (FMTF), IATA develops and publishes guidance materials to support a globally harmonized implementation of fatigue management strategies, e.g., "Fatigue Safety Performance Indicators (SPIs): A Key Component of Proactive Fatigue Hazard Identification". This document reviews different SPIs to help operators develop processes and procedures to monitor the effectiveness of fatigue management approaches. In 2015 IATA published the "Common Protocol for Minimum Data Collection Variables in Aviation Operations" document. This document presents an overview of a common protocol for data collection and identifies a minimum set of fatigue related variables that would allow for the comparison of data across operational studies. The 2nd Edition of the cobranded IATA/ICAO/IFALPA Fatigue Management Guide for Airline Operators is also available. All the documents developed with the support of the IATA FMTF can be download free of charge, from www.iata.org.

ENHANCE QUALITY AND COMPLIANCE

The importance of monitoring and oversight in the maintenance and improvement of aviation safety standards cannot be emphasized enough. Regulations must evolve as the industry grows and technologies change. The audit programs aim to increase global safety performance and to reduce the number of redundant auditing activities in the industry. The 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.

Auditing - IOSA

IATA's Operational Safety Audit program (IOSA) is an internationally recognized and accepted evaluation system designed to assess the operational management and control systems of an airline and generally mentioned as the "gold standard" for operators. The initial goals of establishing a broad foundation for improved operational safety and security and eliminating redundant industry audits have been reached. All IATA members are IOSA registered and must remain registered to maintain IATA membership.

IATA Standard Safety Assessment Program (ISSA)

The 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 IATA Operational Safety Audit (IOSA) program to the operators of smaller aircraft that are not eligible for the IOSA program.

The ISSA program offers entry into an IATA Assessment Registry to operators that utilize aircraft with a maximum take-off weight (MTOW) below 5,700 kg. It also offers a one term registration opportunity to operators of aircraft with an MTOW above 5700 kg.

Auditing - ISAGO

The IATA Safety Audit for Ground Operations (ISAGO) improves ground safety and aims to reduce accidents and incidents and risk in ground operations. ISAGO is a standardized and structured audit program of Ground Service Providers (GSPs), that is, ground handling companies operating at airports. It uses internationally recognized operational standards that have been developed by global experts. The audits are conducted by highly trained and experienced auditors.

Latest analysis conducted with IATA Ground Damage data indicated (with clear and strong statistical evidence) that ISAGO had made a positive impact on safety culture and safety performance of the GSPs. ISAGO Providers exhibited a better reporting culture, 70% of their damage were reported comparing to only 32% of reported damage for non-ISAGO GSPs. ISAGO registered GSPs also experienced significantly less severe damage.

Auditing - IFQP

The IATA Fuel Quality Pool (IFQP) is a group of more than 170 airlines that work together to assess the implementation of safety and quality standards and procedures at aviation fuel facilities. IFQP-qualified Inspectors perform the inspections at airport worldwide, against industry regulations, and the reports are shared among the IFQP members.

By providing comprehensive training of inspectors and development of standardized inspection procedures according to industry standard they get to enhance safety and improve quality control standards of fuel facilities at the airport, in compliance with airlines regulators requirements.

Auditing - DAQCP

The IATA DAQCP is a group of more than 100 airlines that audit de/anti-icing providers and share the inspection reports and workload at various locations worldwide. Its main goal is to ensure that safety guidelines, quality control recommendations and standards of the de-icing/anti-icing procedures are followed at all airports.

Auditing – IDQP

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

ADVOCATE FOR IMPROVED AVIATION INFRASTRUCTURE

Working closely with IATA members, key partners such as ICAO, the Civil Air Navigation Services Organization (CANSO) and Airports Council International (ACI), state regulators and Air Navigation Service Providers (ANSPs), the IATA Air Traffic Management (ATM) Infrastructure department strives to ensure that ATM and Communication Navigation and Surveillance (CNS) infrastructure is globally harmonized, interoperable, and meets the requirements of the aviation industry. Advocating for improved aviation infrastructure is fundamental to addressing current and future operational deficiencies and safety risks.

By 2020, forecasts indicate that traffic is expected to increase by about:

- 50% in Asia
- 40% in South America
- 40% in the Middle East
- 11% in Africa

Supporting such traffic growth will require cost-effective investments in infrastructure that meet safety and operational requirements. The ICAO Global Air Navigation Plan (GANP) provides a framework for harmonized implementation of service level improvement enablers by aircraft operators and ANSPs.

The IATA Safety Strategy focuses on the following key priorities:

- Implementation of Performance-Based Navigation (PBN); particularly Approaches with Vertical Guidance (APV).
- Operational improvements and safety enhancements associated with the implementation of Aviation System Block Upgrade (ASBU) modules; e.g., Continuous Descent Operations (CDO) and Continuous Climb Operations (CCO).
- Collaborative Decision Making (CDM) to achieve safety and service level improvements.

Performance-Based Navigation with Vertical Guidance

At their 37th General Assembly in September 2010, ICAO member states agreed to complete a national 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.

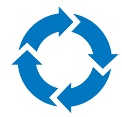
Due to a low level of progress, IATA continues to engage States, ANSPs, and airlines to accelerate implementation of APV procedures and demonstrate the risks associated with the continued use of non-precision approaches.

Air Traffic Management

IATA has implemented the following ATM infrastructure safety initiatives:

- Promoted operational improvements and safety enhancements associated with the implementation of ASBU modules; e.g., PBN, CDO, CCO.
- Encouraged CDM to achieve infrastructure improvements.
- Encouraged the flexible use of airspace between civilian and military airspace users.
- Advocated for global interoperability and harmonization, especially with the Single European Sky ATM Research (SESAR) program and the NextGen programme in the United States.

SUPPORT CONSISTENT IMPLEMENTATION OF SMS



In 2016 IATA continued to drive effective implementation of Safety Management in the Industry through various initiatives, centered on educating airline operators and other relevant stakeholders on the intent of amended ICAO Annex 19 provisions and on programs that will facilitate operator SMS compliance.

These initiatives included the first ever IATA Safety Management Conference, held in Abu Dhabi in October 2016, the development and launch of the IATA Aviation Safety Culture (I-ASC) survey tool, reviewing safety data and safety information governance and working to support the understanding and implementation of Annex 19 amendments.

Additionally, continuous monitoring of the findings related to IOSA SMS designated SARPs helps IATA identify needs to develop targeted supporting guidance and training material.

IATA Safety has focused its SMS efforts on the following areas:

IATA Safety Management Conference – A Decade in Review and the Vision Forward

The first ever IATA Safety Management Conference was held in Abu Dhabi in October 2016. Marking the first decade since the introduction of the ICAO Safety Management requirements, and in preparation for the Annex 19 amendments, this first of its kind conference reviewed the vision and intent of safety management. It provided a forum for all stakeholders under the purview of Annex 19 to share experiences, challenges and lessons learned with Safety Management System (SMS) and State Safety Program (SSP) implementation, and identify key strategies to collectively move forward. The conference brought together 281 safety specialists and stakeholders representing all regions and various Industry segments (operators, airports, ANSPs, ground service providers, states, academia), to contribute to the further evaluation and coordinated development of aviation safety management programs worldwide.

Safety Culture – Addressing the Requirement to Measure and Improve Safety Culture

IATA Safety developed and launched the "I-ASC" (IATA Aviation Safety Culture) survey, specifically designed for the aviation industry, to provide participants with the means to meet ICAO Safety Management System (SMS) / State Safety Program (SSP) requirements to measure and continuously improve their safety culture. The survey is a standardized tool that supports an organizations' safety management activities. I-ASC provides insight into the daily challenges and perceived risk areas of front line and management employees, thus helping organizations identify specific areas of improvement and hazards, ultimately contributing to improvements in safety performance. The pilot survey was successfully completed in 2016 with Icelandair. Currently two IATA members are in the process of conducting the survey, with more than fifteen others considering this tool. As more operators conduct this survey, the results will allow benchmarking capabilities on a global, regional, alliance basis.

Annex 19 Amendments – Guidance Material

The amendments became effective in July 2016 and become applicable in November 2019. The three main areas emphasized in Annex 19 amendments are safety data and safety information protection, Safety Culture and State Safety Programs (SSPs).

IATA continues to participate in the development of ICAO guidance material, supporting Annex 19 amendments. The 4th Edition of the ICAO Safety Management Manual is expected to be made available by ICAO in July 2017, complemented by a website with examples, tools, and a repository of best practices.

In addition, IATA has been working with Industry in developing SPI guidance material that will be published in 2017.

Safety Data and Safety Information Protection

The IATA Global Aviation Data Management (GADM) program produces safety information which can be used by Industry to support safety management activities. IATA recognizes not only the value of safety information exchange programs in support of maintaining or improving aviation safety, but also the importance of a transparent and controlled governance plan which ensures proper protections on the disclosure and use of information produced by this program. As such, a Safety Information Exchange Governance protocol has been drafted. Aligned with the new Annex 19 provisions, this document provides transparency regarding IATA's role in the exchange of safety information, and the rules that govern it.

Other initiatives include working with stakeholders around the world to not only raise awareness on the enhanced safety data and safety information protections, its disclosure and use, but also applying them in a practical sense.

SUPPORT EFFECTIVE TRAINING

Training and Licensing

The IATA Training and Licensing portfolio seeks to modernize and harmonize the training of current and future generations of pilots and maintenance technicians. It is a multi-faceted portfolio that seeks to develop guidance materials and best practices to support the implementation of Multi-Crew Pilot License (MPL) training, Evidence-Based Training (EBT), Pilot Aptitude Testing (PAT), Upset Prevention and Recovery Training (UPRT), Flight Crew Monitoring, Instructor Qualification (IQ), , and Engineering & Maintenance (E&M) training and qualification requirements.

Multi-Crew Pilot License (MPL) Training

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 competency-based training and assessment of airline pilots: Multi-Crew Pilot License (MPL) training.

MPL moves from task-based to competency-based training in a multi-crew setting from the initial stages of training. Crew Resource Management (CRM) and Threat and Error Management (TEM) skills are embedded throughout the training. The majority of incidents and accidents in civil aviation are still caused by human factors such as a lack of interpersonal skills (e.g. communication, leadership and teamwork), workload management, situational awareness, and structured decision making. MPL requires full-time embedded, as opposed to added-on, CRM and TEM training.

The second edition and cobranded IATA/IFALPA MPL Implementation Guide was published in 2015 to support airlines during their implementation process.

Evidence-Based Training

Evidence-Based Training (EBT) applies the principles of competency-based training for safe, effective and efficient airline operations while addressing relevant threats. ICAO has defined competency as the combination of Knowledge, Skills and Attitudes (KSAs) required to perform tasks to a prescribed standard under certain conditions.

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 will 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

Implementation of EBT enables airlines to develop more effective training programs while improving operational safety. In recognition of the importance of competent instructors in any training program, the EBT program provides specific additional guidance on the required competencies and qualifications for instructors delivering EBT.

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 avoid 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 training and operations performance success rates, a more positive working environment and reductions in labor turnover.

Upset Prevention and Recovery Training (UPRT)

Loss of Control In-Flight is one of the leading causes of fatalities in commercial aviation. This has led Industry to a revision of current training practices and the adoption of new regulations to address this phenomenon. The manual published by IATA 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 ATOs providing licensing training for their ab-initio cadets. It may be used for both, traditional and competency-based training schemes.

Flight Crew Monitoring

The need to address flight crew monitoring came 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 Threat and Error Management (TEM) model.

Flight Crew Competency Framework

IATA will be part of the ICAO Competency-based Training and Assessment Task Force (CBTA-TF), whose task will consist in developing an ICAO aeroplane pilot competency framework for all pilot licenses, type rating, instrument rating and recurrent training. This will imply a revision of provisions related to the MPL and to evidence-based training, including provisions in Annex 1 - Personnel Licensing, the PANS-TRG and Annex 6 Part 1; and the updating of related guidance materials including the Manual of Evidence-based Training (Doc 9995), the Manual on upset prevention and recovery training (Doc 10011); and a proposal to increase the FSTD credit for licensing in Annex 1. This work will be carried out from March 2017 to November 2020.

Instructor Qualification

Instructor Qualification (IQ) addresses the need to upgrade and harmonize instructors’ qualifications, from the selection, initial training and continuous instructor proficiency, including additional training requirements to conduct modern training such as EBT and competency-based training. IATA, supported by the Pilot Training Task Force, will provide the industry a new guidance and best practices covering Instructor Competencies.

Engineering and Maintenance Training and Qualification Requirements

The aim of the Engineering and Maintenance (E&M) training and qualification program is to identify, develop and evaluate the competencies required by commercial aircraft maintenance personnel to operate safely, effectively and efficiently. This is accomplished by managing the most relevant risks, threats and errors, based on evidence.

E&M 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 key factors to the success of E&M.

IDENTIFY AND ADDRESS EMERGING/ EVOLVING SAFETY ISSUES

Techniques to improve aviation safety have moved beyond the analysis of isolated accidents to data-driven analyses of trends throughout the air transport value chain.

This approach is supported by IATA’s Global Aviation Data Management (GADM) program. GADM is an ISO-certified (9001: 2015) master database that supports a proactive data-driven approach for advanced trend analysis and predictive risk mitigation.

Pulling from a multitude of sources, GADM is the most comprehensive airline operational database available. These sources include the IATA accident database, the Safety Trend Evaluation Analysis and Data Exchange System (STEADES), IOSA and ISAGO audit findings, Flight Data eXchange (FDX), the Ground Damage Database (GDDB) and operational reports, among others.

In 2013, the IATA Safety Group launched the Hazard Identification Task Force (HITF) to develop and implement a process for emerging and new hazard identification for the industry that builds on airline hazard registries, industry expertise and an open forum such as the Issue Review Meeting (IRM), as well as analysis from IATA’s GADM program.

The Hazard Identification Process (HIP) allows IATA to be systematic and holistic when identifying hazards. The process provides the promise that there is a “closed loop”, permitting action, follow up and on-going monitoring of hazards. It aligns with SMS methodology used by the airlines and elsewhere in the aviation industry. IATA will use this process to validate that high-priority hazards facing the aviation industry are addressed effectively.

That being said, the HIP has limitations to be aware of:

- The process will only work when all parties are engaged.
- In some instances, IATA cannot directly address a hazard, but can only raise awareness and/or lobby other organizations for change. In this way, the HIP will help to focus the IATA Safety Initiatives, rather than aim to capture all existing hazards.
- The process is not meant to substitute for an individual airline’s SMS activity. Therefore, the data produced in the Hazard Registry will not necessarily reflect an accurate risk position for all operators.
- Some hazards may be regionally biased while others will have a more generic application.
- Hazards might affect stakeholders differently. It remains the responsibility of the affected organization to mitigate the hazard and to monitor its level of risk. For this reason, risk ratings are not included in the Hazard Registry.

The HITF will take a phased approach to implementing the HIP, initially starting with identifying hazards through the IRM and inputting these to the IATA Hazard Registry. Once this first stage is completed, the HITF will broaden its scope to include hazards from other sources.

With GADM and through the HITF and Hazard Registry, the IATA Safety Department is able to provide the industry with comprehensive, cross-database analysis to identify emerging trends and flag risks to be mitigated through safety programs. IATA's safety experts investigate these new areas of focus and develop preventative programs. Some of the evolving issues the IATA Safety Department is working on are:

- Lithium Batteries
- Irresponsible use of Unmanned Aircraft Systems (UAS)
- Conflict Zones
- Cyber Security

Lithium Batteries

There have been a number of developments with the carriage of lithium batteries in the last year.

Several guidance documents have been released by IATA SFO Safety and IATA Cargo. These include:

- The Lithium Battery Toolkit
- The IATA Safety Risk Assessment (SRA) on the carriage of lithium batteries
- Guidance Document – Battery Powered Cargo Tracking Devices / Data Loggers
- Guidance Document for the 58th (2017) Edition of the IATA Dangerous Goods Regulations
- Personal Transportation Devices Guidance
  - To complement the guidance material provided by Cargo/ Dangerous Goods, designed to help operators formulate a policy on the carriage of personal transportation devices in the cabin (where permitted)
- Electronic Cigarettes in the Cabin
  - To update to the previously issued document with the US DoT change in banning the use of electronic cigarettes on board

In addition to this, IATA Cargo and IATA Safety have drafted a joint document outlining the potential safety risks concerned with new types of baggage. These new innovations, commonly known as "smart luggage" include integrated lithium batteries, motors, power banks, GPS, GSM, Bluetooth, RFID or Wi-Fi technology, which can contravene various regulatory and/or company requirements. This guidance document is pending release at the time of writing.

2017/ 2018 Action Plan and Next Steps:

SAE G-27 Committee – Development of Packaging Performance Standard
The work of the SAE-27 Committee, established to develop a performance standard for lithium batteries, continues to progress. The draft standard will be finalized at a meeting scheduled for 3 – 5 May 2017 in Cologne.

Due to various approval processes, it is likely that the standard will not be available until at least Q3 2017. Once the standard is available, the ICAO Dangerous Goods Panel (DGP) will consider what processes need to be put in place to ensure appropriate identification and traceability of the approved packages.

The ICAO DGP will also consider if the G-27 packaging standard is sufficient to recommend the lifting of the prohibition on the carriage of lithium batteries as cargo on passenger aircraft.

ICAO Flight Operations Panel Cargo Safety Sub Group (CSSG)
In October 2016, based on discussions at the ICAO Flight Operations Panel (FLTOPSP), it was agreed to establish a Cargo Safety Sub-Group (CSSG), comprised of members of the FLTOPSP, the Airworthiness Panel (AIRP) and the DGP. The CSSG was created to address ICAO Air Navigation Commission concerns with the statement:

"Risks posed by the transport of cargo by air may not be sufficiently mitigated because of inadequate information provided to operators necessary for conducting effective risk assessments and a lack of guidance on conducting them." The stated objective for the CSSG is to develop guidance material on conducting safety risk assessments on carriage of cargo, including the carriage of dangerous goods. This is to be completed by Q4 2017.

Irresponsible use of Unmanned Aircraft Systems (UAS)

Unmanned Aircraft Systems (UAS) represent a hazard to civil aviation as they are operating near aerodromes and are used by people unfamiliar with the safety risks, or have little awareness of civil aviation and its regulation. Currently circa 93 States have regulations in place. To help address this issue ICAO has developed an on-line toolkit to help authorities understand the risks associated with small unmanned vehicles and the requirement for appropriate regulation. IATA was part of a small advisory group who developed the toolkit which is now being promoted around the world.

Linked to the above, ICAO issued a State letter on March 2017 emphasizing State responsibilities to protect civil aircraft from "pilotless" aircraft. States attention is drawn to the Chicago Convention's Article 8, which clearly obliges States to ensure that all pilotless aircraft obviate danger to civil aircraft, and Annex 2 that mandates States to ensure that aircraft are not operated in a negligent or reckless manner.

In addition to the safety video, a second IATA video has been produced identifying the need for effective regulation to enable the safe operation of smaller unmanned aircraft. UPS and Airbus participated.

The ICAO Concept of Operations (CONOPS) for International Remotely Piloted Aircraft Systems (RPAS) - RPAS are larger unmanned vehicles requiring certification for international operations in the established controlled airspace structure - has been developed. The key assumption of the CONOPS is that the flight operation of RPAS does not impede or impair other airspace users, service providers (air traffic management /aerodromes) or the safety of third parties on the ground.

Conflict Zones

Risks to civil aviation arising from conflict zones remains a challenge for the industry. Several regions continue to experience militarized hostilities that take place in close and often adjacent proximity to civil operations. States are responsible for the collection and dissemination of protective security intelligence. They must share this information with air operators in a timely manner to effectively support the validity of risk management systems.

IATA fully endorses an amendment currently before the ICAO AVSEC Panel, requiring states to establish relevant information in support of operators' risk assessments. Risk assessment remains an integral component of the Security Management Systems (SeMS), despite members enduring difficultly in accessing relevant security information.

In January 2017, ICAO conducted an industry survey concerning the usefulness of its web-based conflict zone repository. Initial results indicated dramatic improvement was required in order for it to provide a more efficient means of disseminating critical information in a timely manner. IATA continues its research with the objective of proposing different effective security information sharing solutions which could be used by members. Outcomes are tracked by the Security Working Group and will be presented during AVSEC World (Abu Dhabi, November 2017).

Cyber Security

IATA has identified three areas involving the term "Cyber Security" which in itself is in need of definition and clarity when concerning aviation. IATA is still in its Genesis when tackling this expanding and ever-present issue involving, especially but not specifically, next generation e-enabled and connected aircraft (A350, A380, 787, 737 MAX, CS100, CS300 and Embraer E-Jets E2 etc.).

Cyber Security recognizes hazards and concerns that define a menace to enterprise by means of an electronic (and/or digital) medium. In this case, actions of cyber security expertise ensure the enterprise manages perils both internal and external to the company's overall operation.

IATA has distinguished two new terms, one of which is "Aviation Cyber" defined as the potential risk of damage to an aircraft before or after flight during ground time or a given maintenance phase. Given the maintenance arena can be characterized as "electronic" (tech log and e-signatures etc.) and aircraft are serviced at a multitude of different stations globally the importance of this dynamic is fundamental to the overall framework.

The second term identified is "Cyber Threat and Risk" focused on the aircraft that correlates to "Safety of Flight" whereby risk and threat are assessed during flight from take-off until landing.

IATA needs to ensure that all the actors within the civil aviation landscape follow a prescribed engagement identified as a holistic approach. Firstly, there will need to be engagement with OEM's to reinforce (for example) the Aircraft Control Domain (ACD) to mitigate a cyber threat and/or risk, without creating an added burden or bureaucracy for airlines – some examples, but not limited to this scope:

- Update Service
- Technical and/or organizational restrictions
- Collaborative decision making for requirements
- Financing costs to upgrade security in LRU's

The bullets noted above are a matter of aircraft design, in some cases "smart design" is not always necessary. IATA could and should help airlines identify threats and/or risks via the seams concerning systems interfaces from application to application and from platform to platform. Some low hanging fruit that could fuel IATA's next step out of the Genesis phase include:

- List of airline controlled activities which may be used as an attack vector (Cyber Security, Aviation Cyber and Cyber Threat and Risk to Aircraft Correlating to Safety of Flight)
- Sharing of best practices
- Create an aviation cyber forum to foster exchange of information, ideas and practices, and to increase knowledge and subject awareness
- Audit service

1

IATA Annual Safety Report

Safety is aviation's highest priority. Seventy 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 on behalf of 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 53rd year of publication. This is the definitive yearbook to understand and track commercial aviation's safety performance, challenges and opportunities. This comprehensive document includes accident data and analyses, as well as mitigation strategies.

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

Image courtesy of Boeing

INTRODUCTION TO THE IATA SAFETY REPORT 2016

The IATA Safety Report has been IATA's flagship safety document since 1964. It provides the industry with critical information derived from the analysis of aviation accidents to understand safety risks in the industry and propose mitigation strategies.

The 2016 Report was produced at the beginning of 2017 and presents the trends and statistics based on the knowledge of industry at the time. This report is made available to the industry for free distribution.

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, some assumptions must be made. It is important for the reader to understand these assumptions when working with the results of this report:

- Accidents analyzed and the categories and contributing factors assigned to those accidents are based on the best available information at the time of classification
- 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 an increased precision in the accident rate.

ACCIDENT CLASSIFICATION TASK FORCE

The IATA Operations Committee (OPC) and its Safety Group (SG) created the Accident Classification Task Force (ACTF) in order to analyze accidents, identity contributing factors, determine trends and areas of concern relating to operational safety and develop prevention strategies. The results of the work of the ACTF are incorporated in the annual IATA Safety Report.

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

The ACTF 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 Ascend FlightGlobal and the accident investigation boards of the states where the accidents occurred. Once assembled, the ACTF validates each accident report using their expertise to develop an accurate assessment of the events.

ACTF 2016 members:

Mr. Marcel Comeau
AIR CANADA

Mr. Xavier Barriola
AIRBUS

Capt. Denis Landry
AIR LINE PILOTS ASSOCIATION (ALPA)

Dr. Dieter Reisinger (Chairman)
AUSTRIAN AIRLINES

Mrs. Tatyana Morozova
AIR ASTANA

Mr. Ivan Carvalho
AZUL LINHAS AEREAS

Mrs. Marion Chaudet
ATR

Capt. Robert Aaron Jr.
THE BOEING COMPANY

Mr. Richard Mayfield
THE BOEING COMPANY

Mr. David Fisher
BOMBARDIER AEROSPACE

Mr. Luis Savio dos Santos
EMBRAER

Mr. Peter Hunt
IATA

Mr. Bruno Ochin (Secretary)
IATA

Mr. Robert Holliday
IATA

Mr. Michael Henry
ICAO

Capt. Arnaud Du Bédat
IFALPA

Peter Kaumanns
VEREINIGUNG COCKPIT
(German Air Lines Pilot Association)

Capt. Takahisa Otsuka
JAPAN AIRLINES

Mr. Martin Plumleigh
JEPPESEN

Capt. Peter Krupa
LUFTHANSA GERMAN AIRLINES

Capt. Ayedh Almotairy
SAUDI ARABIAN AIRLINES

Mr. Steve Hough (Vice-chairman)
SAS

Capt. João Romão
TAP AIR PORTUGAL

2

Decade in Review

AIRCRAFT ACCIDENTS AND FATALITIES

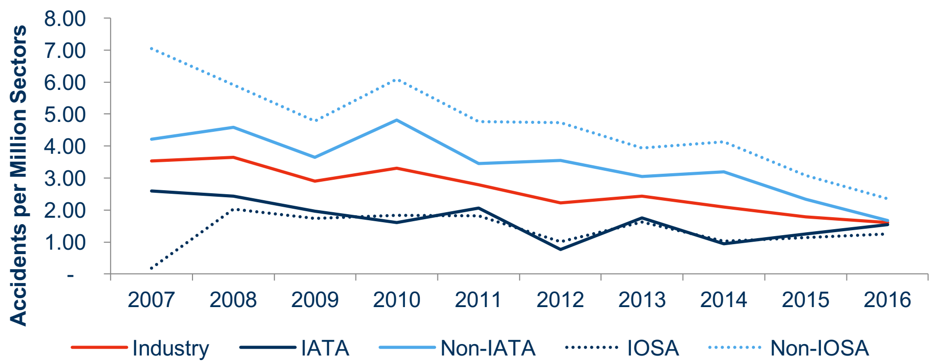
This section presents yearly accident rates for the past 10 years for each of the following accident metrics: all accidents, fatality risk, fatal accidents and hull losses, as well as general statistics on the number of fatalities and accident costs.

Image courtesy of Embraer

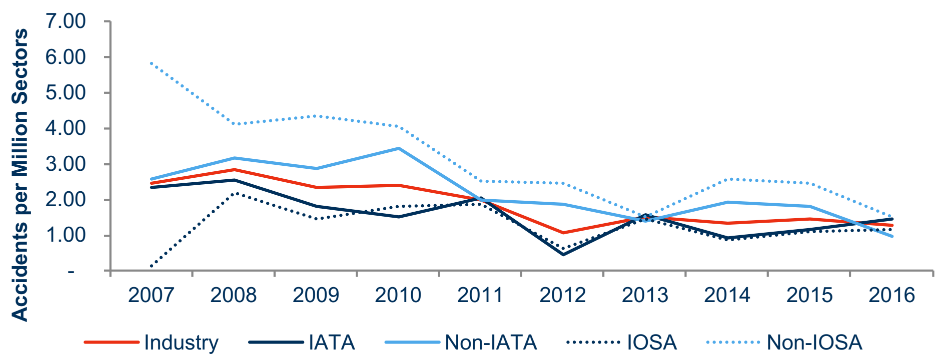
ALL ACCIDENTS

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

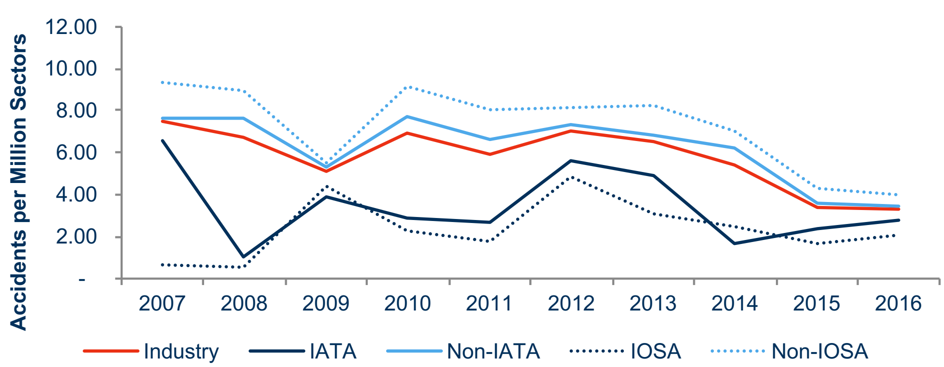
Jet & Turboprop Aircraft



Jet Aircraft



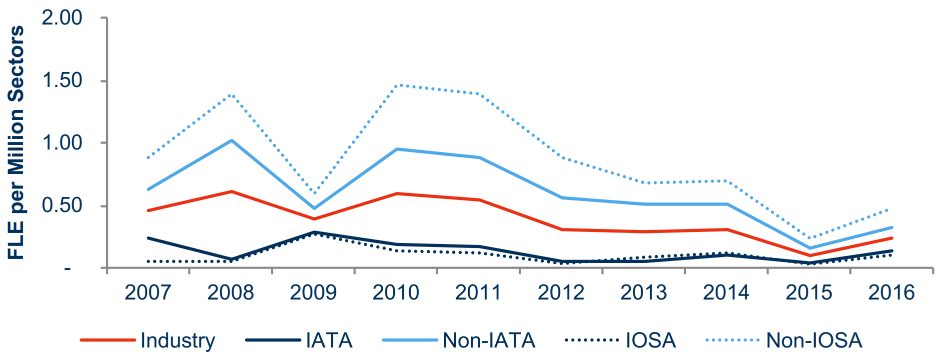
Turboprop Aircraft



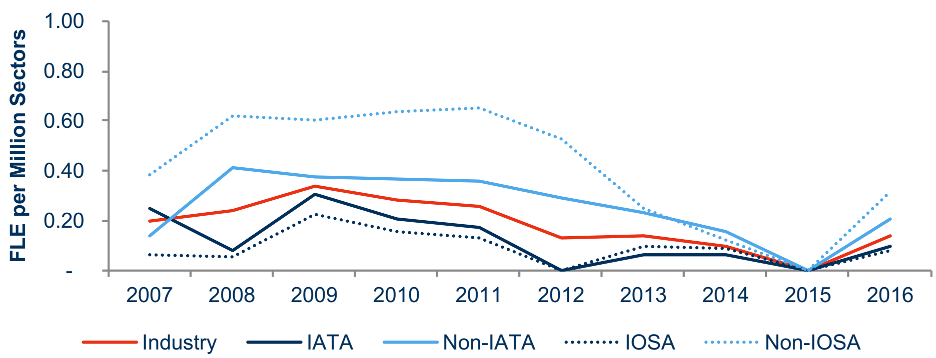
FATALITY RISK

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

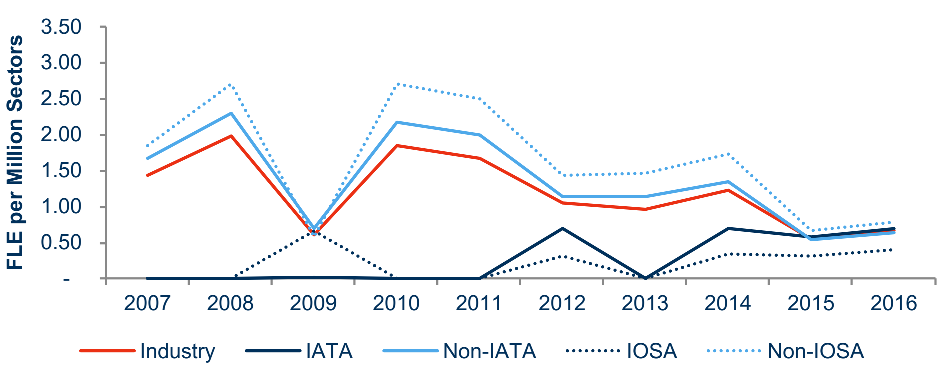
Jet & Turboprop Aircraft



Jet Aircraft



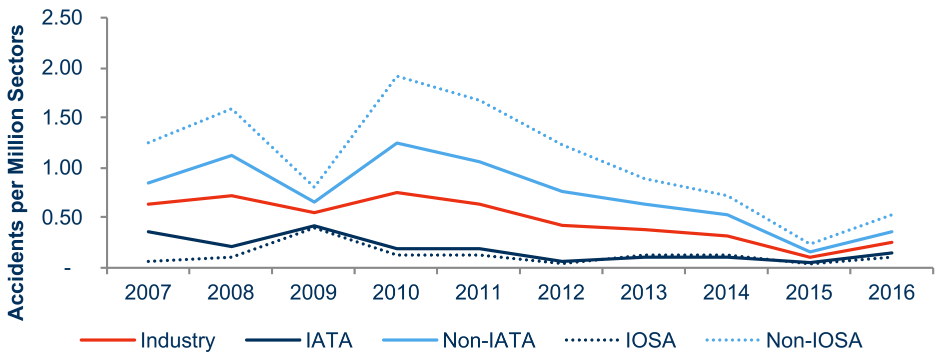
Turboprop Aircraft



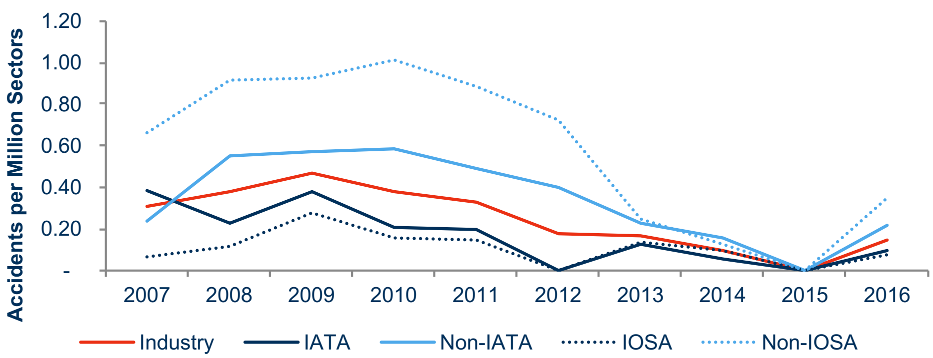
FATAL ACCIDENTS

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

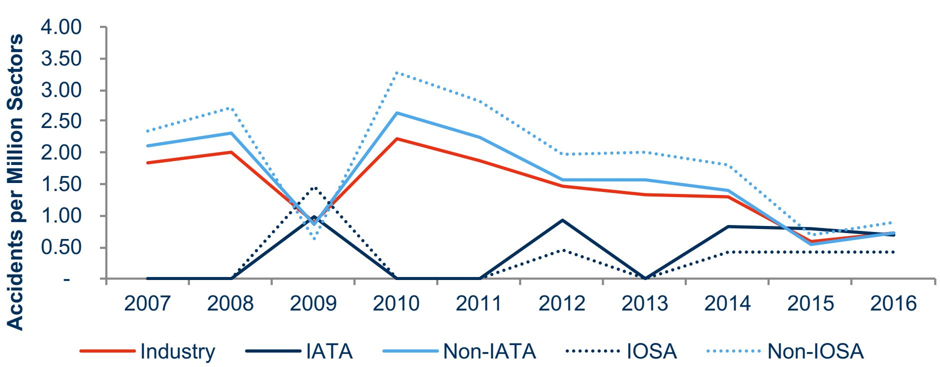
Jet & Turboprop Aircraft



Jet Aircraft



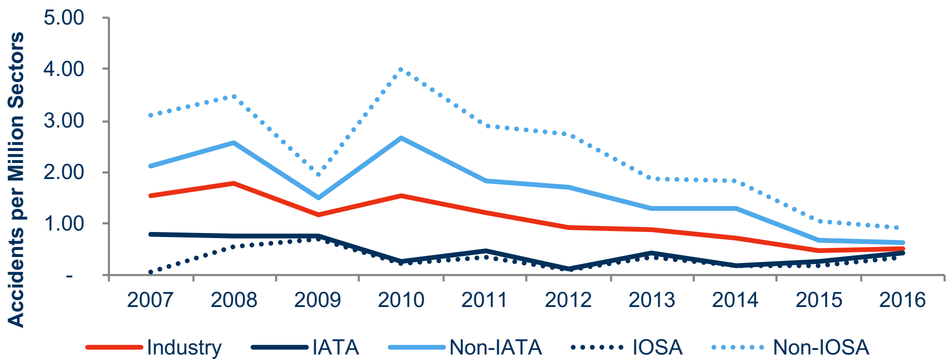
Turboprop Aircraft



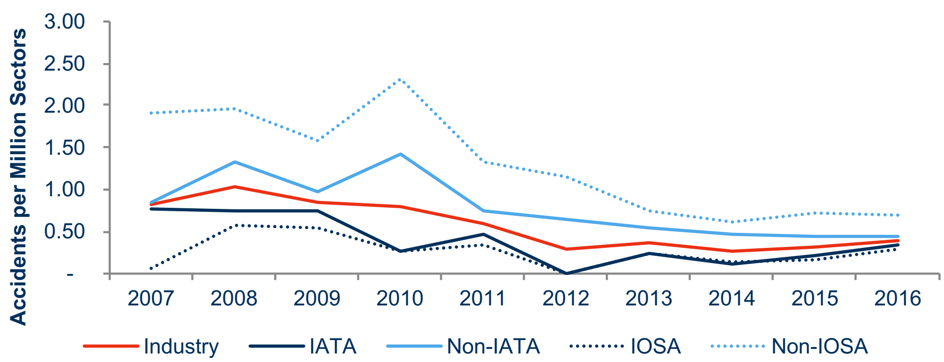
HULL LOSSES

'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.

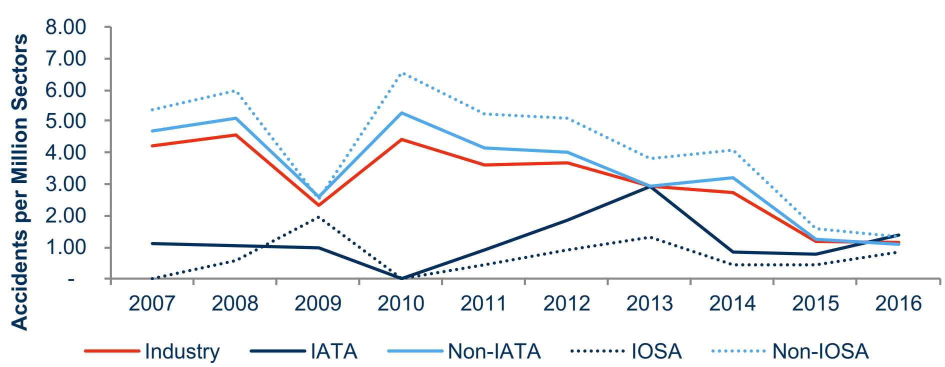
Jet & Turboprop Aircraft



Jet Aircraft



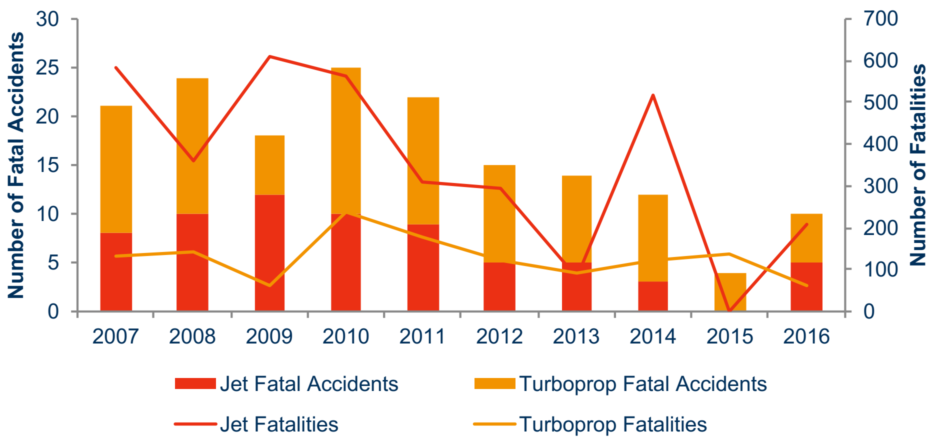
Turboprop Aircraft



FATALITIES

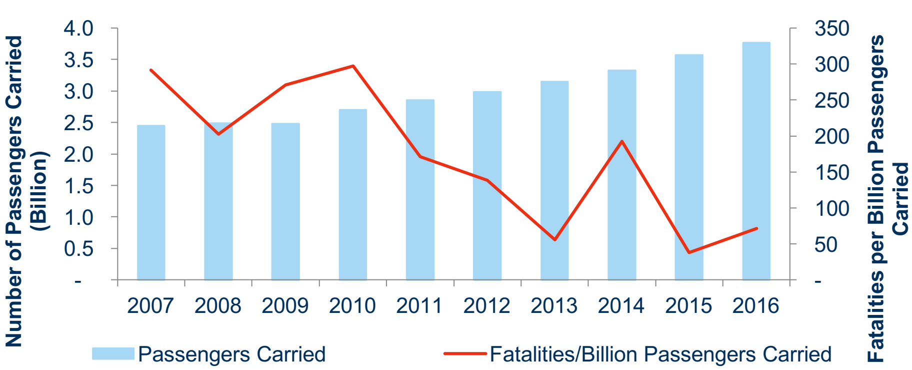
The graph below shows the total number of fatalities (line and vertical right axis) and the number of fatal accidents (stacked bar and vertical left axis) split between aircraft propulsion. The reader needs to be aware of the fact that the data is not being normalized by the aircraft flight count, therefore 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 passengers carried over the years as well as a ratio metric related to the number of fatalities by the number of passengers carried on a specific year.

Number of Passengers Carried and Fatalities 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

2016 in Review

COMMERCIAL AIRLINES OVERVIEW

FLEET SIZE, HOURS AND SECTORS FLOWN

	Jet	Turboprop	Total
World Fleet	25,280	5,587	30,867
Sector Landings (Millions)	33.8	7.0	40.8

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

CARGO OPERATING FLEET BY YEAR-END

	Jet	Turboprop
Percentage of Operating Fleet in All-Cargo Use	7.5%	19.4%

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

REGIONAL BREAKDOWN

	AFI	ASPAC	CIS	EUR	LATAM/CAR	MENA	NAM	NASIA
Jet - Sector Landings (Millions)	0.66	5.24	1.26	7.39	2.52	1.61	9.64	5.19
Turboprop - Sector Landings (Millions)	0.64	1.60	0.30	1.43	0.70	0.12	2.01	0.16

AIRCRAFT ACCIDENTS

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

NUMBER OF ACCIDENTS

	Jet	Turboprop	Total
Total	42	23	65
Hull-Losses	13	8	21
Substantial Damage	29	15	44
Fatal	5	5	10
Full-Loss Equivalents	4.8	4.5	9.3
Fatalities*	206	62	268
For fatalities of people not on board the aircraft	*1*	*0*	*1*

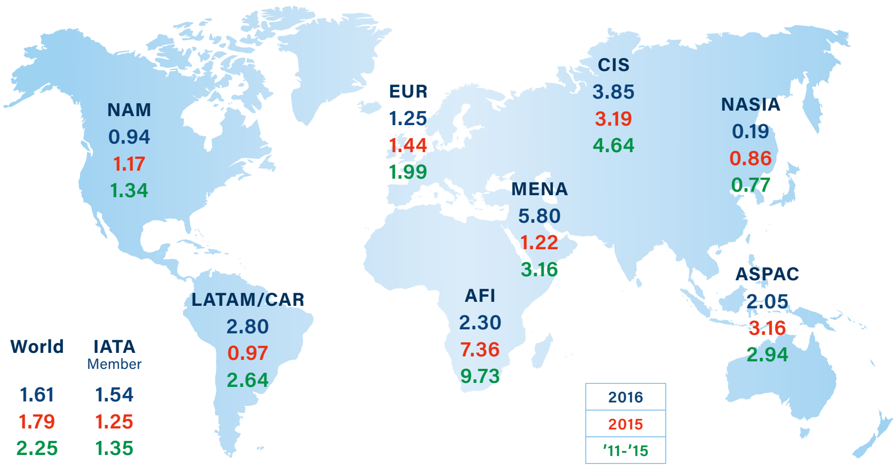
**People on board only*

ACCIDENTS PER OPERATOR REGION

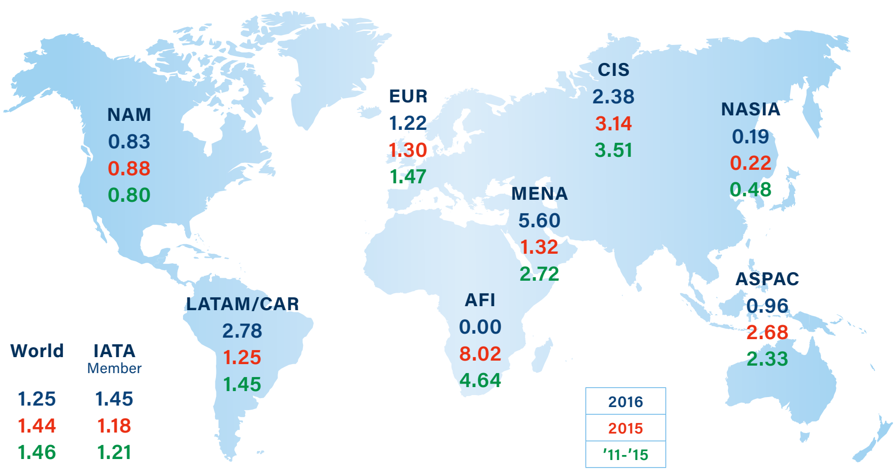
	AFI	ASPAC	CIS	EUR	LATAM/CAR	MENA	NAM	NASIA
Total	3	14	6	11	9	10	11	1
Hull-Losses	1	5	3	2	2	4	4	0
Substantial Damage	2	9	3	9	7	6	7	1
Fatal	0	3	1	1	2	2	1	0
Full-Loss Equivalents	0.0	2.8	0.8	1.0	1.8	2.0	1.0	0.0
Fatalities	0	54	7	2	76	128	1	0

ALL ACCIDENTS

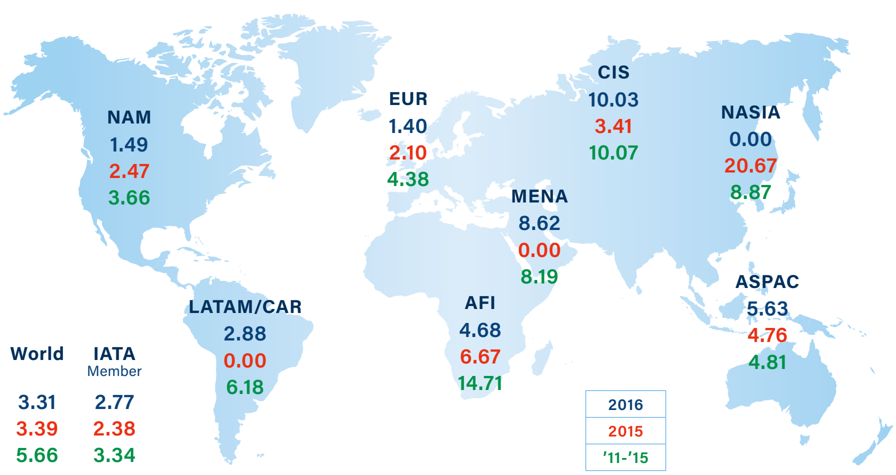
Jet & Turboprop Aircraft



Jet Aircraft

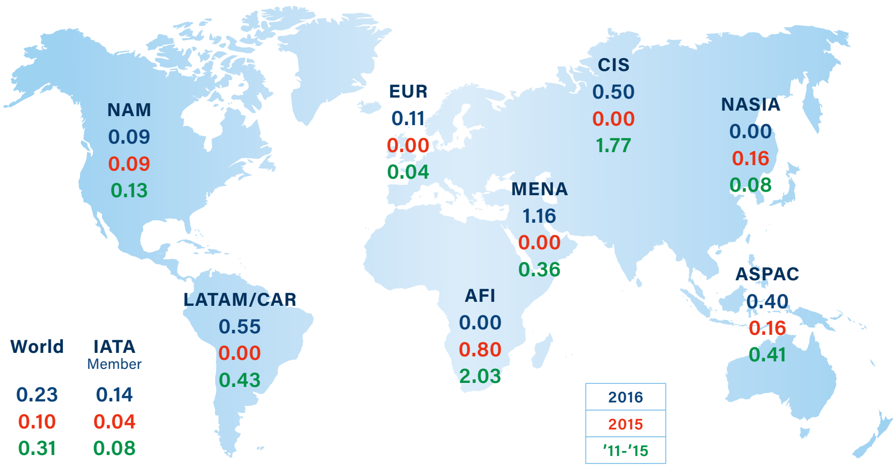


Turboprop Aircraft

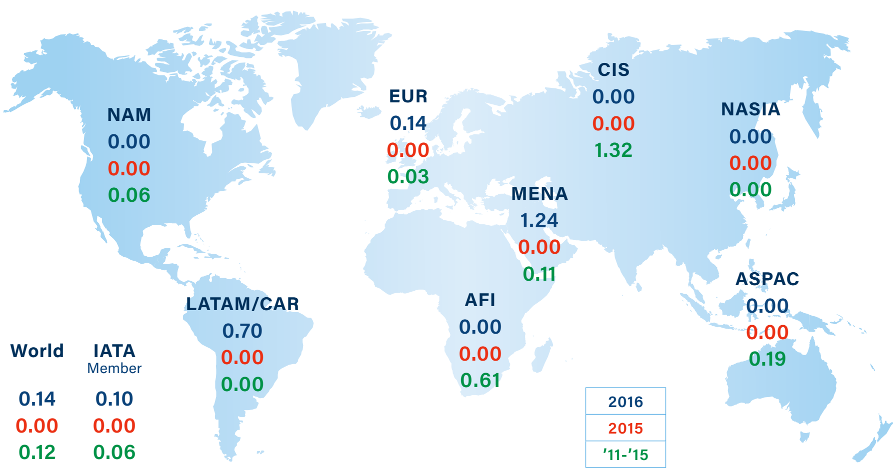


FATALITY RISK

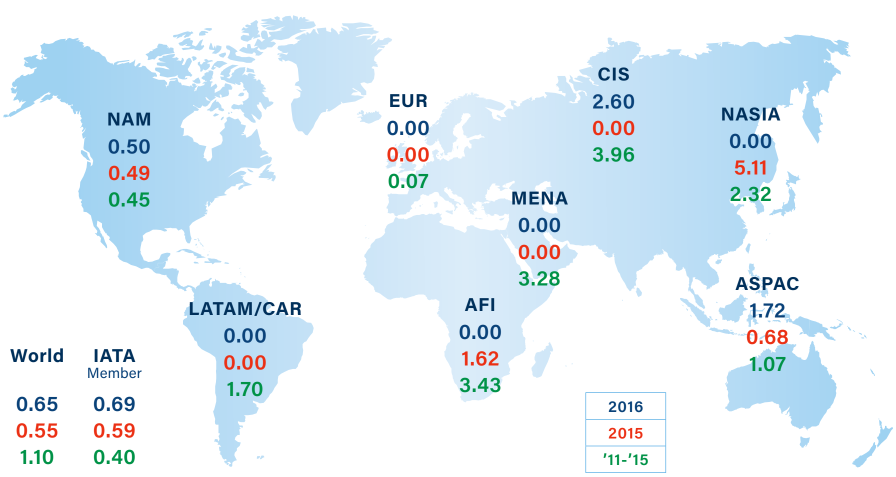
Jet & Turboprop Aircraft



Jet Aircraft

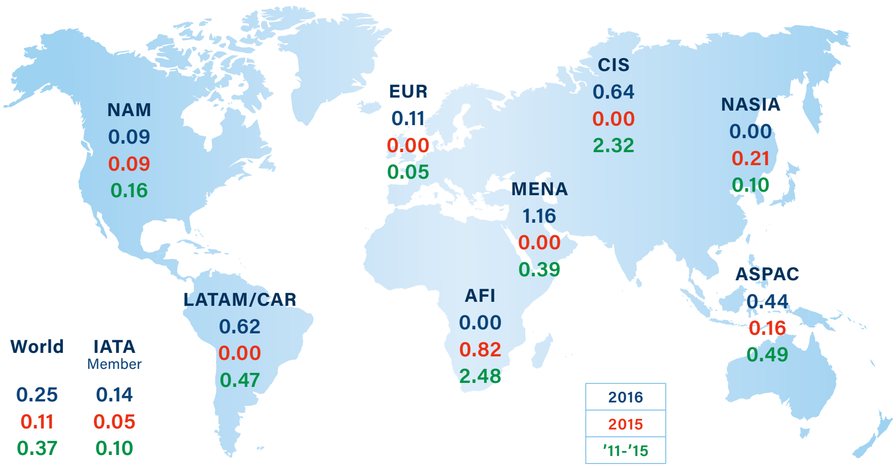


Turboprop Aircraft

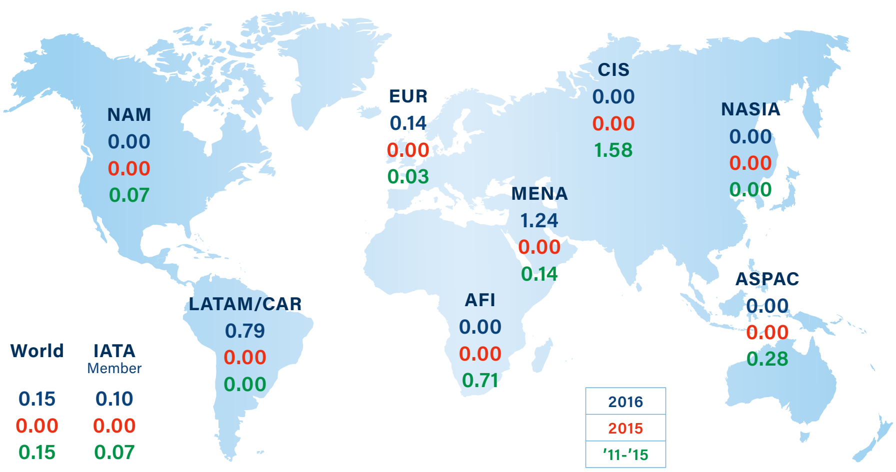


FATAL ACCIDENTS

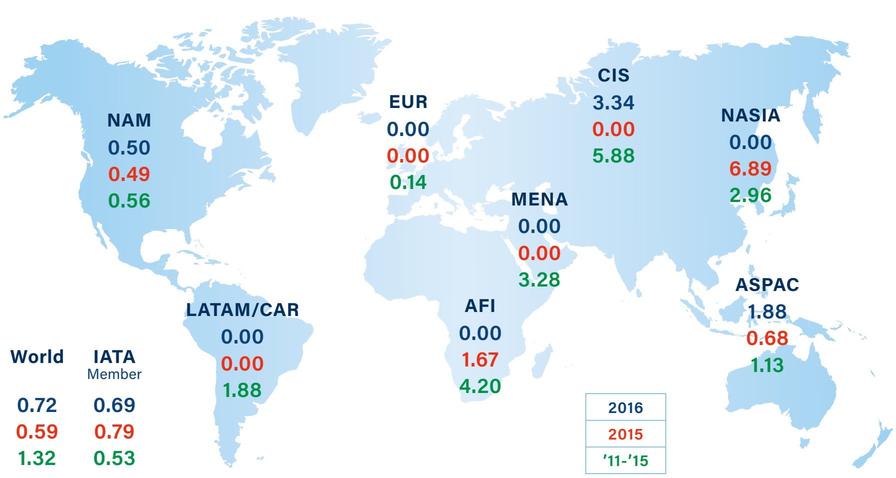
Jet & Turboprop Aircraft



Jet Aircraft

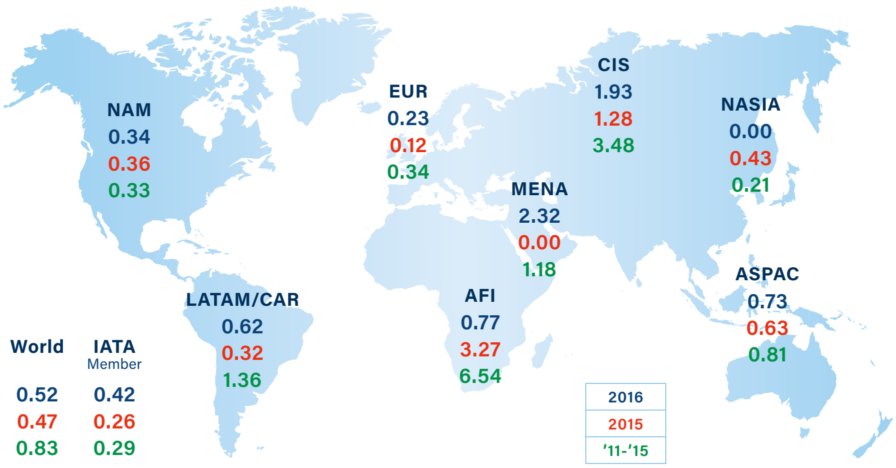


Turboprop Aircraft

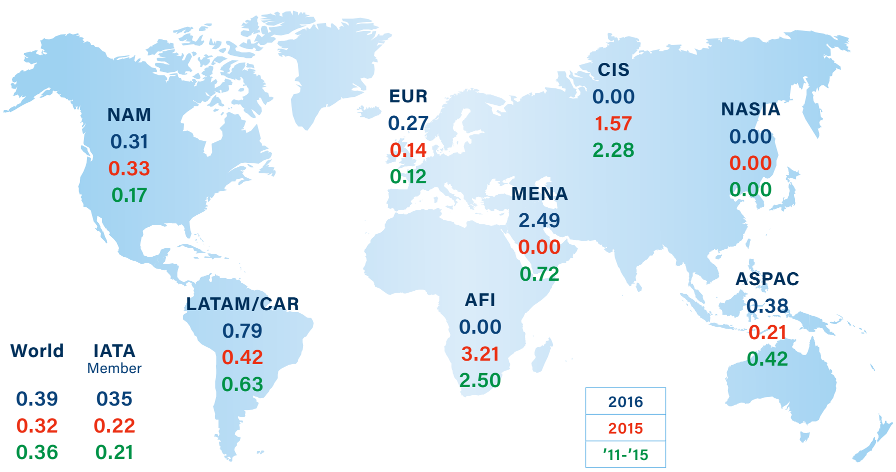


HULL LOSSES

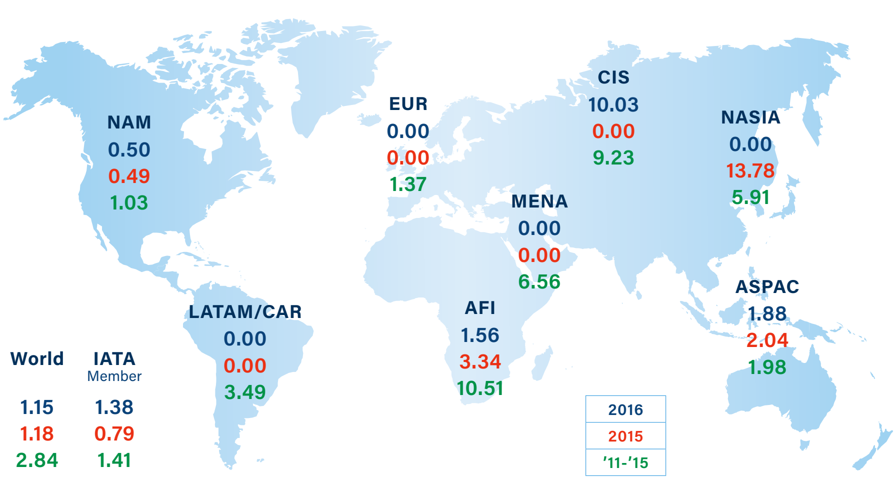
Jet & Turboprop Aircraft



Jet Aircraft



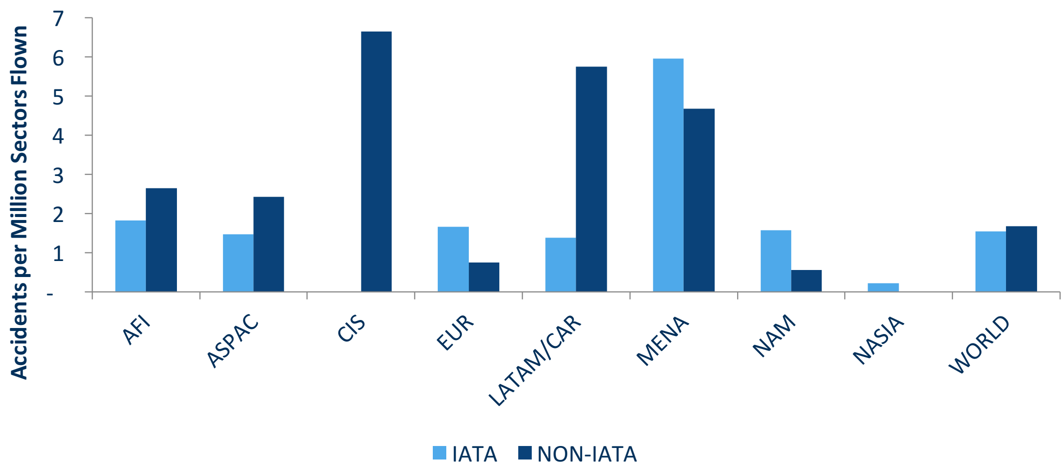
Turboprop Aircraft



IATA Member Airlines vs. Non-Members – Total Accident Rate by Region

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

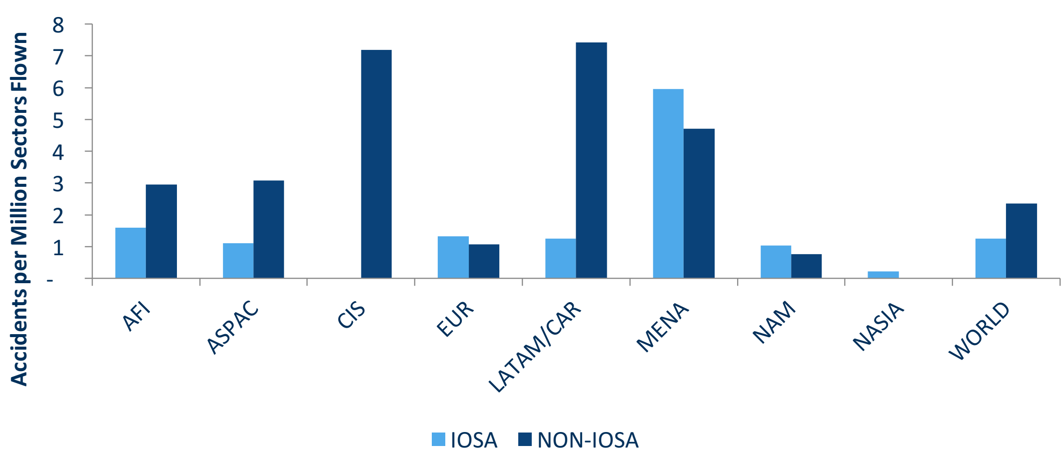
2016 Accident Rate: IATA Member Airlines vs. Non-Members



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 region and globally. IOSA-registered airlines outperformed non-registered ones in the AFI, ASPAC, CIS and LATAM/CAR regions. The non-IOSA-registered airline accident rate was two times higher than for IOSA-registered airlines in 2016.

2016 Accident Rate: IOSA-Registered vs. non-Registered



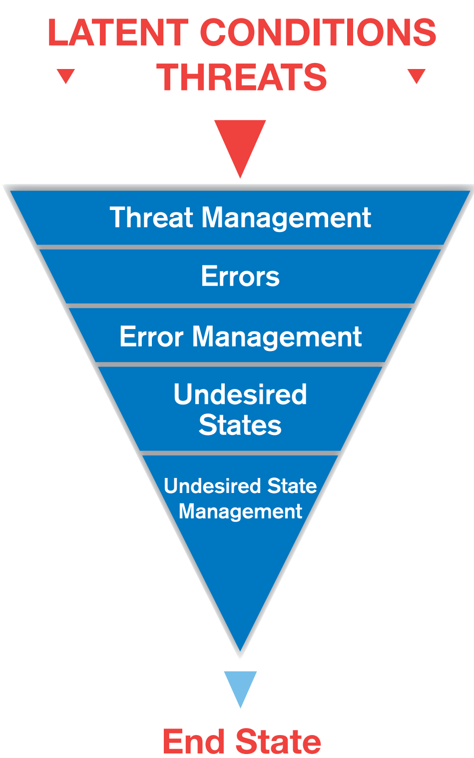
4

In-Depth Accident Analysis 2012 to 2016

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 threat/error management. An undesired aircraft state 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 unstable approach is recoverable. This is a UAS. A runway excursion is unrecoverable. Therefore, this is an End State.

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. Hence, there is a need for operators and states to improve their reporting cultures.

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 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 ACTF 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 overarching issues within an organization or a particular country, or involve performance of front-line personnel, such as pilots or ground personnel.

Countermeasures are aimed at two levels:

- The first is aimed at the operator or state responsible for oversight: these countermeasures are based on activities, processes or systemic issues internal to the airline operation or state's oversight activities.
- The other is aimed at the flight crews, to help them manage threats or their own errors while on the line.

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

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

ANALYSIS BY ACCIDENT CATEGORY AND REGION

This section presents an in-depth analysis of 2011 to 2016 occurrences by accident category

Definitions of these categories can be found in Annex 2

Referring to these accident categories helps an operator to:

Structure safety activities and set priorities

Avoid "forgetting" 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

2016 Aircraft Accidents – Accident Count

Number of accidents: 65
Number of fatalities: 268

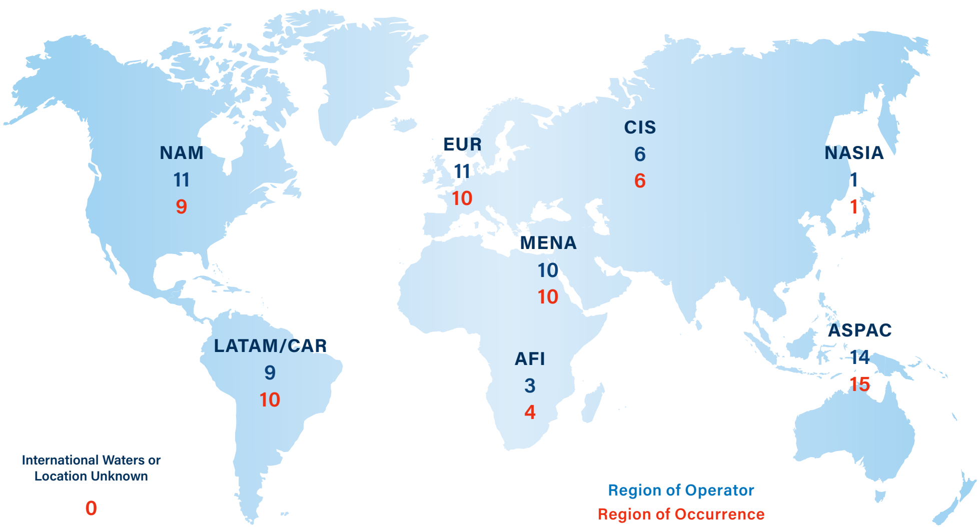
Accident Count % from Total	2016
IATA Member	51%
Full-Loss Equivalents	14%
Fatal	15%
Hull Losses	32%

Passenger	Cargo	Ferry	Jet	Turboprop
75%	23%	2%	65%	35%

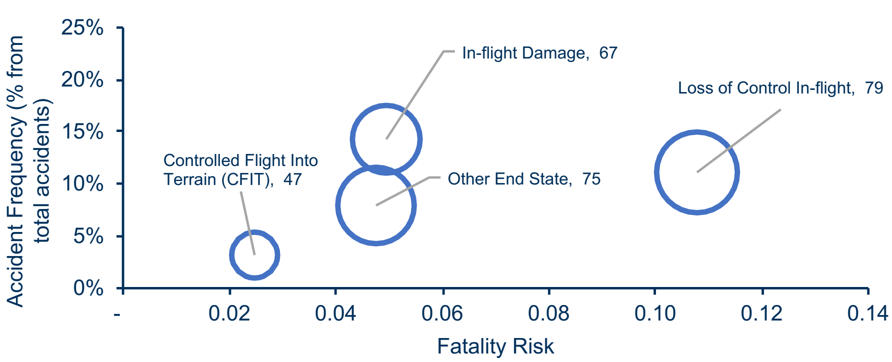
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2016)

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



Accident Category Frequency and Fatality Risk (2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Safety Management:
39%

Threats

Aircraft Malfunction:
44%

Flight Crew Errors

Manual Handling / Flight Controls:
37%

Undesired aircraft state

Long / floated/bounced /firm / off-center/crabbed land:
22%

Countermeasure

Overall Crew Performance:
22%

➤ See detailed view

2016 Aircraft Accidents – Accident Rate*

Accident rate*: 1.61

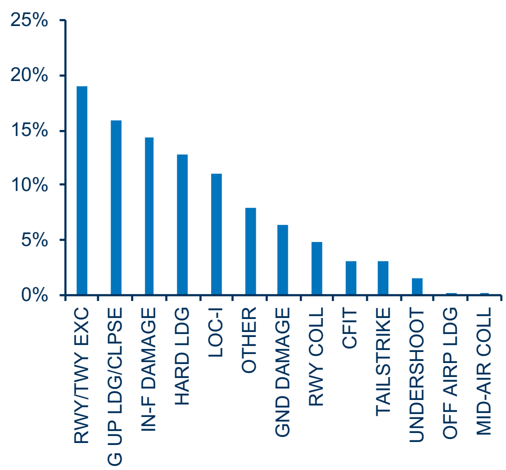
Accident Rate*	2016
IATA Member	1.54
Fatality Risk**	0.23
Fatal	0.25
Hull Losses	0.52

Jet	Turboprop	
1.25	3.31	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 (2016)

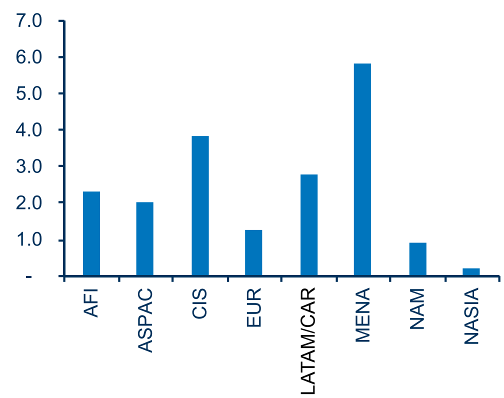
Distribution of accidents as percentage of total



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

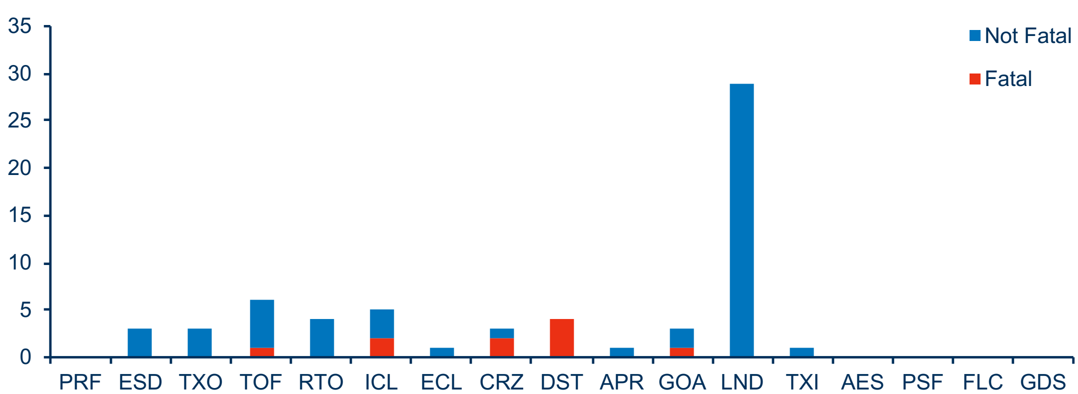
Regional Accident Rate (2016)

Accidents per Million Sectors



Accidents per Phase of Flight (2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



2012-2016 Aircraft Accidents – Accident Count

Number of accidents: 375
Number of fatalities: 1634

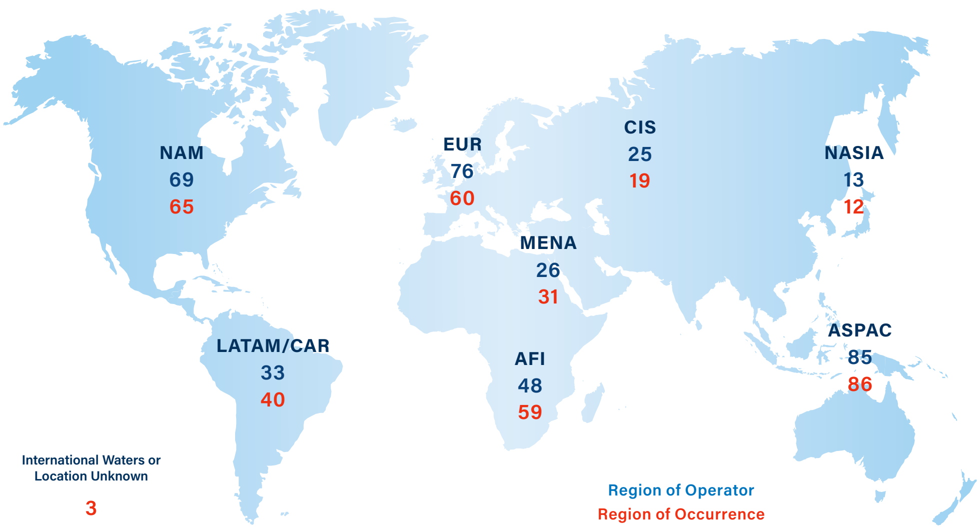
Accident Count % from Total	2012-2016
IATA Member	31%
Full-Loss Equivalents	12%
Fatal	15%
Hull Losses	35%

Passenger	Cargo	Ferry	Jet	Turboprop
76%	21%	3%	53%	47%

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

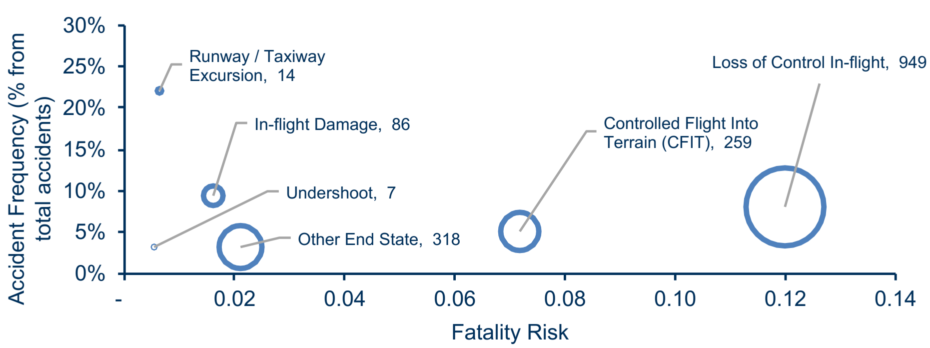
Number of Accidents per Region (2012-2016)

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

Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
31%

Threats

Meteorology:
31%

Flight Crew Errors

Manual Handling / Flight Controls:
33%

Undesired aircraft state

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

Countermeasure

Overall Crew Performance:
22%

➤ See detailed view

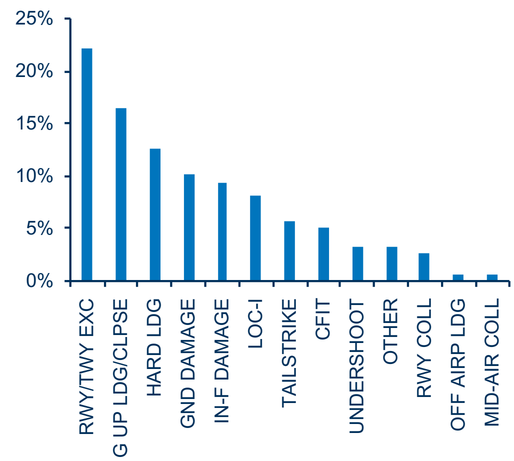
2012-2016 Aircraft Accidents – Accident Rate*

Accident rate*: 2.01		Accident Rate*	2012-2016
		IATA Member	1.26
		Fatality Risk**	0.25
		Fatal	0.30
		Hull Losses	0.70
Jet	Turboprop		
1.31	5.12	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 (2012-2016)

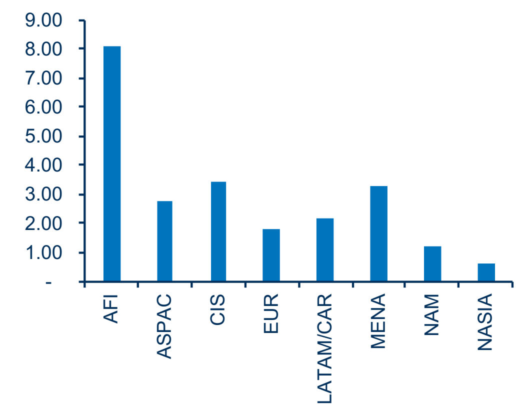
Distribution of accidents as percentage of total



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

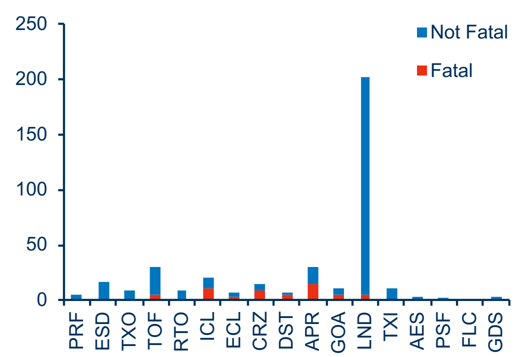
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



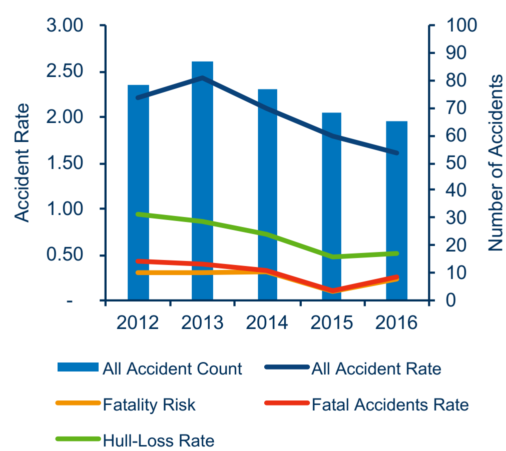
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



2012-2016 Fatal Aircraft Accidents – Accident Count

Number of accidents: 55
Number of fatalities: 1634

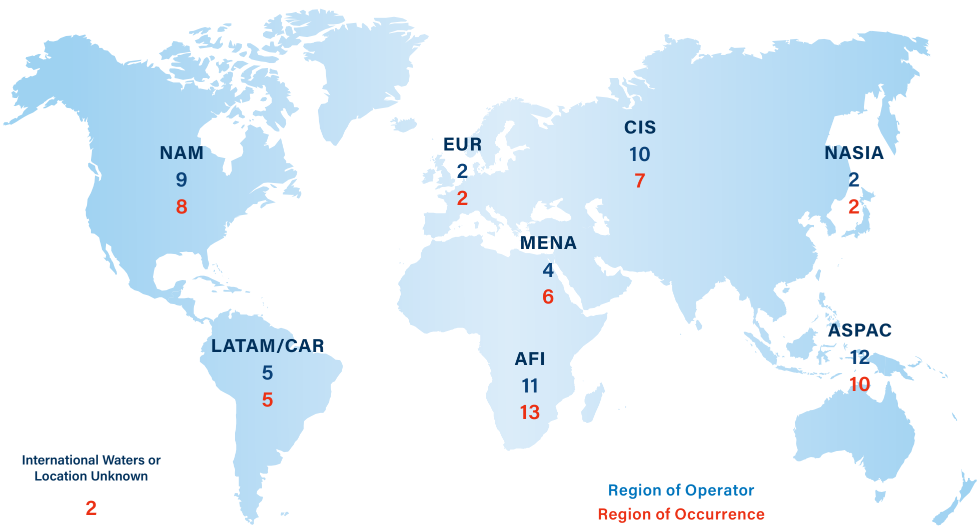
Accident Count % from Total	2012-2016
IATA Member	16%
Full-Loss Equivalents	83%
Fatal	100%
Hull Losses	100%

Passenger	Cargo	Ferry	Jet	Turboprop
53%	44%	4%	33%	67%

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

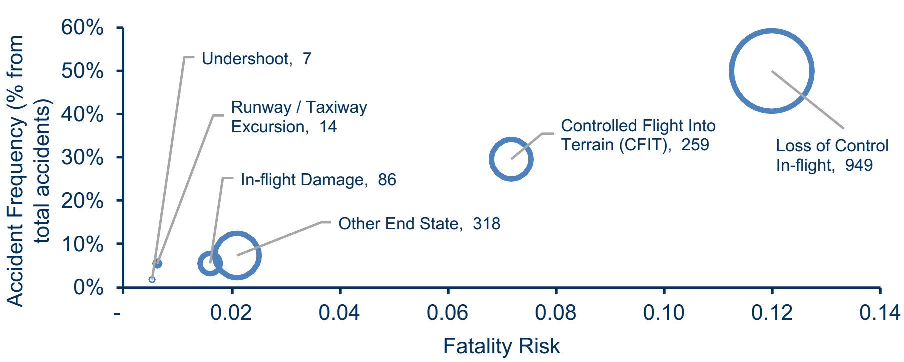
Number of Accidents per Region (2012-2016)

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



Note: B777 (MH370). Location: unknown
B1900, presumingly crashed near Sao Tome and Principe. wreckage not known to have been found

Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
46%

Threats

Meteorology:
43%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
46%

Undesired aircraft state

Vertical / Lateral / Speed Deviation
34%

Countermeasure

Overall Crew Performance:
37%

➤ See detailed view

2012-2016 Fatal Aircraft Accidents – Accident Rate*

Accident rate*: 0.30

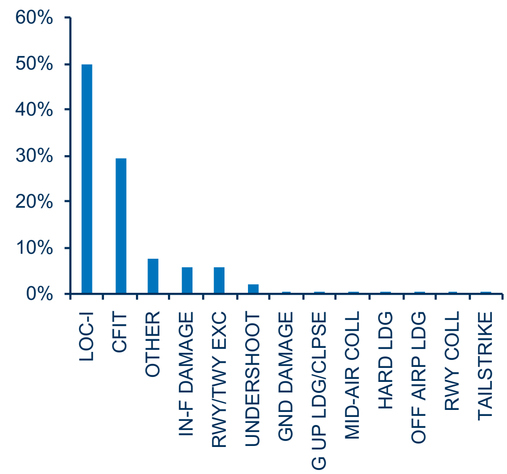
Accident Rate*	2012-2016
IATA Member	0.10
Fatality Risk**	0.25
Fatal	0.30
Hull Losses	0.30

Jet	Turboprop	
0.12	1.08	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 (2012-2016)

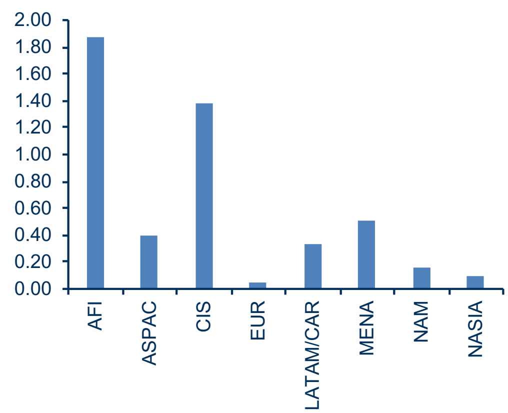
Distribution of accidents as percentage of total



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

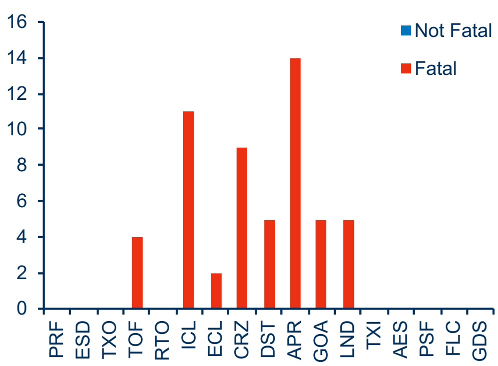
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



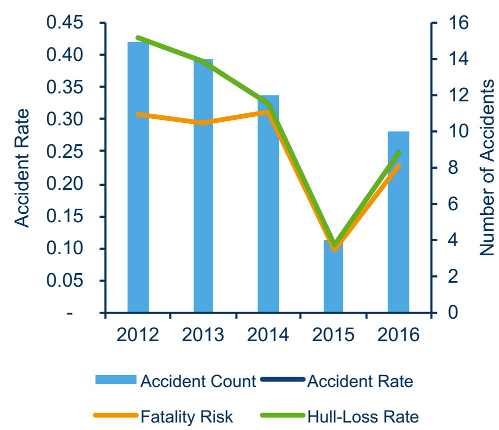
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



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

2012-2016 Non-Fatal Aircraft Accidents – Accident Count

Number of accidents: 320
Number of fatalities: 0

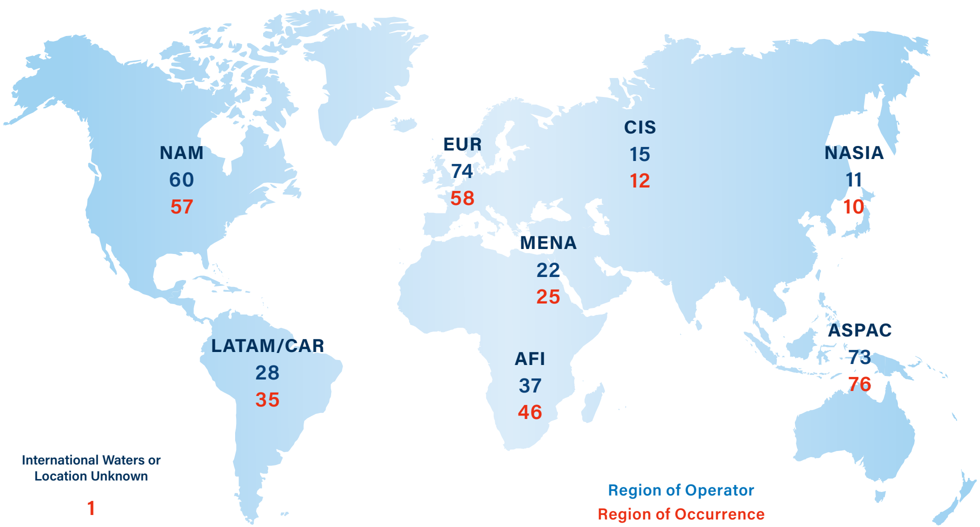
Accident Count % from Total	2012-2016
IATA Member	34%
Full-Loss Equivalents	0%
Fatal	0%
Hull Losses	23%

Passenger	Cargo	Ferry	Jet	Turboprop
80%	17%	3%	57%	43%

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

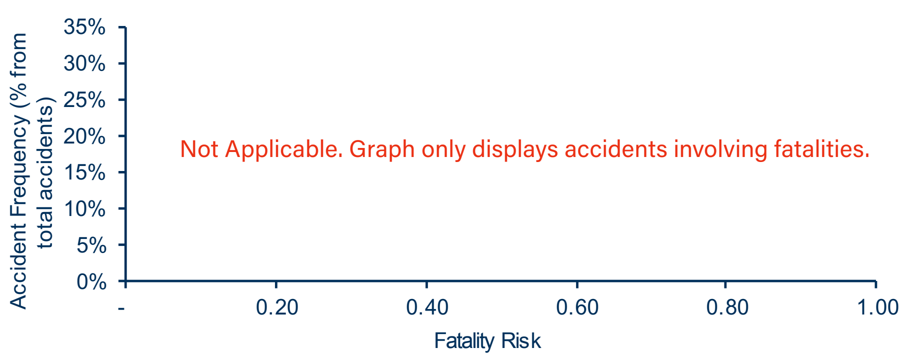
Number of Accidents per Region (2012-2016)

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 (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
29%

Threats

Meteorology:
29%

Flight Crew Errors

Manual Handling / Flight Controls:
34%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land
26%

Countermeasure

Overall Crew Performance:
20%

➤ See detailed view

2012-2016 Non-Fatal Aircraft Accidents – Accident Rate*

Accident rate*: 1.72

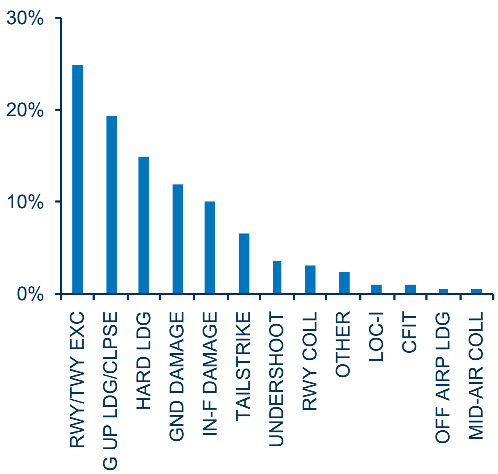
Accident Rate*	2012-2016
IATA Member	1.17
Fatality Risk**	0.00
Fatal	0.00
Hull Losses	0.40

Jet	Turboprop	
1.20	4.04	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 (2012-2016)

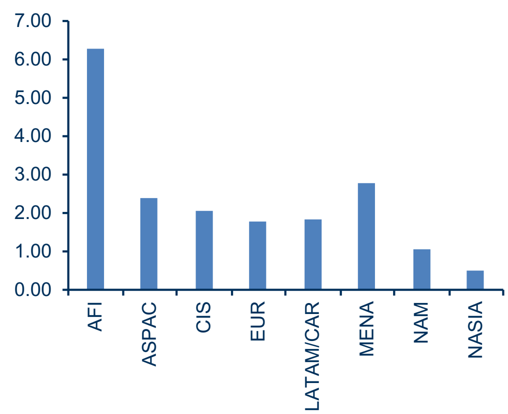
Distribution of accidents as percentage of total



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

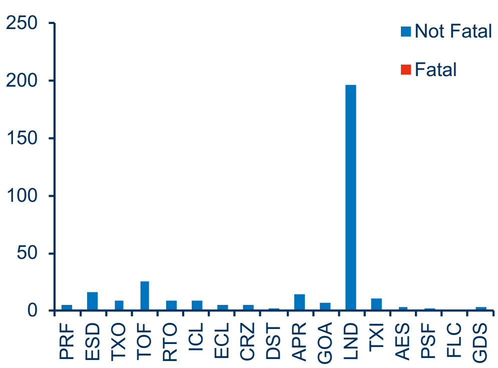
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



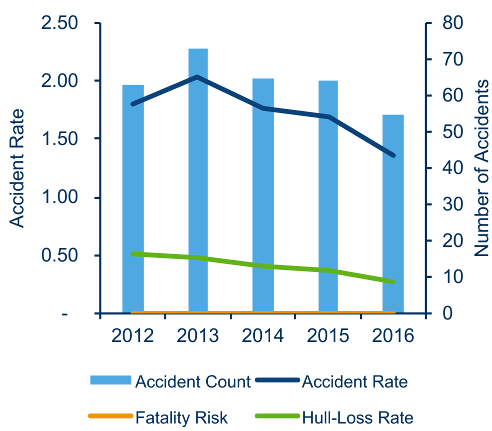
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



2012-2016 IOSA Aircraft Accidents – Accident Count

Number of accidents: 150
Number of fatalities: 707

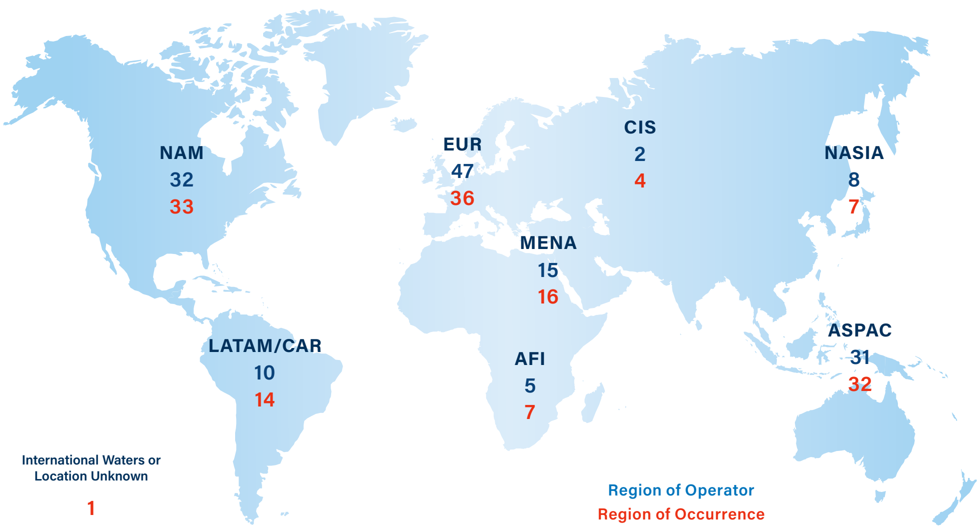
Accident Count % from Total	2012-2016
IATA Member	77%
Full-Loss Equivalents	6%
Fatal	7%
Hull Losses	19%

Passenger	Cargo	Ferry	Jet	Turboprop
90%	7%	2%	78%	22%

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

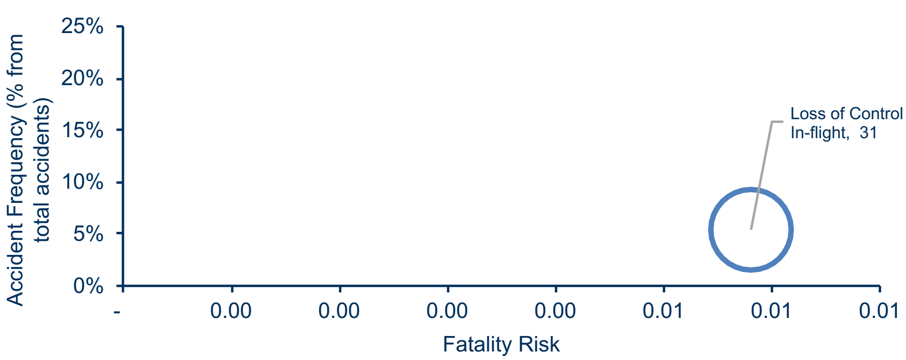
Number of Accidents per Region (2012-2016)

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



Note: B777 (MH370). Location: unknown

Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
21%

Threats

Meteorology:
27%

Flight Crew Errors

Manual Handling / Flight Controls:
32%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land
21%

Countermeasure

Overall Crew Performance:
21%

➤ See detailed view

2012-2016 IOSA Aircraft Accidents – Accident Rate*

Accident rate*: 1.21

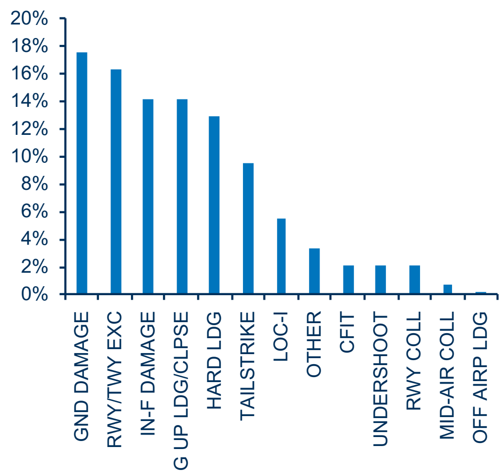
Accident Rate*	2012-2016
IATA Member	1.24
Fatality Risk**	0.07
Fatal	0.09
Hull Losses	0.23

Jet	Turboprop	
1.04	2.80	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 (2012-2016)

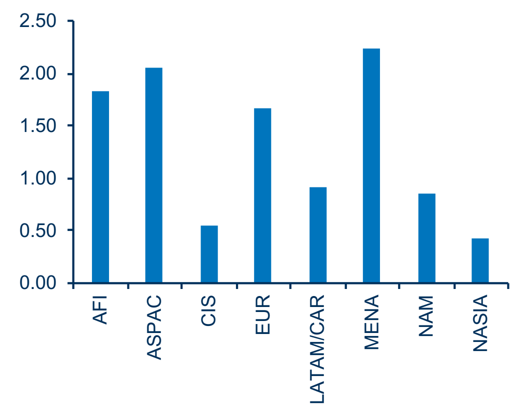
Distribution of accidents as percentage of total



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

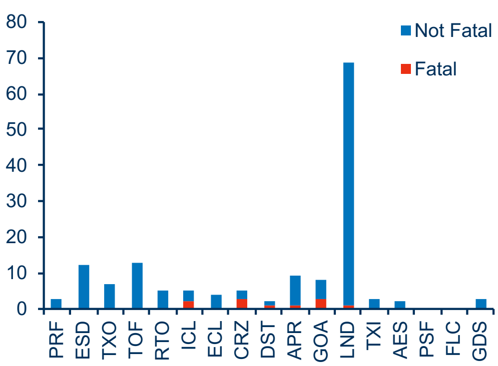
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



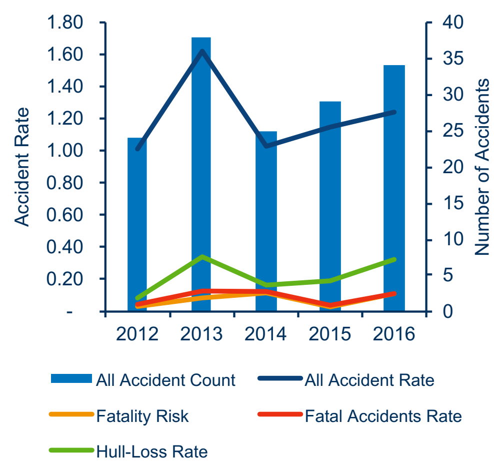
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



2012-2016 Non-IOSA Aircraft Accidents – Accident Count

Number of accidents: 225
Number of fatalities: 927

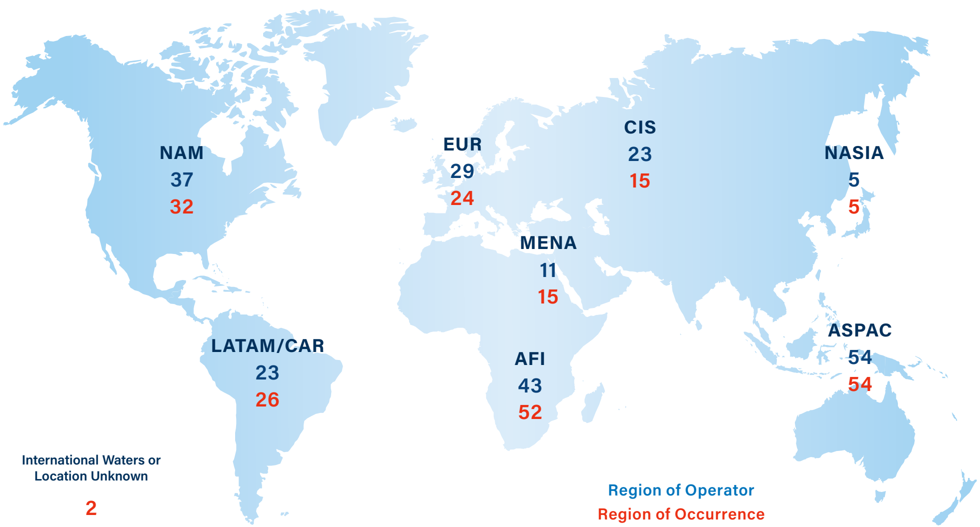
Accident Count % from Total	2012-2016
IATA Member	0%
Full-Loss Equivalents	16%
Fatal	20%
Hull Losses	45%

Passenger	Cargo	Ferry	Jet	Turboprop
67%	30%	3%	37%	63%

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

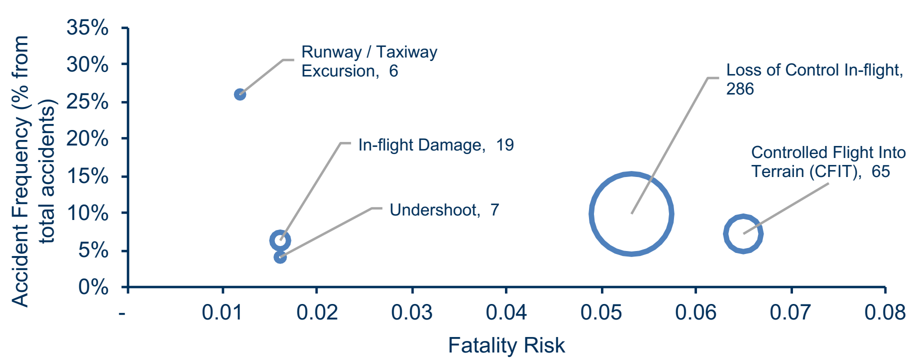
Number of Accidents per Region (2012-2016)

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)
B1900, presumingly crashed near Sao Tome and Principe. wreckage not known to have been found

Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
39%

Threats

Meteorology:
34%

Flight Crew Errors

Manual Handling / Flight Controls:
34%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land
26%

Countermeasure

Overall Crew Performance:
23%

➤ See detailed view

2012-2016 Non-IOSA Aircraft Accidents – Accident Rate*

Accident rate*: 3.62

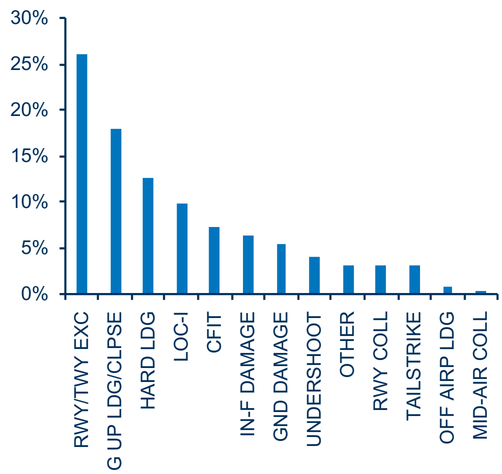
Accident Rate*	2012-2016
IATA Member	-
Fatality Risk**	0.59
Fatal	0.71
Hull Losses	1.64

Jet	Turboprop	
2.08	6.35	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 (2012-2016)

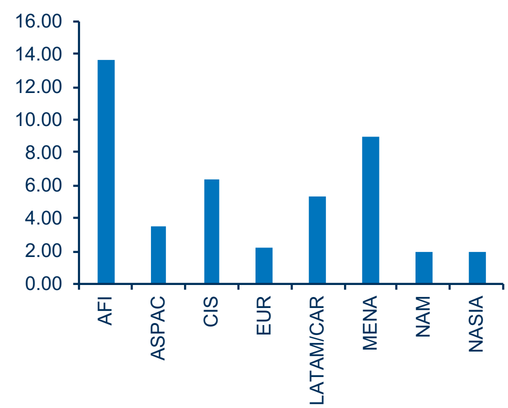
Distribution of accidents as percentage of total



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

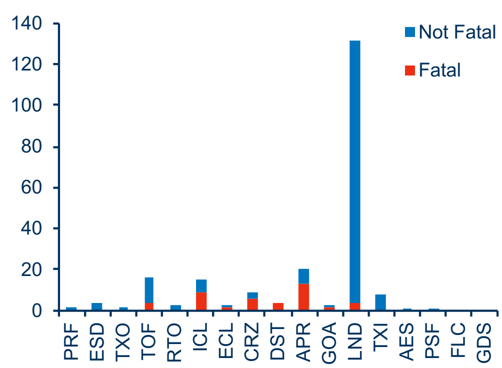
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



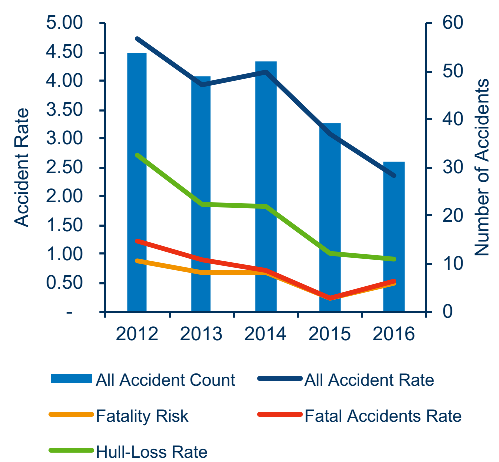
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Controlled Flight into Terrain – Accident Count

2016	Number of accidents: 2	Number of fatalities: 47
2012-2016	Number of accidents: 19	Number of fatalities: 259

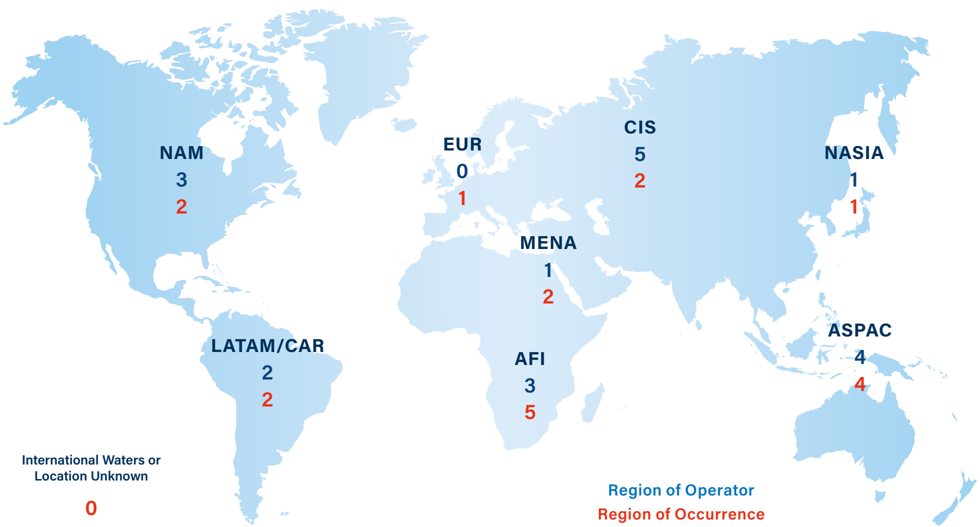
Accident Count % from Total	2016	'12-'16
IATA Member	50%	16%
Full-Loss Equivalents	50%	70%
Fatal	50%	84%
Hull Losses	50%	95%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	100%	0%	0%	0%	100%
2012-2016	47%	47%	5%	16%	84%

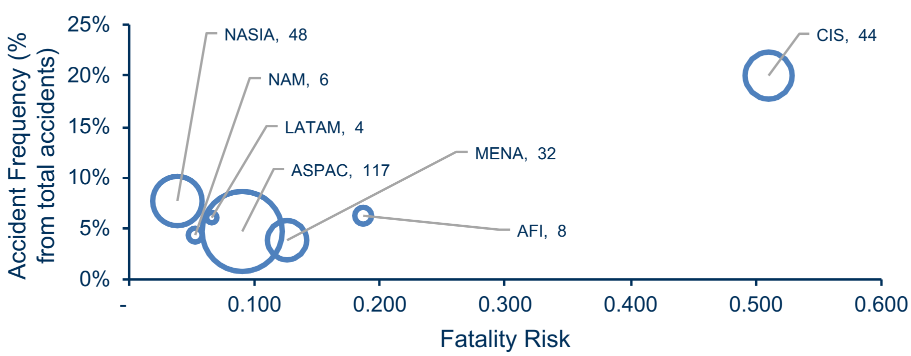
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
82%

Threats

Nav Aids:
64%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
64%

Undesired aircraft state

Vertical / Lateral / Speed deviation:
55%

Countermeasure

Overall Crew Performance:
55%

➤ See detailed view

Controlled Flight into Terrain – Accident Rate*

2016 Accident rate: 0.05
2012-2016 Accident rate: 0.10

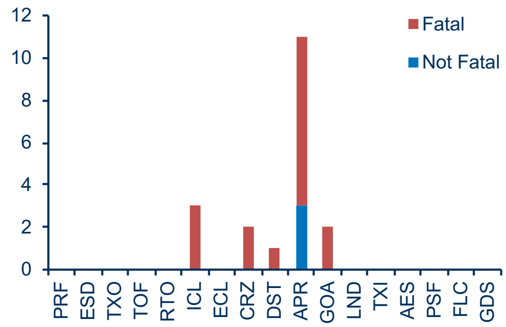
Accident Rate*	2016	'12-'16
IATA Member	0.05	0.03
Fatality Risk**	0.02	0.07
Fatal	0.02	0.09
Hull Losses	0.02	0.10

	Jet	Turboprop	
2016	0.00	0.29	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	0.02	0.47	

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

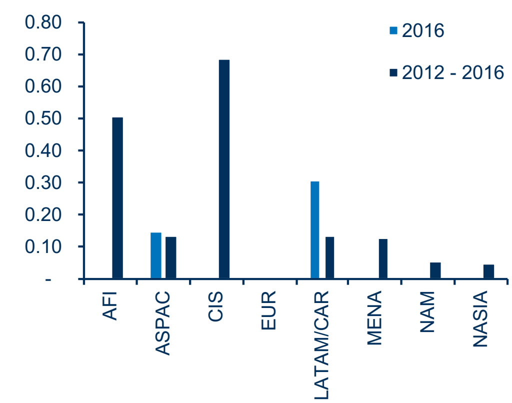
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



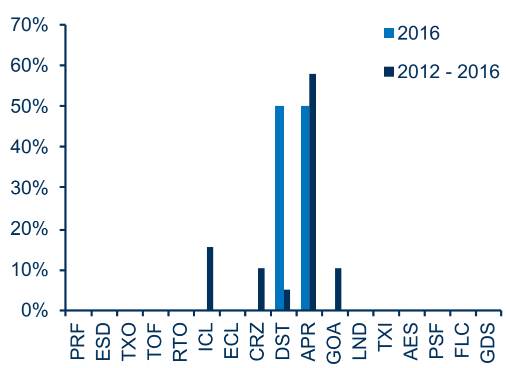
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



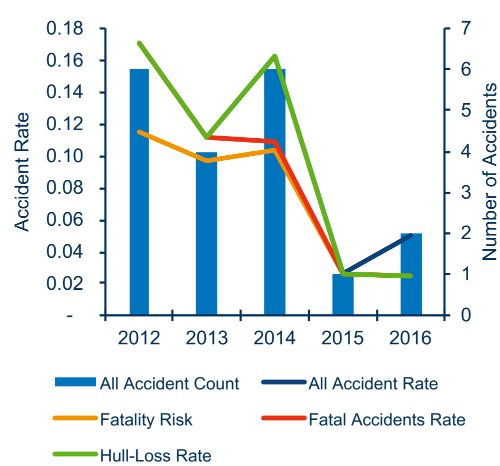
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Loss of Control In-flight – Accident Count

2016	Number of accidents: 7	Number of fatalities: 79
2012-2016	Number of accidents:30	Number of fatalities: 949

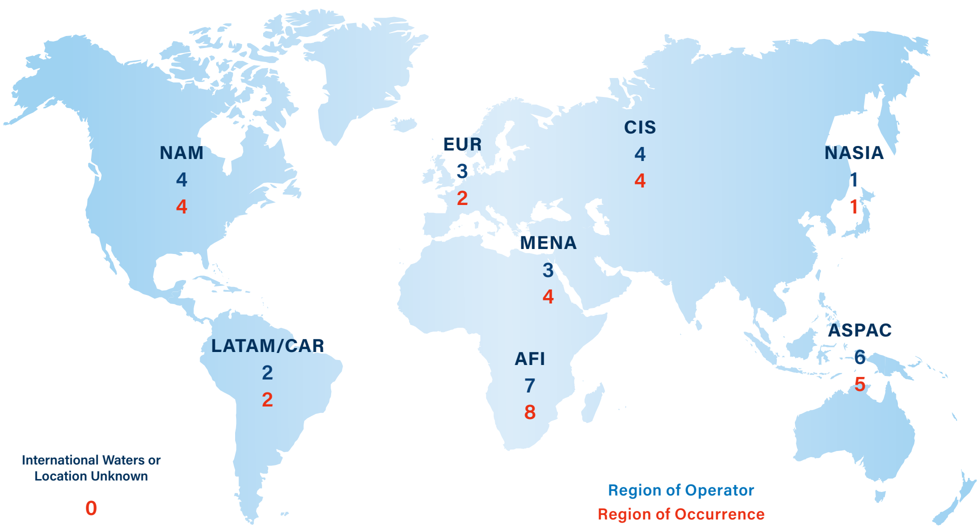
Accident Count % from Total	2016	'12-'16
IATA Member	29%	17%
Full-Loss Equivalents	62%	74%
Fatal	71%	90%
Hull Losses	86%	93%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	29%	71%	0%	57%	43%
2012-2016	57%	43%	0%	37%	63%

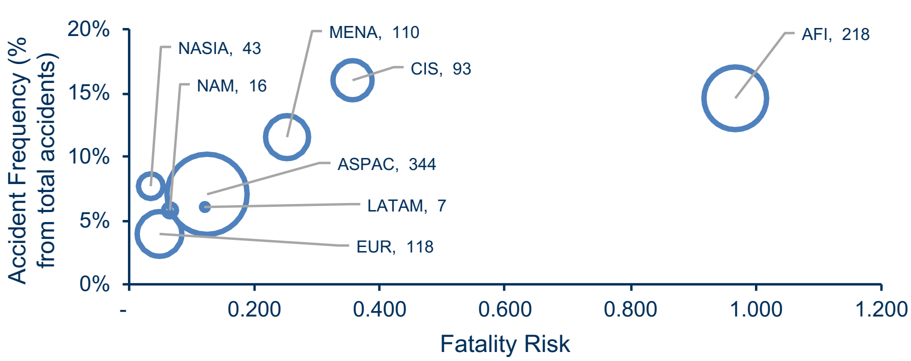
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Flight Operations:
32%

Threats

Aircraft Malfunction:
45%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
41%

Undesired aircraft state

Operation Outside Aircraft Limitations:
32%

Countermeasure

Overall Crew Performance:
36%

➤ See detailed view

Loss of Control In-flight – Accident Rate*

2016 Accident rate: 0.17
2012-2016 Accident rate: 0.16

Accident Rate*	2016	'12-'16
IATA Member	0.09	0.05
Fatality Risk**	0.11	0.12
Fatal	0.12	0.14
Hull Losses	0.15	0.15

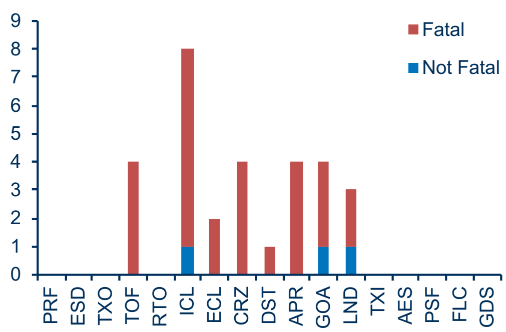
	Jet	Turboprop
2016	0.12	0.43
2012-2016	0.07	0.56

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

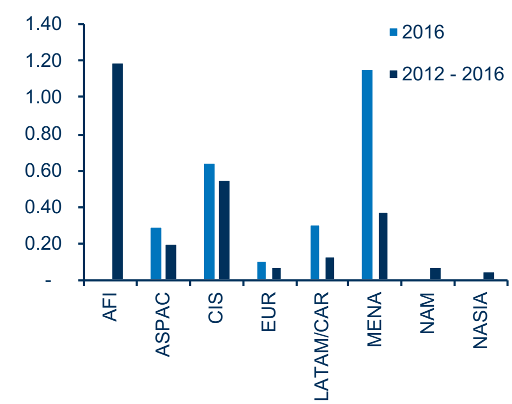
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



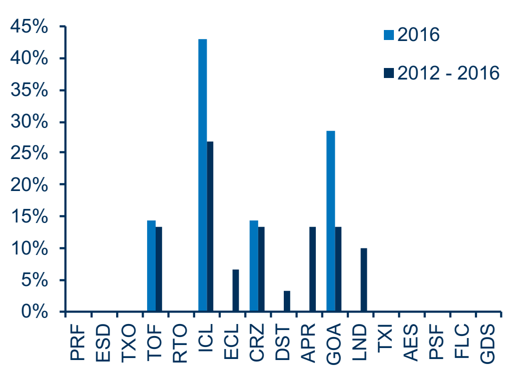
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



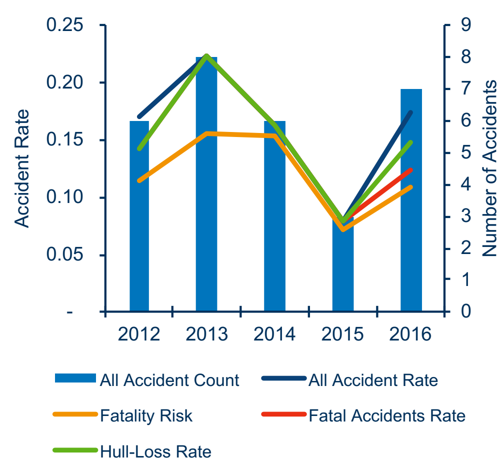
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Mid-air Collision – Accident Count

2016	Number of accidents: 0	Number of fatalities: 0
2012-2016	Number of accidents: 2	Number of fatalities: 0

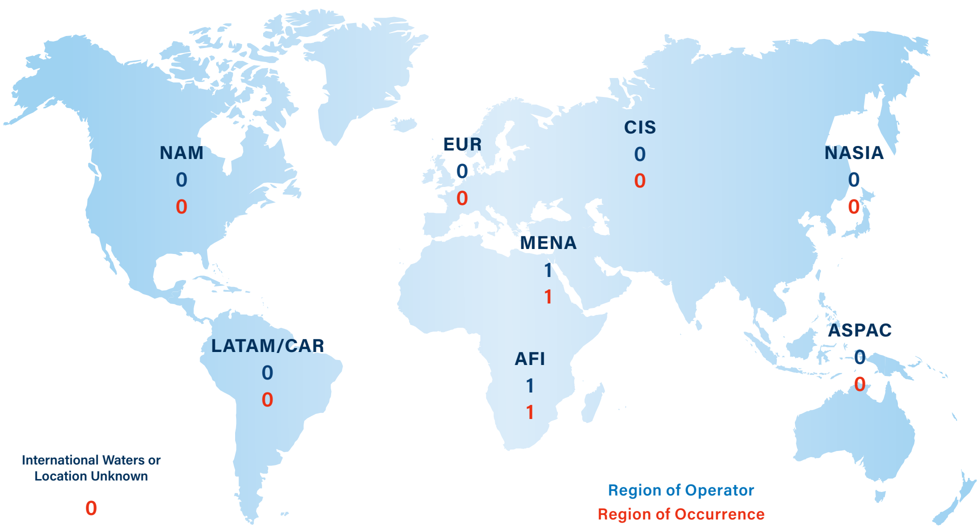
Accident Count % from Total	2016	'12-'16
IATA Member	0%	50%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	0%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	0%	0%	0%	0%	0%
2012-2016	100%	0%	0%	100%	0%

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

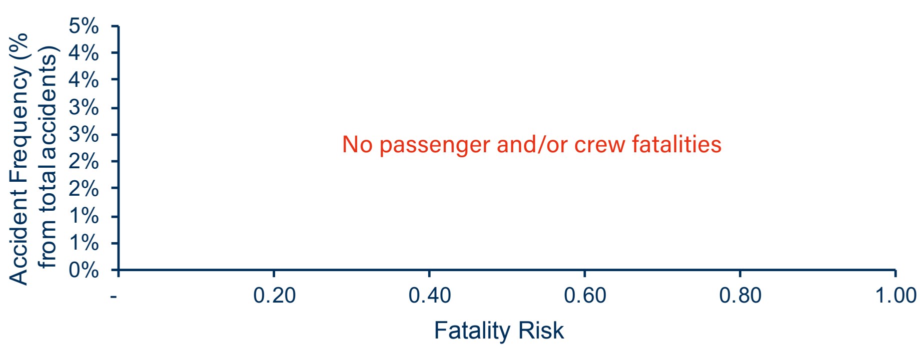
Number of Accidents per Region (2012-2016)

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 non-commercial aircraft (HS-125 ambulance configuration) resulted in the crash and death of all onboard of the HS-125. The B737 suffered substantial damage.

Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

At least 3 accidents required to display classification

Threats

At least 3 accidents required to display classification

Flight Crew Errors

At least 3 accidents required to display classification

Undesired aircraft state

At least 3 accidents required to display classification

Countermeasure

At least 3 accidents required to display classification

➤ See detailed view

Mid-air Collision – Accident Rate*

2016 Accident rate: 0.00
2012-2016 Accident rate: 0.01

Accident Rate*	2016	'12-'16
IATA Member	0.00	0.01
Fatality Risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.00	0.00

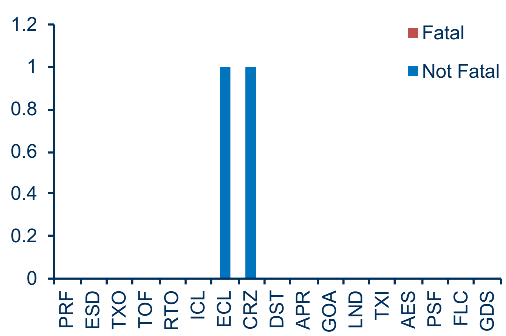
	Jet	Turboprop
2016	0.00	0.00
2012-2016	0.01	0.00

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

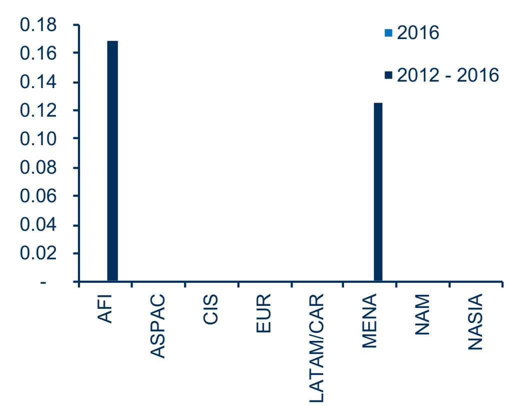
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



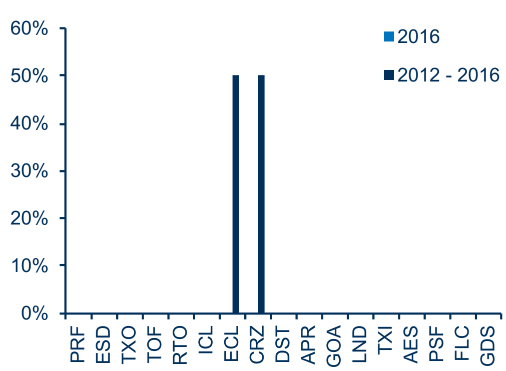
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



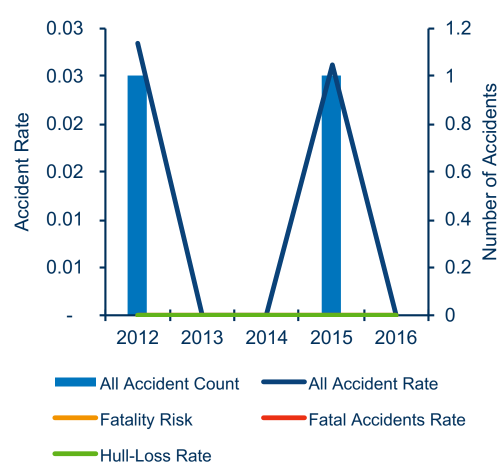
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Runway/Taxiway Excursion – Accident Count

2016	Number of accidents: 12	Number of fatalities: 0
2012-2016	Number of accidents: 82	Number of fatalities: 14

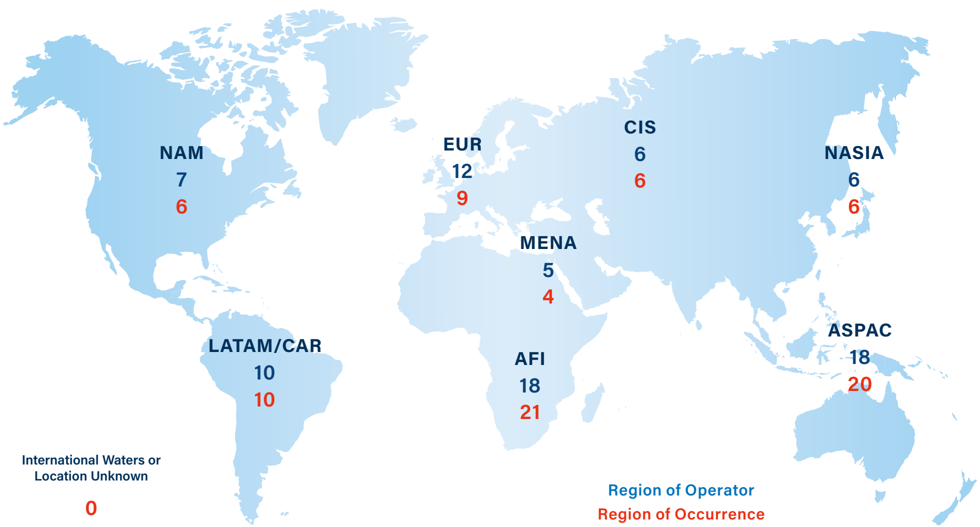
Accident Count % from Total	2016	'12-'16
IATA Member	42%	23%
Full-Loss Equivalents	0%	1%
Fatal	0%	4%
Hull Losses	25%	40%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	75%	25%	0%	83%	17%
2012-2016	77%	22%	1%	50%	50%

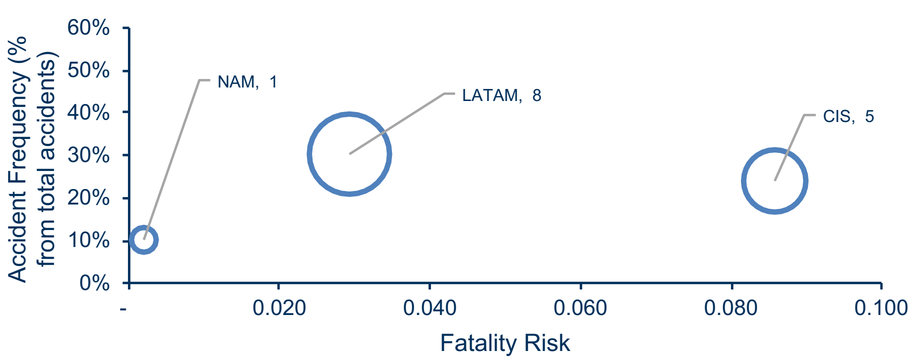
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
45%

Threats

Meteorology:
49%

Flight Crew Errors

Manual Handling / Flight Controls:
48%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
46%

Countermeasure

Overall Crew Performance:
31%

➤ See detailed view

Runway/Taxiway Excursion – Accident Rate*

2016 Accident rate: 0.30
2012-2016 Accident rate: 0.44

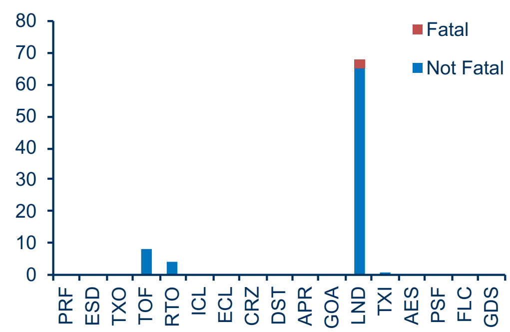
Accident Rate*	2016	'12-'16
IATA Member	0.23	0.21
Fatality Risk**	0.00	0.01
Fatal	0.00	0.02
Hull Losses	0.07	0.18

	Jet	Turboprop	
2016	0.30	0.29	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	0.27	1.20	

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

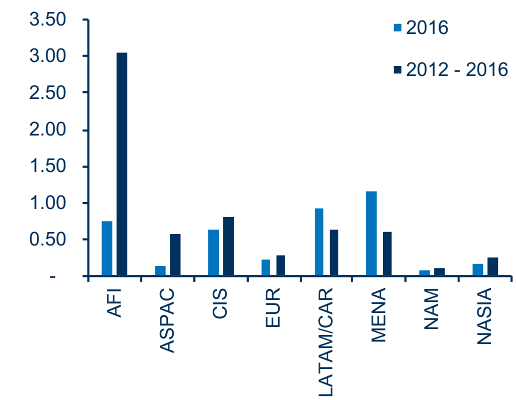
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



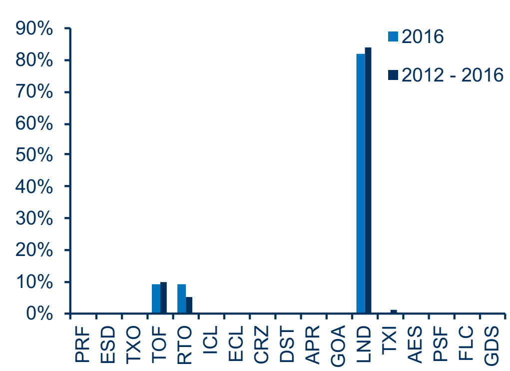
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



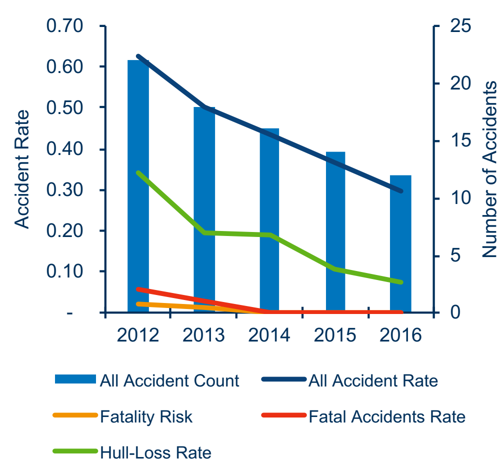
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



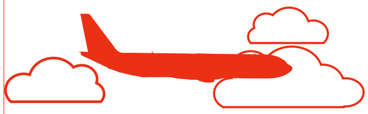
5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



In-flight Damage – Accident Count

2016 Number of accidents: 9 Number of fatalities: 67
2012-2016 Number of accidents: 35 Number of fatalities: 86



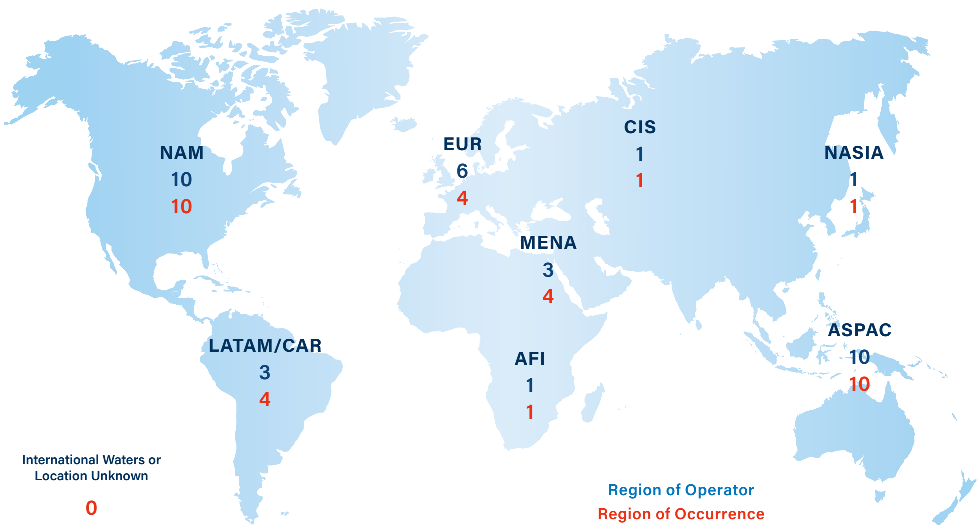
Accident Count % from Total	2016	'12-'16
IATA Member	78%	51%
Full-Loss Equivalents	22%	9%
Fatal	22%	9%
Hull Losses	44%	20%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	89%	11%	0%	89%	11%
2012-2016	83%	14%	0%	83%	17%

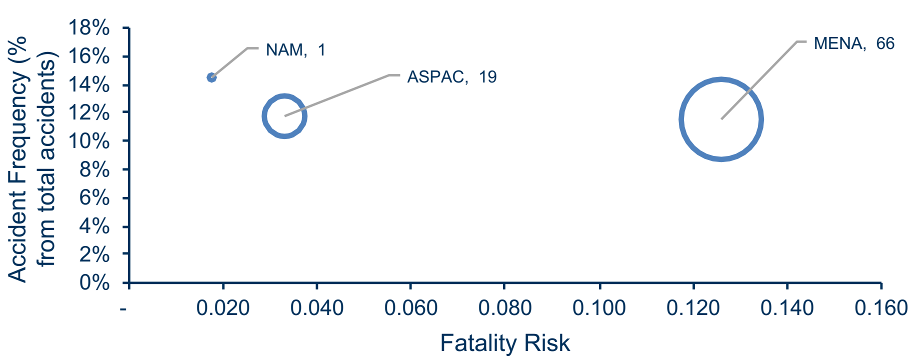
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
18%

Threats

Aircraft Malfunction:
39%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
18%

Undesired aircraft state

Vertical / Lateral / Speed Deviation:
6%

Countermeasure

Automation Management:
6%

➤ See detailed view

In-flight Damage – Accident Rate*

2016 Accident rate: 0.22
2012-2016 Accident rate: 0.19

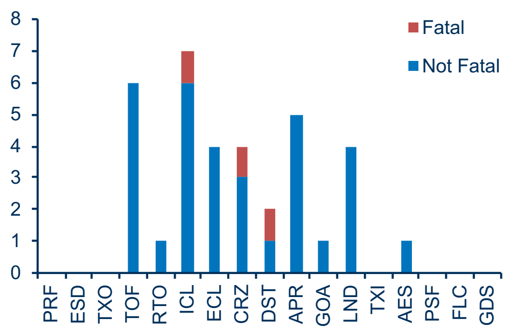
Accident Rate*	2016	'12-'16
IATA Member	0.33	0.19
Fatality Risk**	0.05	0.02
Fatal	0.05	0.02
Hull Losses	0.10	0.04

	Jet	Turboprop	
2016	0.24	0.14	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	0.19	0.18	

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

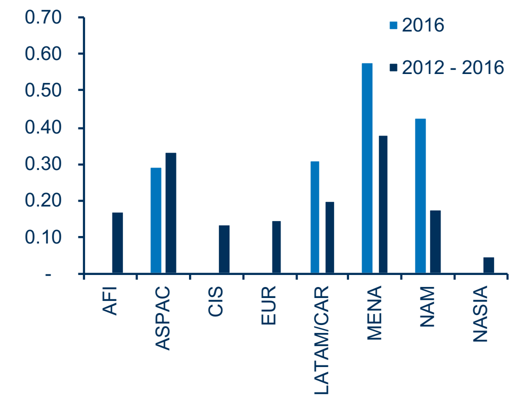
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



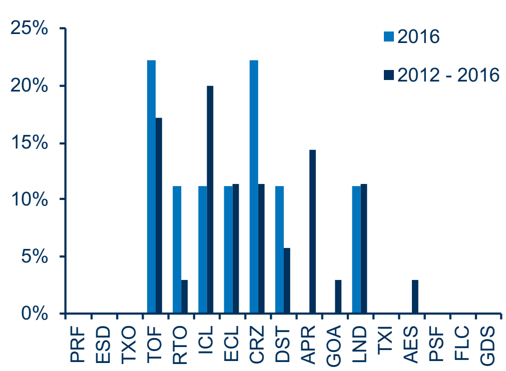
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



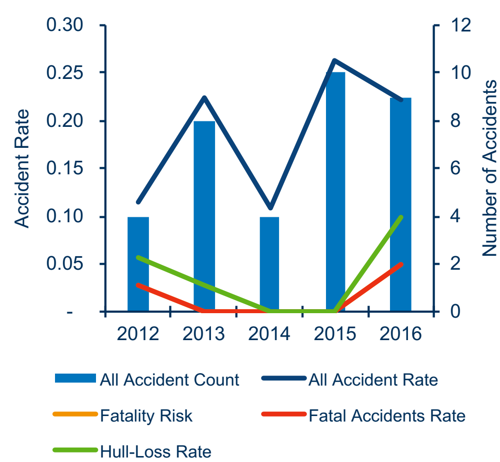
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



5-Year Trend (2012-2016)

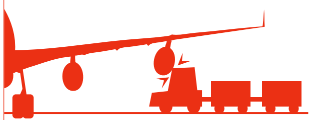
See Annex 1 for the definitions of different metrics used



Ground Damage – Accident Count

2016 Number of accidents: 5 Number of fatalities: 0

2012-2016 Number of accidents: 39 Number of fatalities: 0



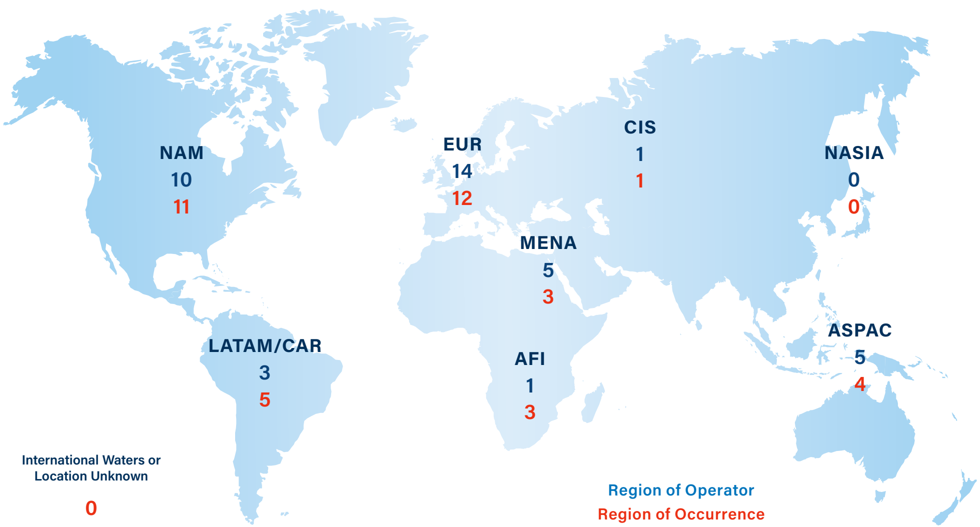
Accident Count % from Total	2016	'12-'16
IATA Member	100%	49%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	10%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	100%	0%	0%	100%	0%
2012-2016	92%	5%	3%	69%	31%

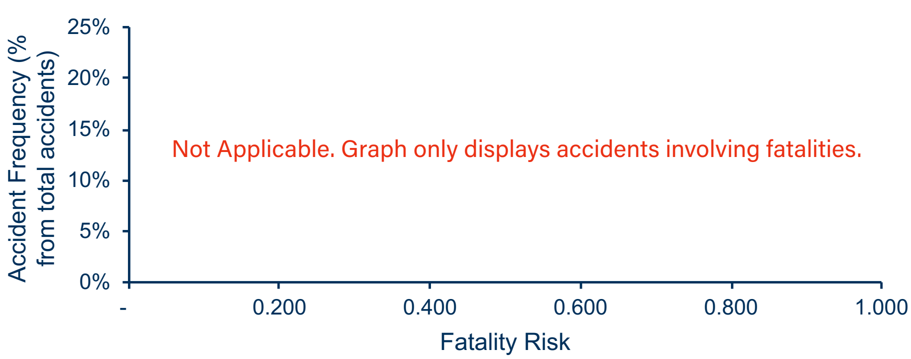
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
24%

Threats

Ground Events:
48%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
15%

Undesired aircraft state

Ramp movements:
15%

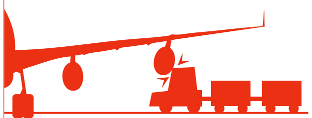
Countermeasure

Overall Crew Performance:
15%

➤ See detailed view

Ground Damage – Accident Rate*

2016 Accident rate: 0.12
2012-2016 Accident rate: 0.21



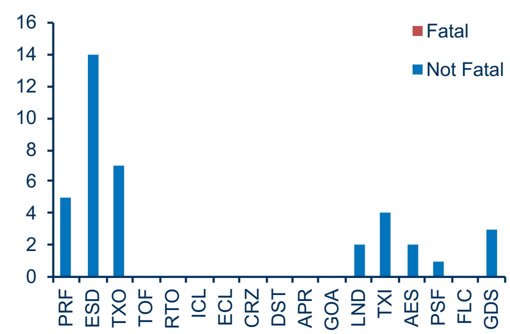
Accident Rate*	2016	'12-'16
IATA Member	0.23	0.21
Fatality Risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.00	0.02

	Jet	Turboprop	
2016	0.15	0.00	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	0.18	0.35	

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

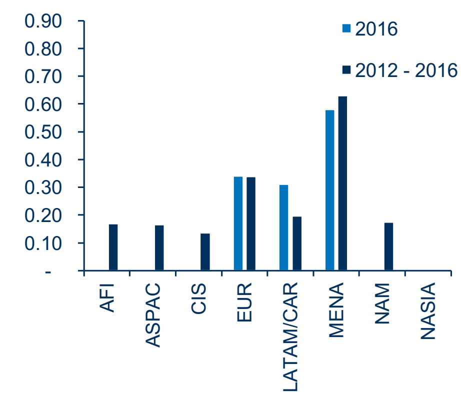
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



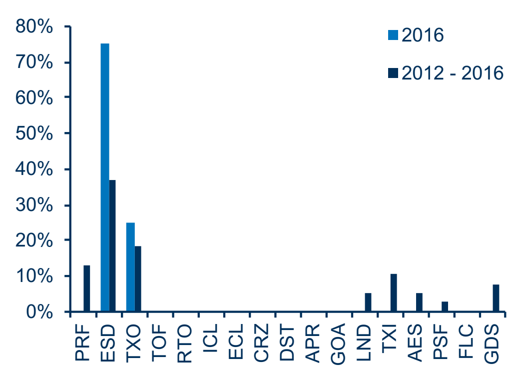
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



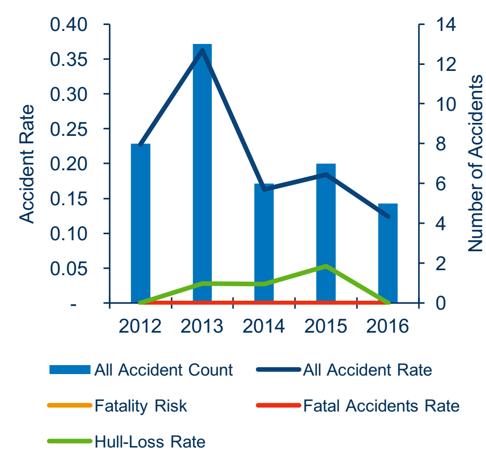
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Undershoot – Accident Count

2016	Number of accidents: 1	Number of fatalities: 0
2012-2016	Number of accidents: 12	Number of fatalities: 7

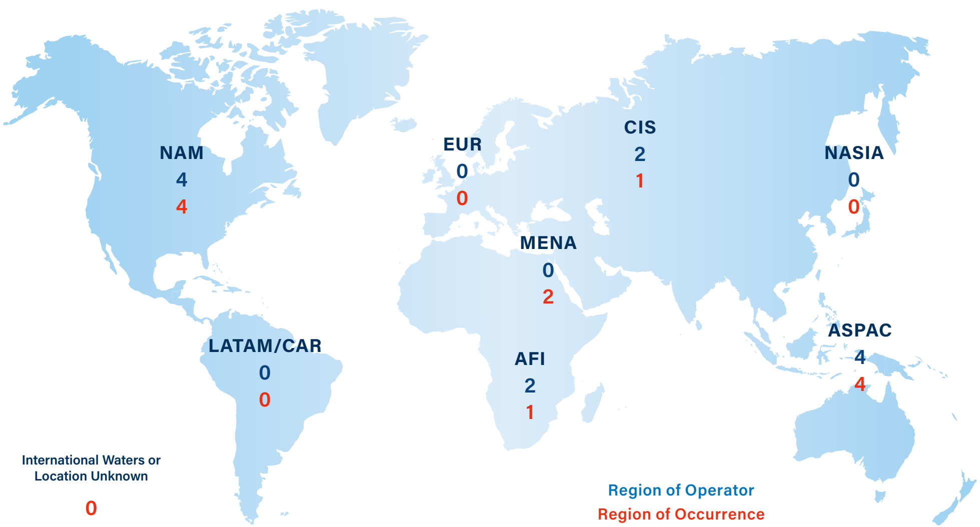
Accident Count % from Total	2016	'12-'16
IATA Member	0%	25%
Full-Loss Equivalents	0%	8%
Fatal	0%	8%
Hull Losses	100%	50%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	100%	0%	0%	0%	100%
2012-2016	67%	25%	8%	50%	50%

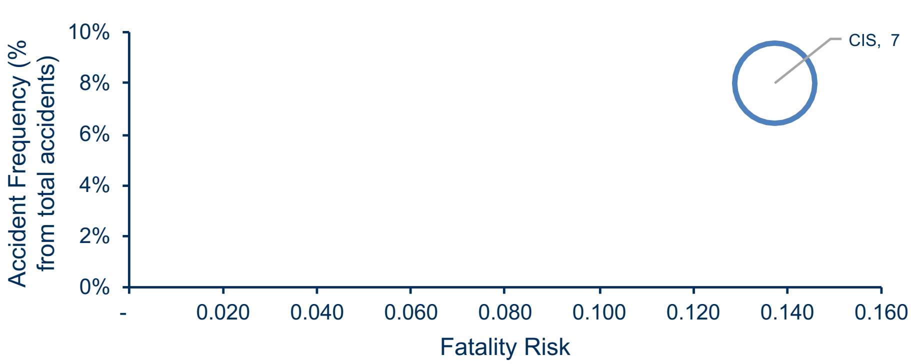
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
55%

Threats

Meteorology:
73%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
45%

Undesired aircraft state

Vertical / Lateral / Speed Deviation:
64%

Countermeasure

Overall Crew Performance:
27%

➤ See detailed view

Undershoot – Accident Rate*

2016 Accident rate: 0.02
2012-2016 Accident rate: 0.06

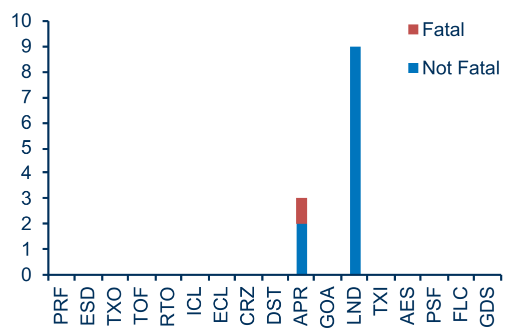
Accident Rate*	2016	'12-'16
IATA Member	0.00	0.03
Fatality Risk**	0.00	0.01
Fatal	0.00	0.01
Hull Losses	0.02	0.03

	Jet	Turboprop	
2016	0.00	0.14	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	0.04	0.18	

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

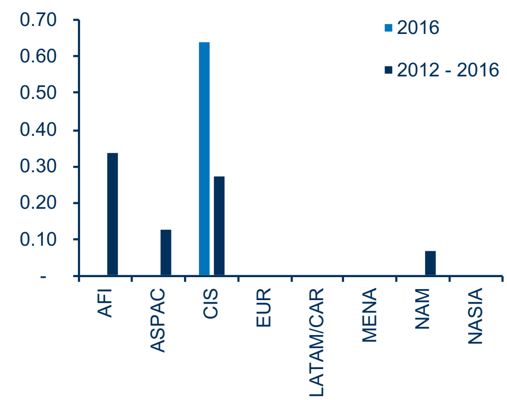
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



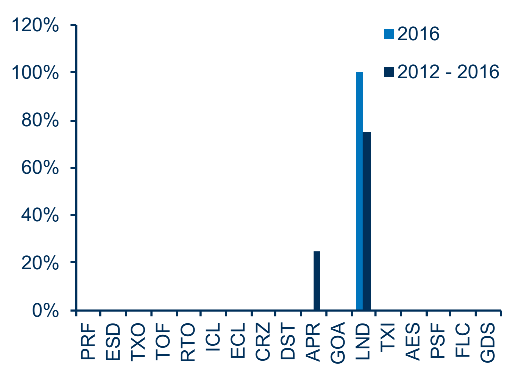
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



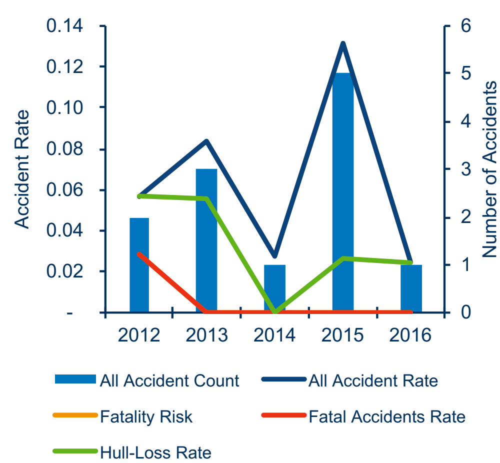
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



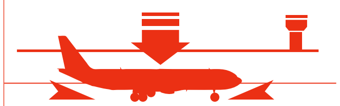
5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Hard Landing – Accident Count

2016	Number of accidents: 9	Number of fatalities: 0
2012-2016	Number of accidents: 48	Number of fatalities: 0



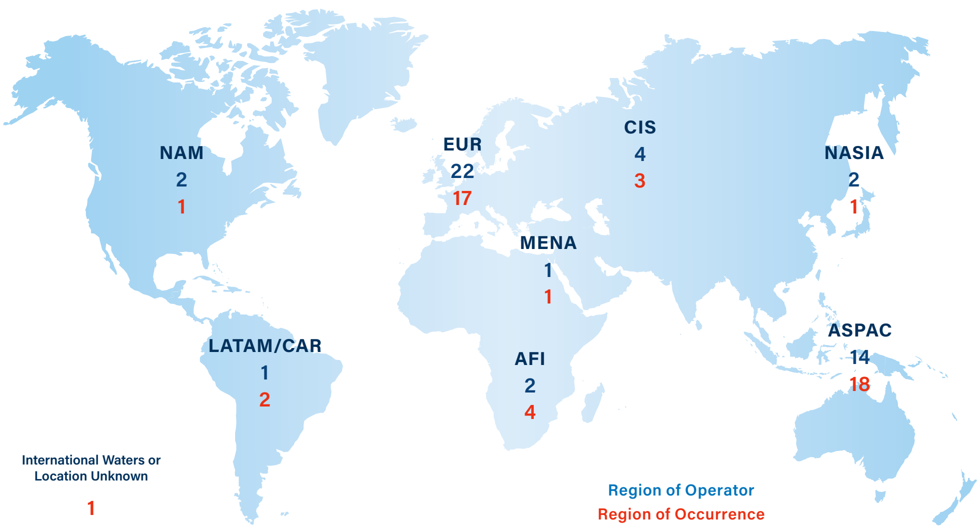
Accident Count % from Total	2016	'12-'16
IATA Member	56%	33%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	11%	19%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	78%	22%	0%	67%	33%
2012-2016	83%	13%	2%	65%	35%

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

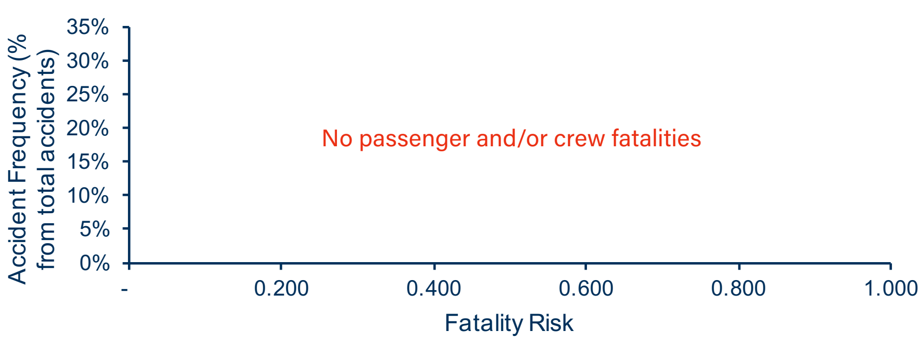
Number of Accidents per Region (2012-2016)

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 (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Flight Operations:
26%

Threats

Meteorology:
48%

Flight Crew Errors

Manual Handling / Flight Controls:
74%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
65%

Countermeasure

Overall Crew Performance:
37%

➤ See detailed view

Hard Landing – Accident Rate*

2016 Accident rate: 0.22
2012-2016 Accident rate: 0.26

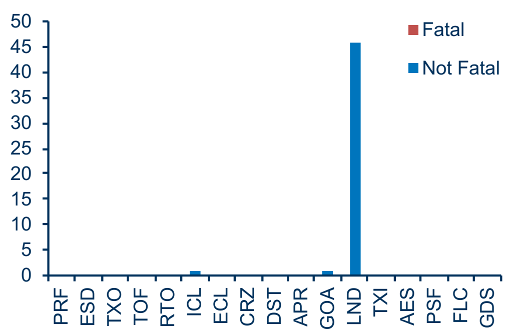
Accident Rate*	2016	'12-'16
IATA Member	0.23	0.17
Fatality Risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.02	0.05

	Jet	Turboprop	
2016	0.18	0.43	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	0.20	0.50	

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

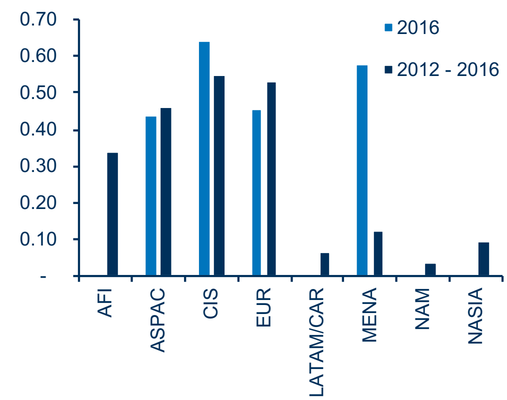
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



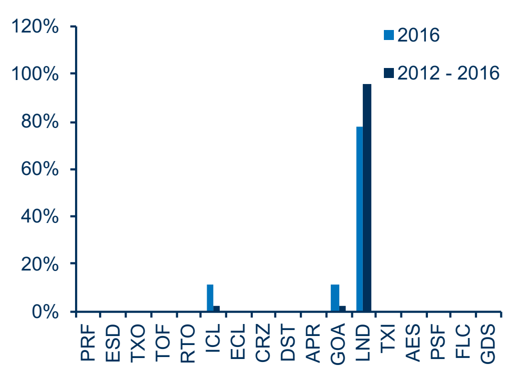
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



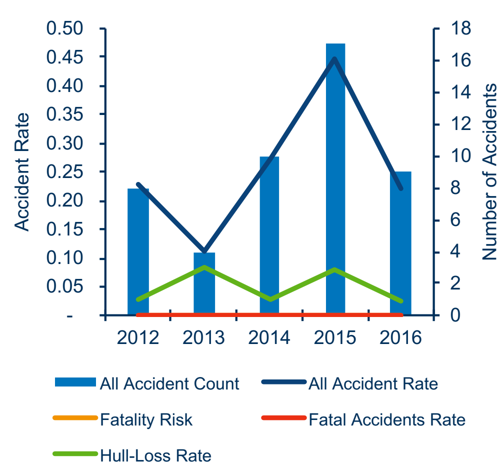
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Gear-up Landing/Gear Collapse – Accident Count

2016	Number of accidents: 10	Number of fatalities: 0
2012-2016	Number of accidents: 61	Number of fatalities: 0

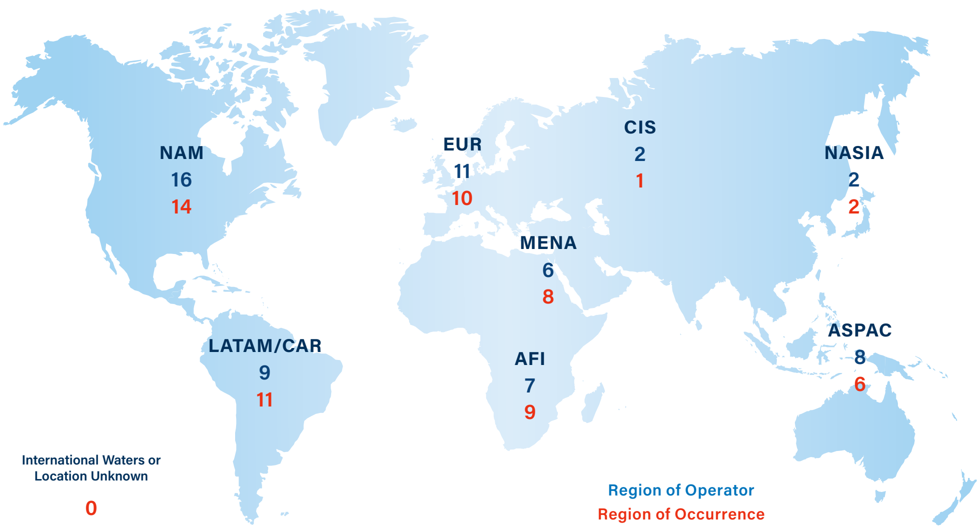
Accident Count % from Total	2016	'12-'16
IATA Member	40%	26%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	20%	21%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	80%	20%	0%	50%	50%
2012-2016	72%	25%	3%	41%	59%

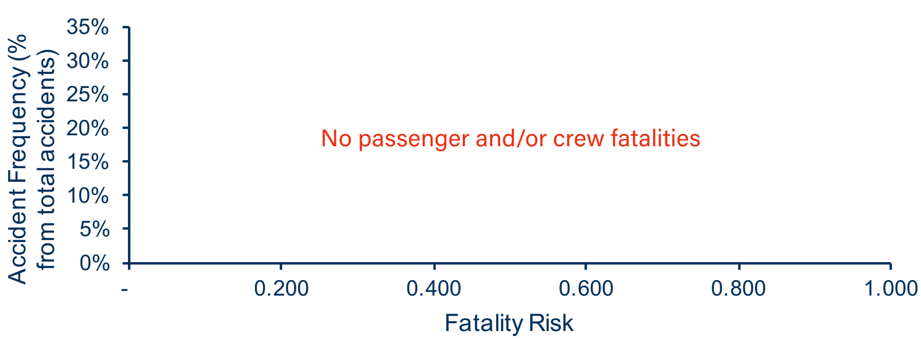
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Maintenance Operations:
30%

Threats

Aircraft Malfunction:
86%

Flight Crew Errors

Manual Handling / Flight Controls:
2%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
2%

Countermeasure

N/A

➤ See detailed view

Gear-up Landing/Gear Collapse – Accident Rate*

2016 Accident rate: 0.25

2012-2016 Accident rate: 0.33

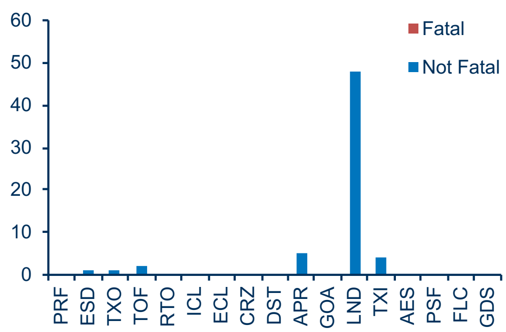
Accident Rate*	2016	'12-'16
IATA Member	0.19	0.17
Fatality Risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.05	0.07

	Jet	Turboprop	
2016	0.15	0.72	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	0.16	1.05	

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

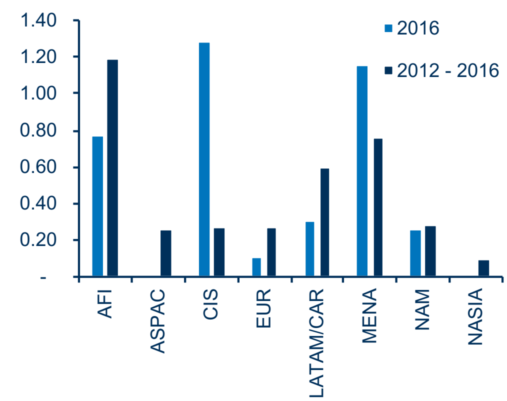
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



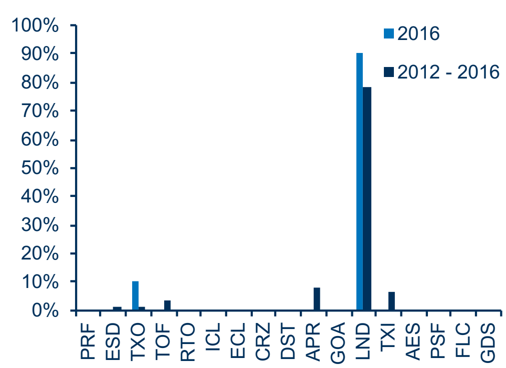
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



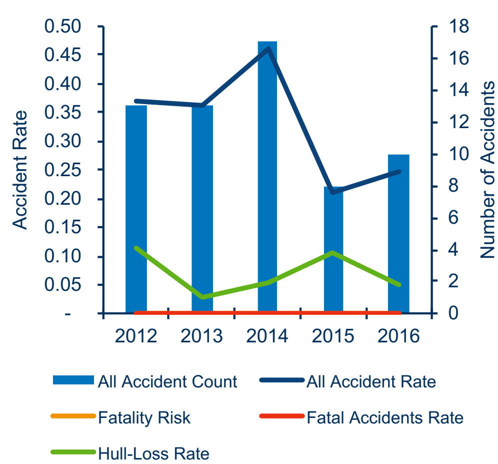
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Tailstrike – Accident Count

2016	Number of accidents: 2	Number of fatalities: 0
2012-2016	Number of accidents: 21	Number of fatalities: 0

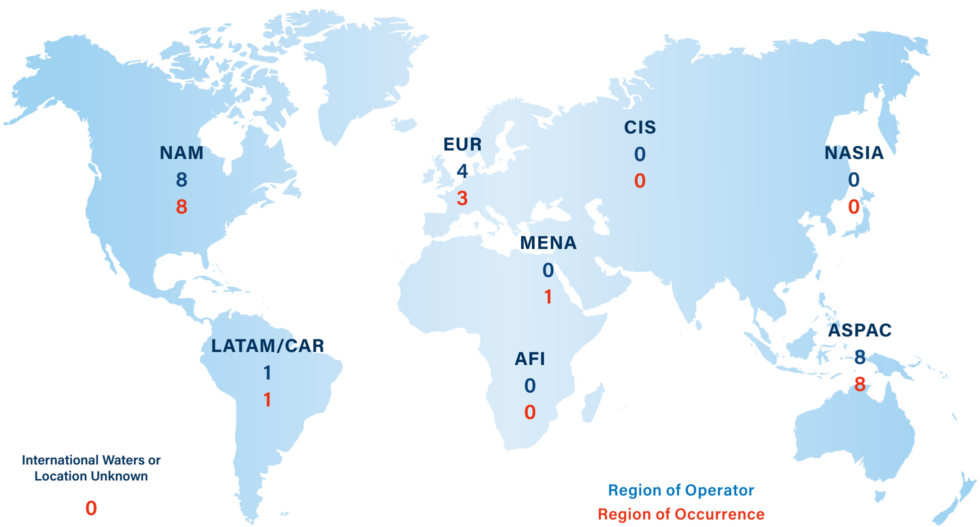
Accident Count % from Total	2016	'12-'16
IATA Member	100%	57%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	5%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	50%	50%	0%	100%	0%
2012-2016	86%	14%	0%	76%	24%

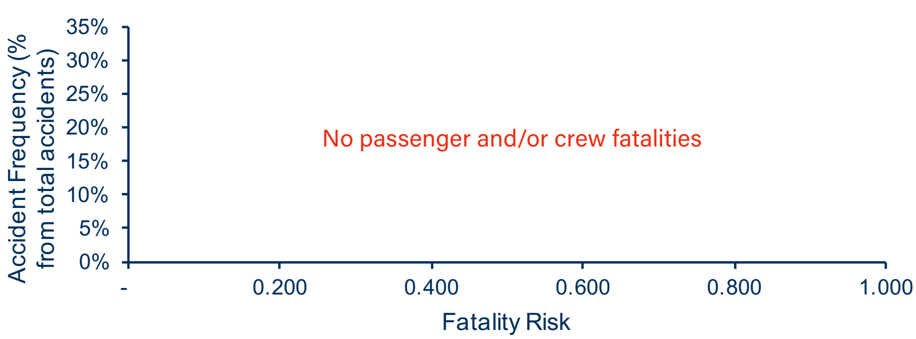
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Flight Operations:
26%

Threats

Meteorology:
32%

Flight Crew Errors

Manual Handling / Flight Controls:
84%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
37%

Countermeasure

Monitor / Cross-check:
26%

➤ See detailed view

Tailstrike – Accident Rate*

2016 Accident rate: 0.05
2012-2016 Accident rate: 0.11

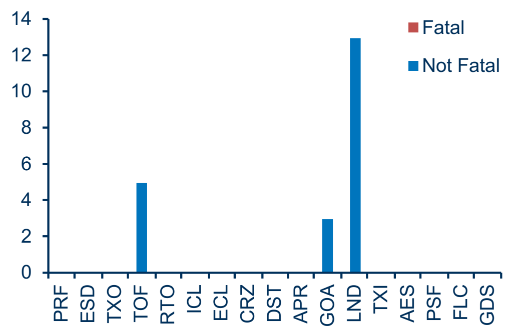
Accident Rate*	2016	'12-'16
IATA Member	0.09	0.13
Fatality Risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.00	0.01

	Jet	Turboprop	
2016	0.06	0.00	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	0.11	0.15	

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

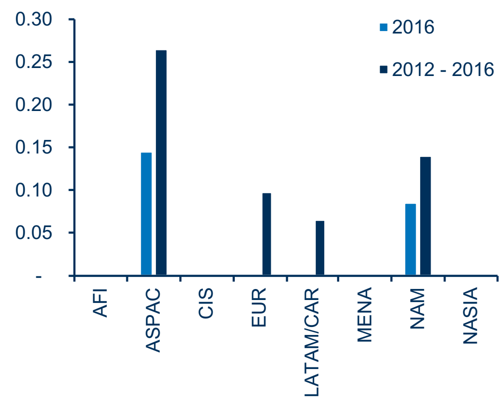
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



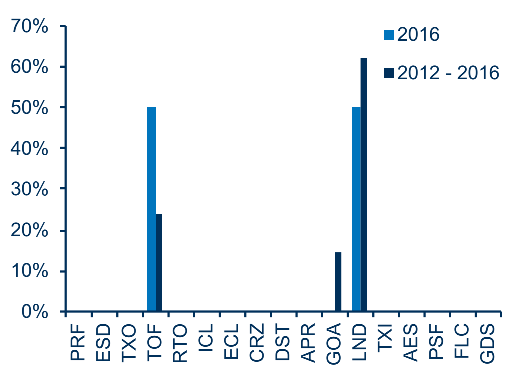
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



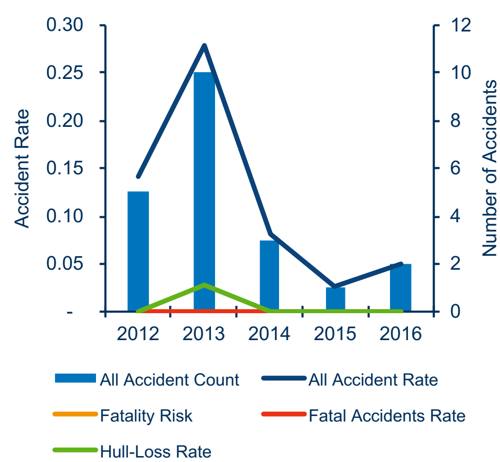
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



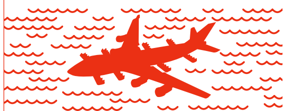
5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Off-Airport Landing/Ditching – Accident Count

2016	Number of accidents: 0	Number of fatalities: 0
2012-2016	Number of accidents: 2	Number of fatalities: 0



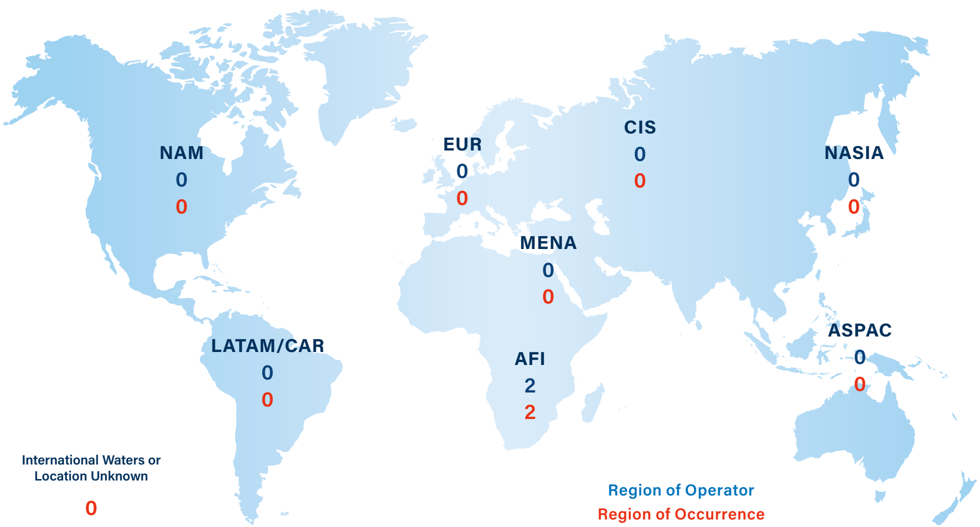
Accident Count % from Total	2016	'12-'16
IATA Member	0%	0%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	50%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	0%	0%	0%	0%	0%
2012-2016	50%	0%	50%	50%	50%

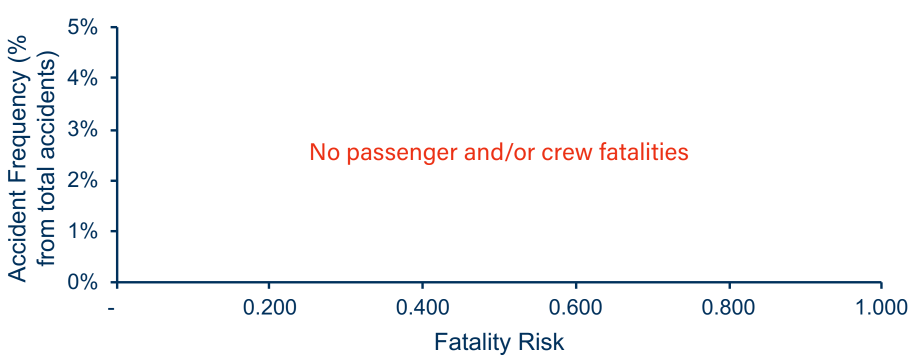
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

At least 3 accidents required to display classification

Threats

At least 3 accidents required to display classification

Flight Crew Errors

At least 3 accidents required to display classification

Undesired aircraft state

At least 3 accidents required to display classification

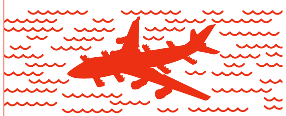
Countermeasure

At least 3 accidents required to display classification

➤ See detailed view

Off-Airport Landing/Ditching – Accident Rate*

2016 Accident rate: 0.00
2012-2016 Accident rate: 0.01



Accident Rate*	2016	'12-'16
IATA Member	0.00	0.00
Fatality Risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.00	0.01

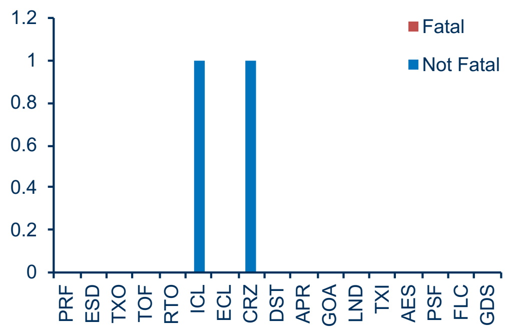
	Jet	Turboprop
2016	0.00	0.00
2012-2016	0.01	0.03

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

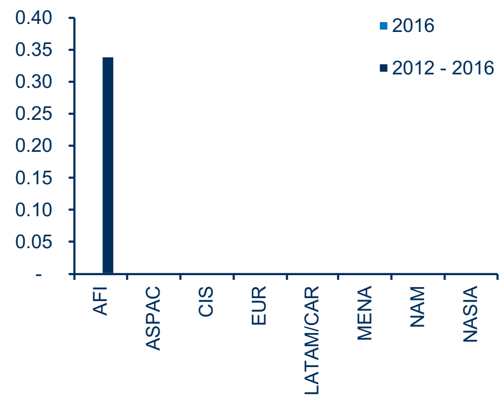
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



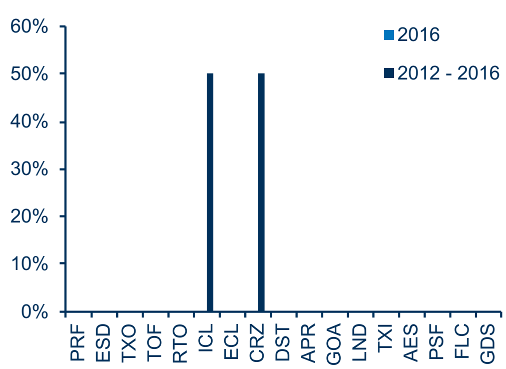
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



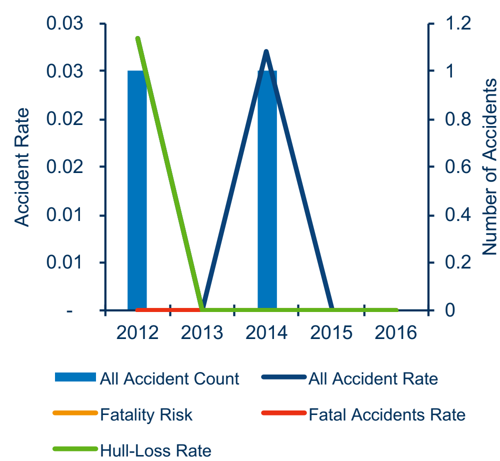
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Runway Collision – Accident Count

2016	Number of accidents: 3	Number of fatalities: 0
2012-2016	Number of accidents: 10	Number of fatalities: 0

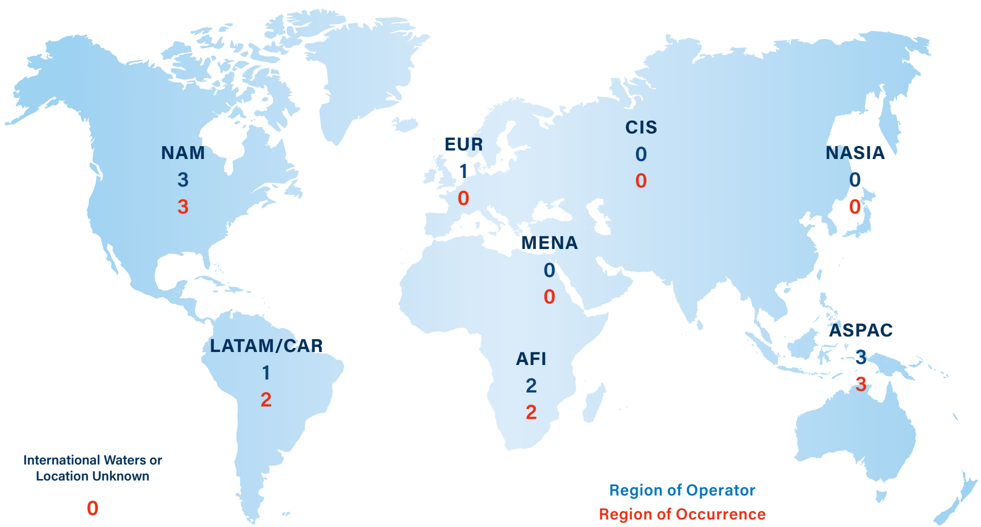
Accident Count % from Total	2016	'12-'16
IATA Member	33%	20%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	33%	20%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	100%	0%	0%	33%	67%
2012-2016	100%	0%	0%	30%	70%

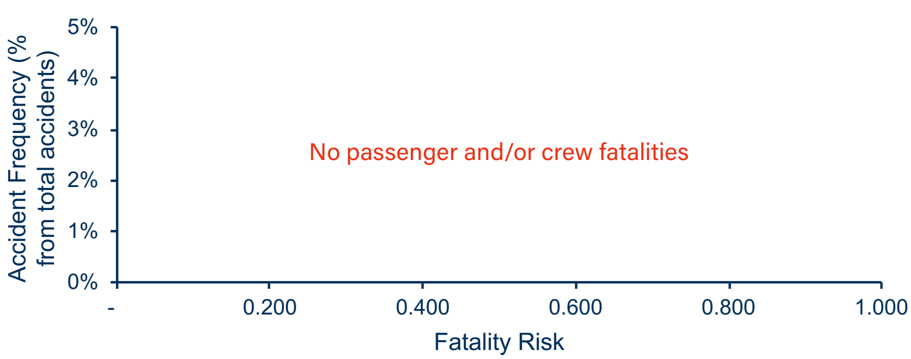
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
50%

Threats

Airport perimeter control/fencing/wildlife control:
60%

Flight Crew Errors

No contributing factor identified

Undesired aircraft state

Vertical / Lateral / Speed Deviation:
10%

Countermeasure

No contributing factor identified

➤ See detailed view

Runway Collision – Accident Rate*

2016 Accident rate: 0.07
2012-2016 Accident rate: 0.05

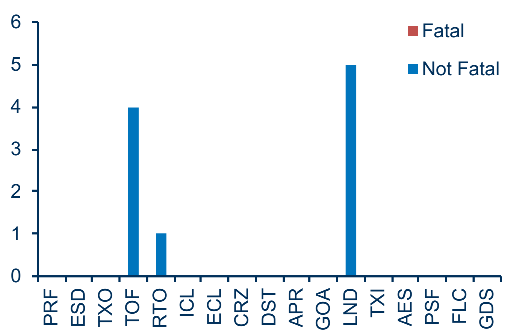
Accident Rate*	2016	'12-'16
IATA Member	0.05	0.02
Fatality Risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.02	0.01

	Jet	Turboprop	
2016	0.03	0.29	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	0.02	0.20	

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

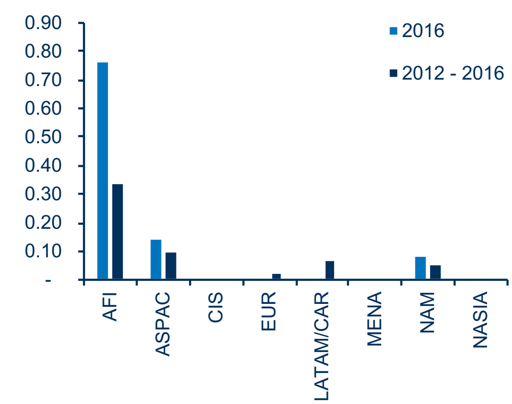
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



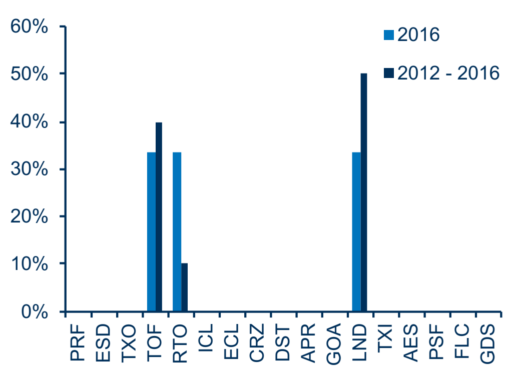
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



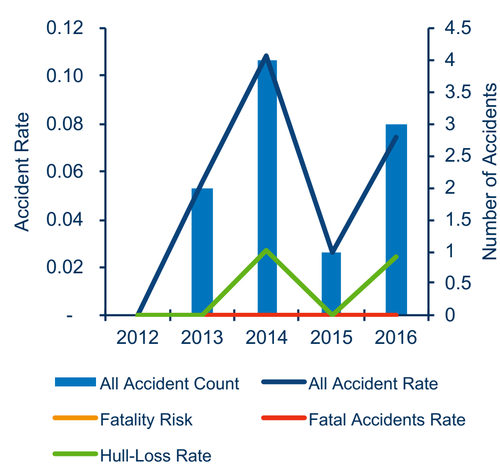
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Jet Aircraft Accidents – Accident Count

2016	Number of accidents: 42	Number of fatalities: 206
2012-2016	Number of accidents: 200	Number of fatalities: 1099

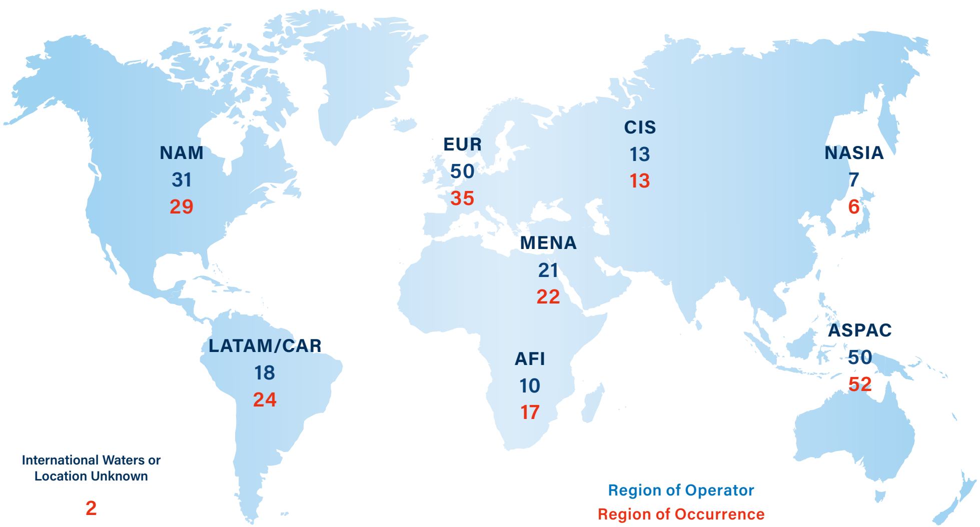
Accident Count % from Total	2016	'12-'16
IATA Member	69%	49%
Full-Loss Equivalents	5%	2%
Fatal	12%	9%
Hull Losses	31%	25%

	Passenger	Cargo	Ferry
2016	79%	21%	0%
2012-2016	83%	15%	2%

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

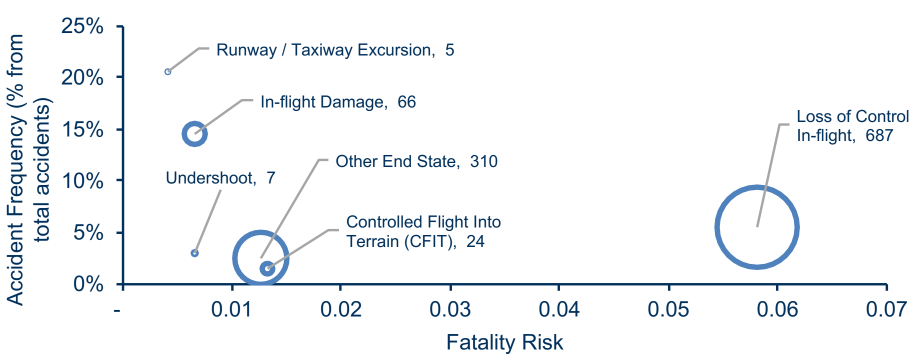
Number of Accidents per Region (2012-2016)

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 (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
28%

Threats

Meteorology:
33%

Flight Crew Errors

Manual Handling / Flight Controls:
32%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
27%

Countermeasure

Overall Crew Performance:
19%

➤ See detailed view

Jet Aircraft Accidents – Accident Rate*

2016 Accident rate: 1.25
2012-2016 Accident rate: 1.31

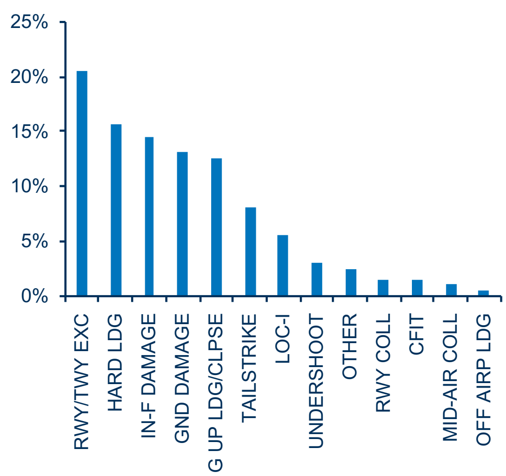
Accident Rate*	2016	'12-'16
IATA Member	1.45	1.12
Fatality Risk**	0.06	0.03
Fatal	0.15	0.12
Hull Losses	0.39	0.33

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 (2012-2016)

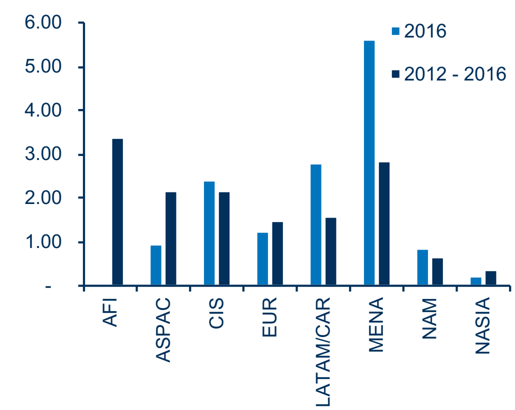
Distribution of accidents as percentage of total



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

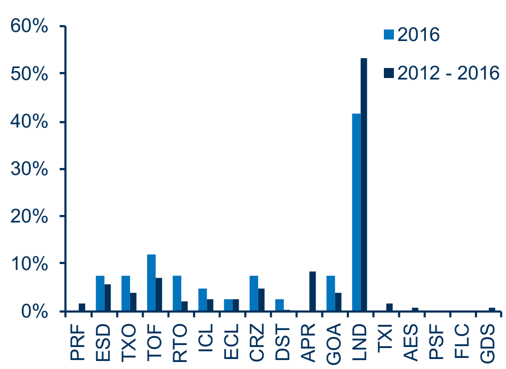
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



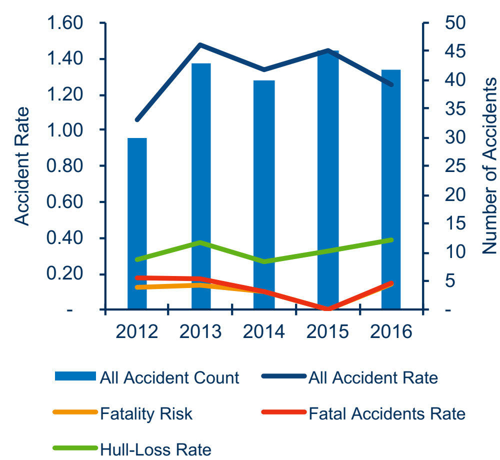
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Turboprop Aircraft Accidents – Accident Count

2016	Number of accidents: 23	Number of fatalities: 62
2012-2016	Number of accidents: 175	Number of fatalities: 535

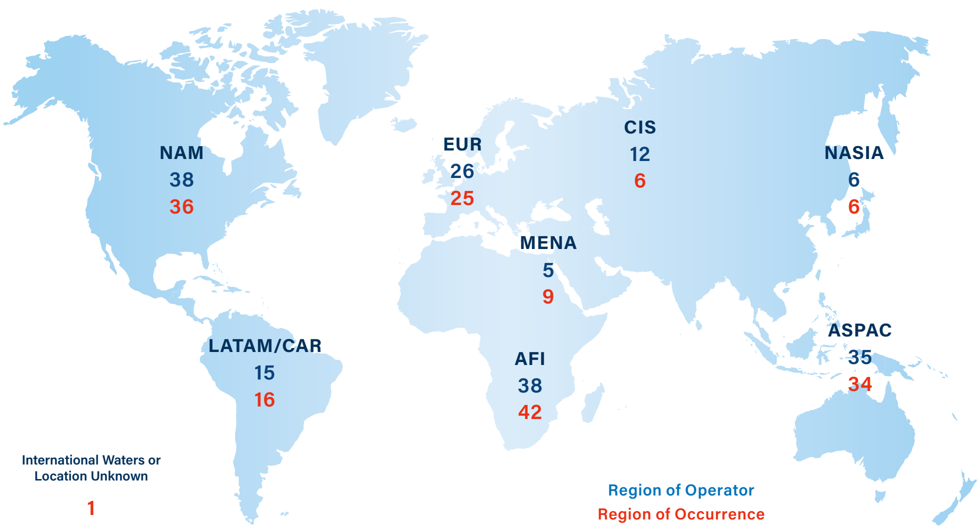
Accident Count % from Total	2016	'12-'16
IATA Member	17%	11%
Full-Loss Equivalents	4%	2%
Fatal	22%	21%
Hull Losses	35%	46%

	Passenger	Cargo	Ferry
2016	70%	26%	4%
2012-2016	69%	28%	3%

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

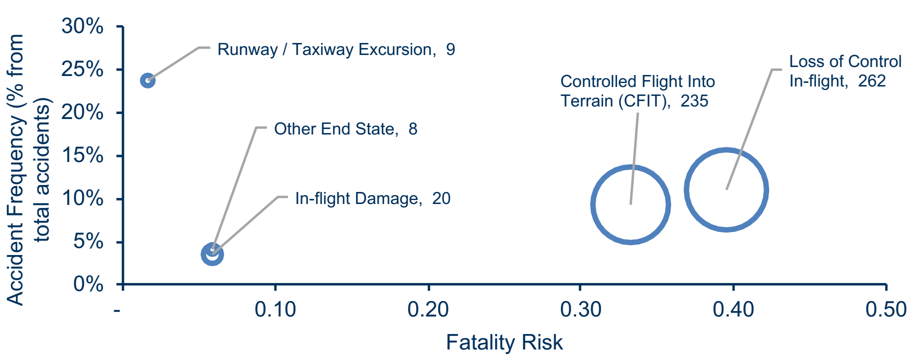
Number of Accidents per Region (2012-2016)

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 (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
36%

Threats

Aircraft Malfunction:
30%

Flight Crew Errors

Manual Handling / Flight Controls:
35%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
20%

Countermeasure

Overall Crew Performance:
27%

➤ See detailed view

Turboprop Aircraft Accidents – Accident Rate*

2016 Accident rate: 3.31
2012-2016 Accident rate: 5.12

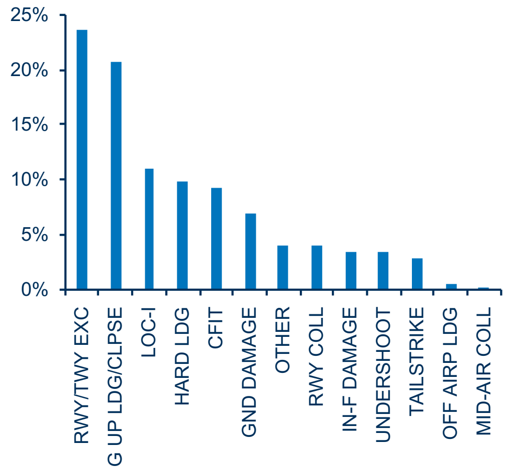
Accident Rate*	2016	'12-'16
IATA Member	2.77	3.33
Fatality Risk**	0.14	0.10
Fatal	0.72	1.08
Hull Losses	1.15	2.34

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 (2012-2016)

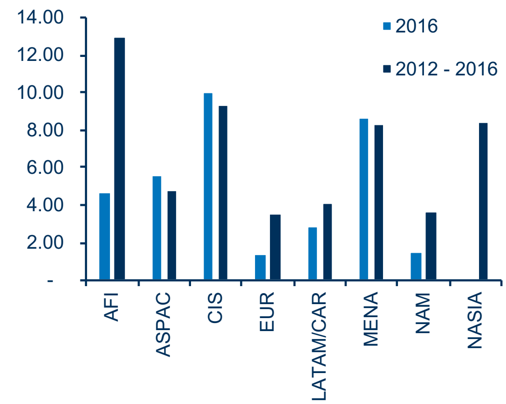
Distribution of accidents as percentage of total



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

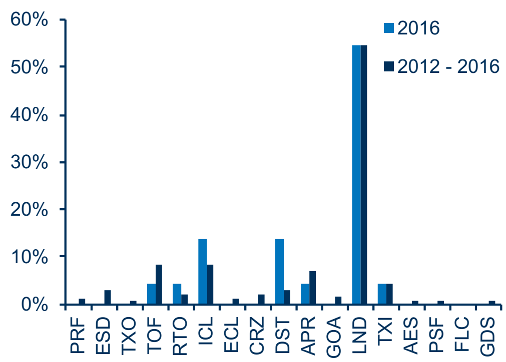
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



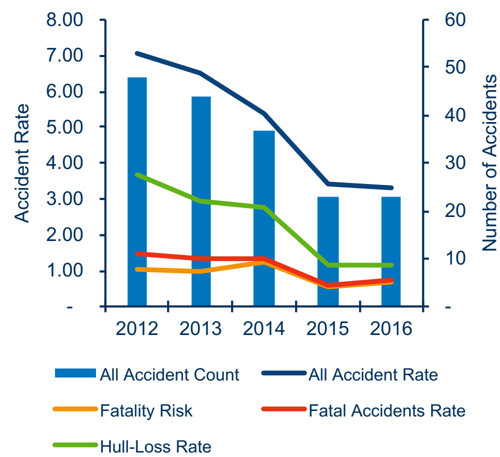
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



“The accident rate for IOSA members was nearly twice as good as for non-IOSA airlines”

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).

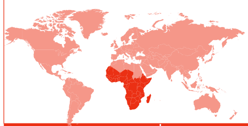
For example, if a Canadian-registered operator has an accident in Europe, this accident is considered a North American accident.

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

Image courtesy of Airbus

Africa Aircraft Accidents – Accident Count

2016	Number of accidents: 3	Number of fatalities: 0
2012-2016	Number of accidents: 48	Number of fatalities: 231



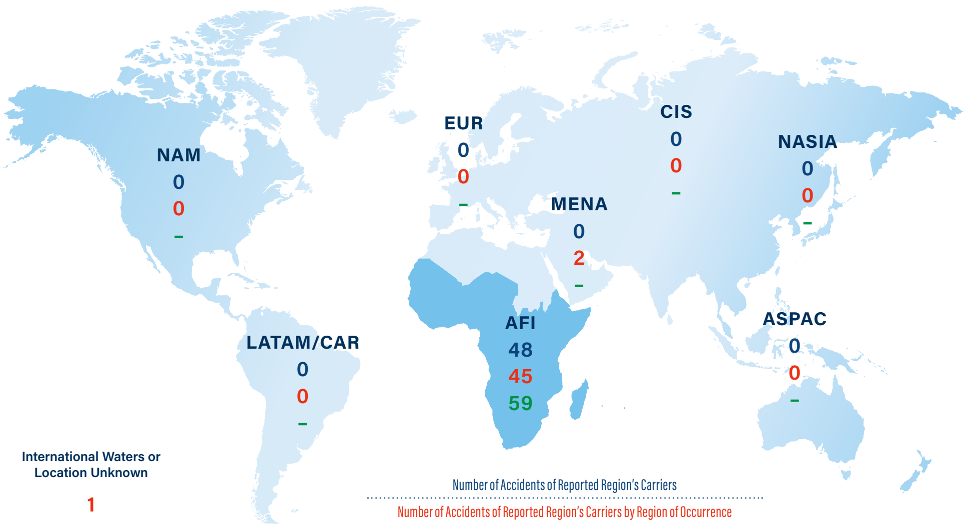
Accident Count % from Total	2016	'12-'16
IATA Member	33%	8%
Full-Loss Equivalents	0%	18%
Fatal	0%	23%
Hull Losses	33%	63%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	100%	0%	0%	0%	100%
2012-2016	56%	35%	8%	21%	79%

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

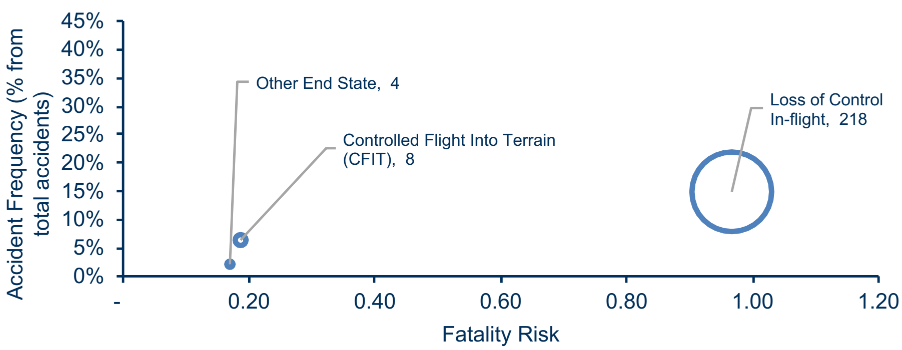
Number of Accidents per Region (2012-2016)

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 (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
52%

Threats

Airport Facilities:
33%

Flight Crew Errors

Manual Handling / Flight Controls:
26%

Undesired aircraft state

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

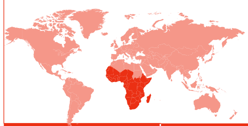
Countermeasure

Overall Crew Performance:
19%

➤ See detailed view

Africa Aircraft Accidents – Accident Rate*

2016 Accident rate: 2.30
2012-2016 Accident rate: 8.14



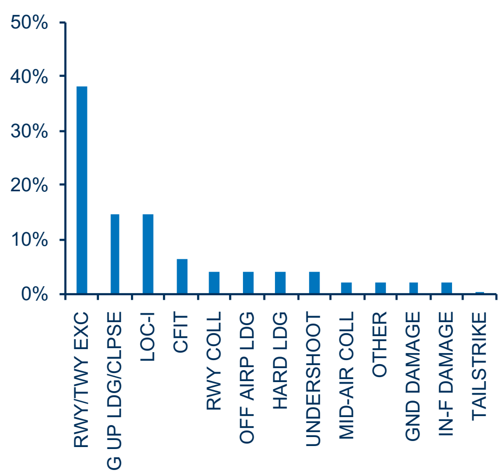
Accident Rate*	2016	'12-'16
IATA Member	1.82	1.60
Fatality Risk**	0.00	1.49
Fatal	0.00	1.87
Hull Losses	0.77	5.09

	Jet	Turboprop	
2016	0.00	4.68	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	3.39	12.93	

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

Accident Category Distribution (2012-2016)

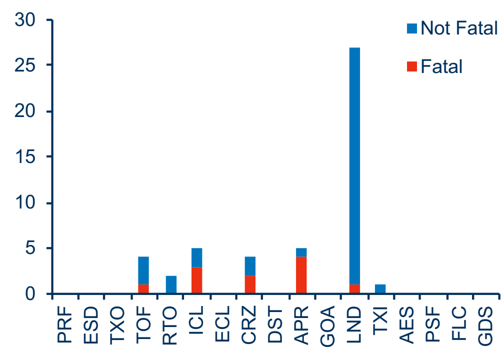
Distribution of accidents as percentage of total



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

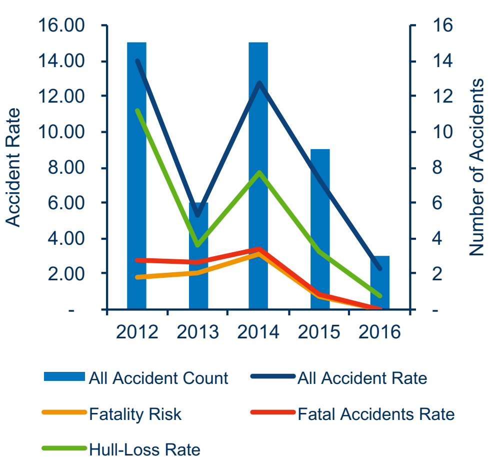
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



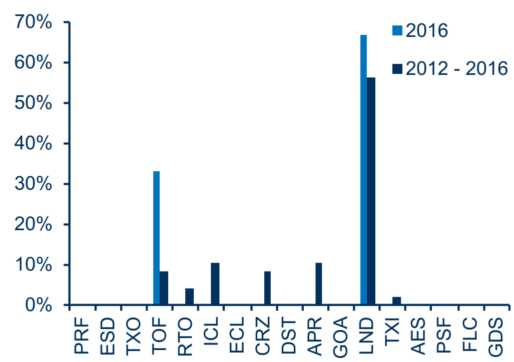
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



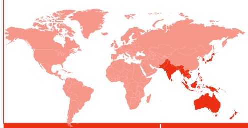
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



Asia/Pacific Aircraft Accidents – Accident Count

2016	Number of accidents: 14	Number of fatalities: 54
2012-2016	Number of accidents: 85	Number of fatalities: 723



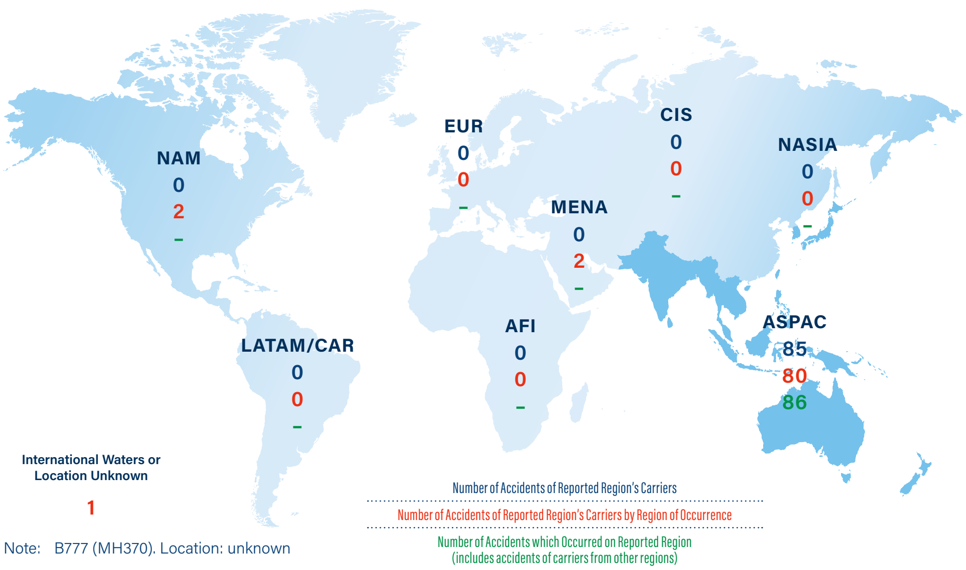
Accident Count % from Total	2016	'12-'16
IATA Member	29%	33%
Full-Loss Equivalents	20%	11%
Fatal	21%	14%
Hull Losses	36%	27%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	71%	29%	0%	36%	64%
2012-2016	86%	12%	1%	59%	41%

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

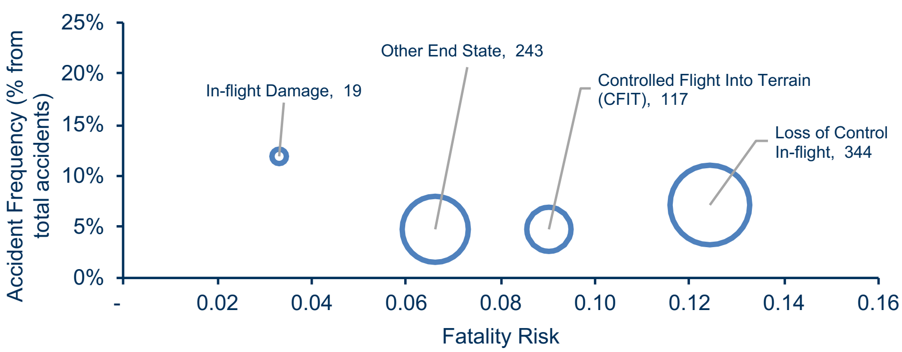
Number of Accidents per Region (2012-2016)

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



Note: B777 (MH370). Location: unknown

Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
53%

Threats

Meteorology:
31%

Flight Crew Errors

Manual Handling / Flight Controls:
45%

Undesired aircraft state

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

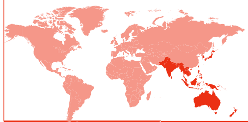
Countermeasure

Overall Crew Performance:
27%

➤ See detailed view

Asia/Pacific Aircraft Accidents – Accident Rate*

2016 Accident rate: 2.05
2012-2016 Accident rate: 2.81



Accident Rate*	2016	'12-'16
IATA Member	1.47	2.42
Fatality Risk**	0.40	0.31
Fatal	0.44	0.40
Hull Losses	0.73	0.76

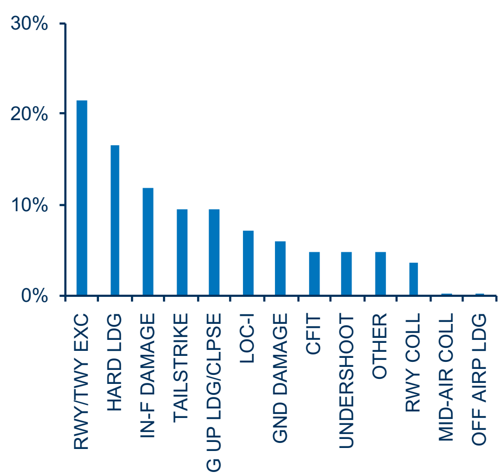
	Jet	Turboprop
2016	0.96	5.63
2012-2016	2.18	4.78

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 (2012-2016)

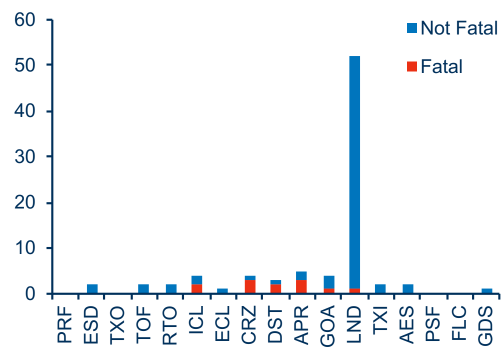
Distribution of accidents as percentage of total



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

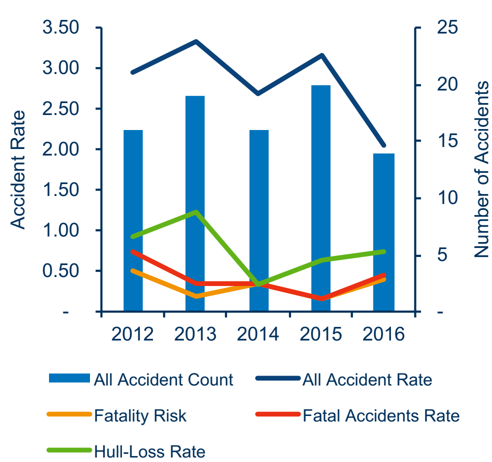
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



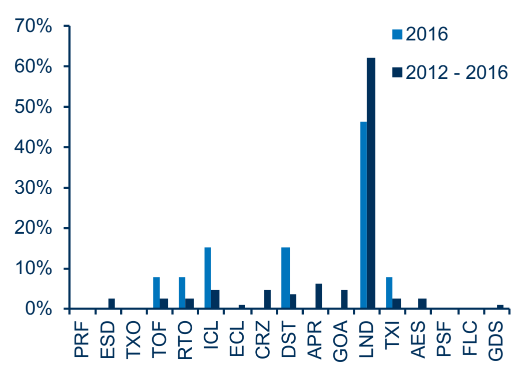
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



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

2016	Number of accidents: 6	Number of fatalities: 7
2012-2016	Number of accidents: 25	Number of fatalities: 149

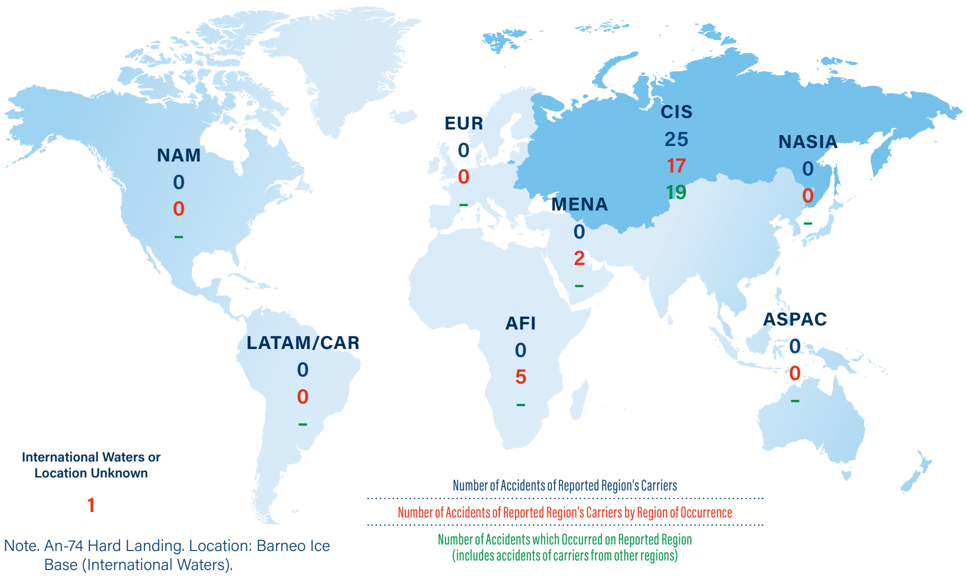
Accident Count % from Total	2016	'12-'16
IATA Member	0%	4%
Full-Loss Equivalents	13%	32%
Fatal	17%	40%
Hull Losses	50%	72%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	50%	50%	0%	50%	50%
2012-2016	56%	36%	8%	52%	48%

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

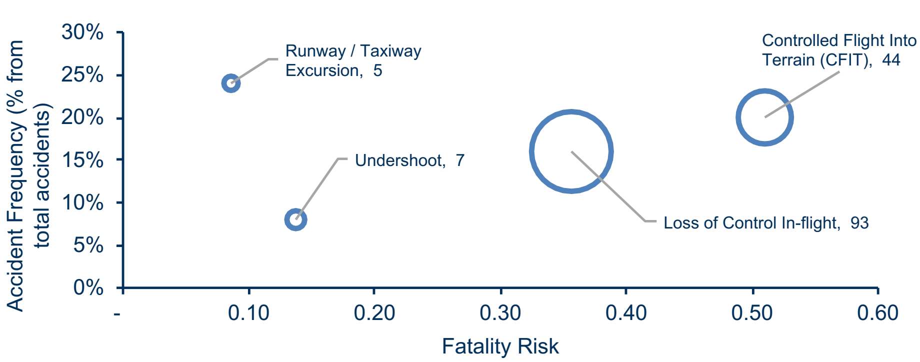
Number of Accidents per Region (2012-2016)

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 (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
53%

Threats

Meteorology:
58%

Flight Crew Errors

SOP Adherence / SOP Cross-verification:
42%

Undesired aircraft state

Vertical / Lateral / Speed Deviation:
37%

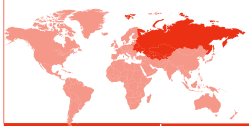
Countermeasure

Overall Crew Performance:
32%

➤ See detailed view

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

			Accident Rate*	2016	'12-'16
2016	Accident rate: 3.85		IATA Member	0.00	0.31
2012-2016	Accident rate: 3.43		Fatality Risk**	0.50	1.09
			Fatal	0.64	1.37
			Hull Losses	1.93	2.47

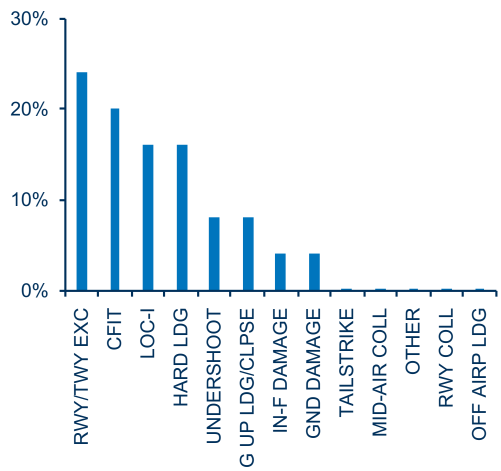


	Jet	Turboprop	
2016	2.38	10.03	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	2.17	9.37	

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

Accident Category Distribution (2012-2016)

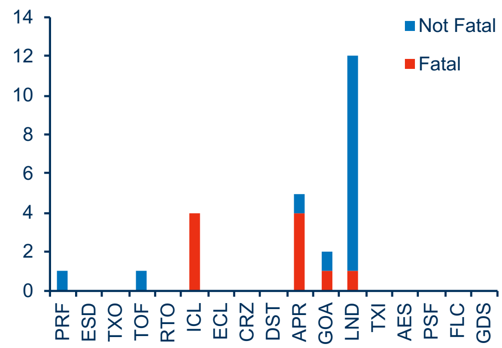
Distribution of accidents as percentage of total



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

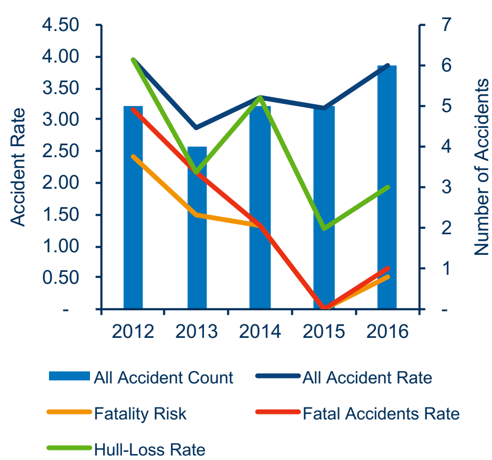
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



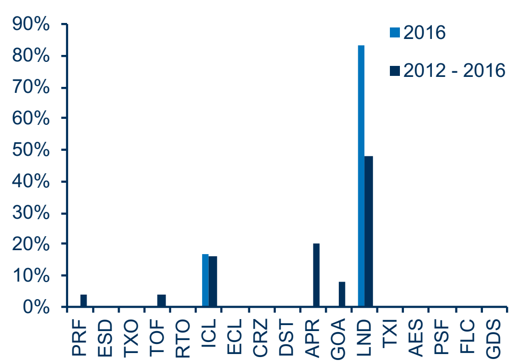
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



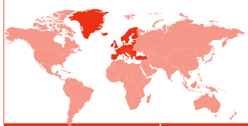
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



Europe Aircraft Accidents – Accident Count

2016	Number of accidents: 11	Number of fatalities: 2
2012-2016	Number of accidents: 76	Number of fatalities: 118



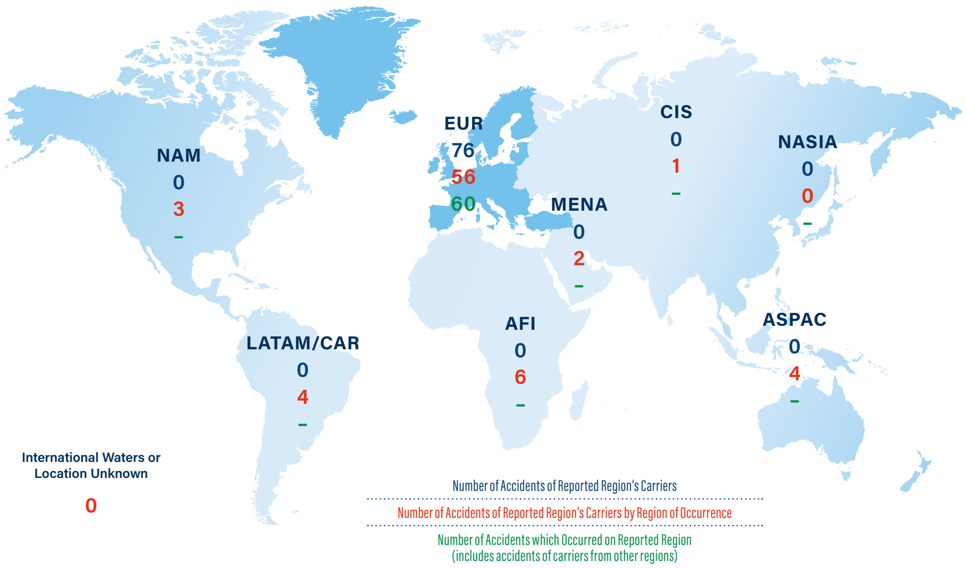
Accident Count % from Total	2016	'12-'16
IATA Member	73%	46%
Full-Loss Equivalents	9%	3%
Fatal	9%	3%
Hull Losses	18%	17%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	82%	18%	0%	82%	18%
2012-2016	82%	14%	3%	66%	34%

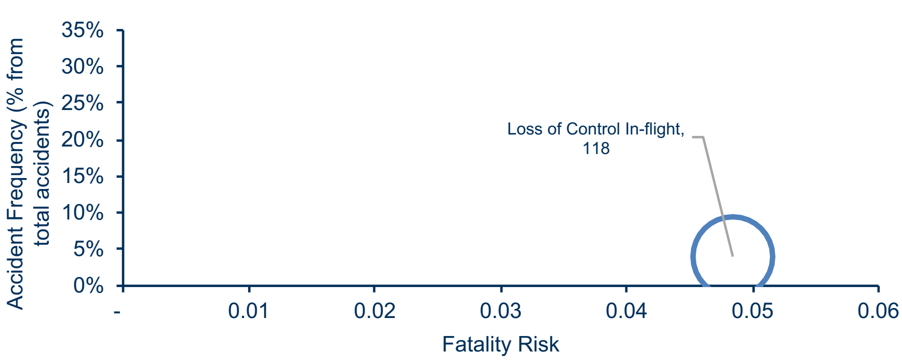
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Flight Operations:
14%

Threats

Meteorology:
30%

Flight Crew Errors

Manual Handling / Flight Controls:
36%

Undesired aircraft state

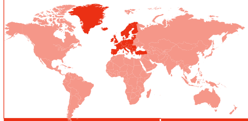
Long/floated/bounced/firm/off-center/crabbed land:
26%

Countermeasure

Overall Crew Performance:
23%

➤ See detailed view

Europe Aircraft Accidents – Accident Rate*



2016 Accident rate: 1.25
2012-2016 Accident rate: 1.84

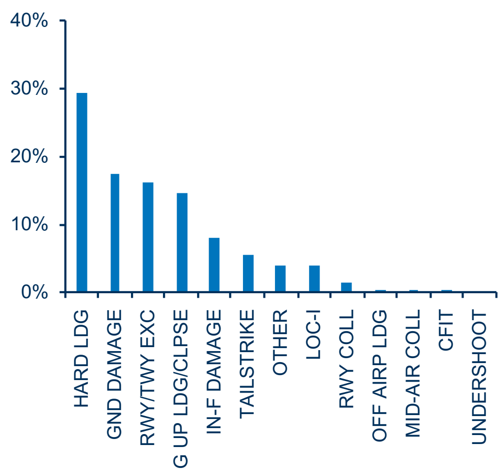
Accident Rate*	2016	'12-'16
IATA Member	1.66	1.67
Fatality Risk**	0.11	0.05
Fatal	0.11	0.05
Hull Losses	0.23	0.31

	Jet	Turboprop	
2016	1.22	1.40	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	1.47	3.61	

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

Accident Category Distribution (2012-2016)

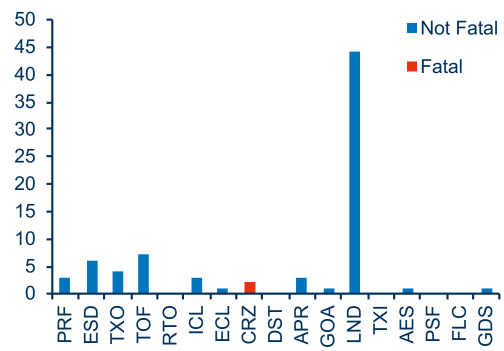
Distribution of accidents as percentage of total



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

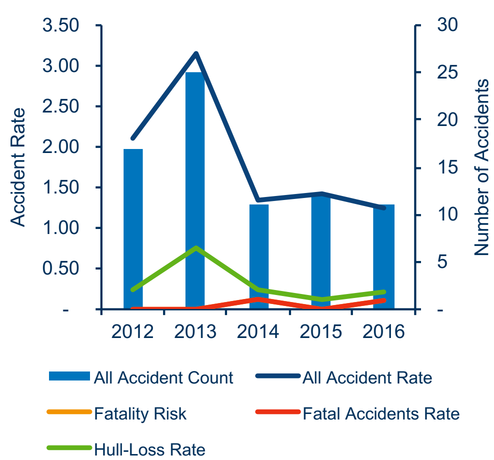
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



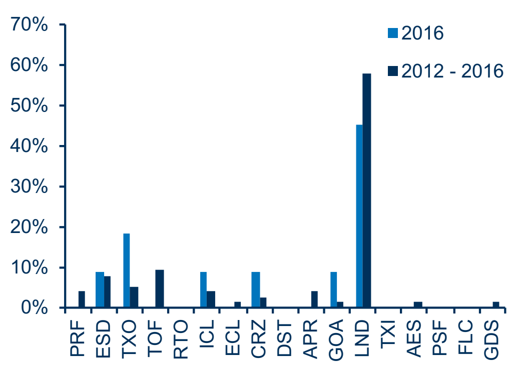
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



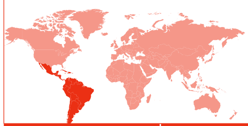
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



Latin America & the Caribbean Aircraft Accidents – Accident Count

2016	Number of accidents: 9	Number of fatalities: 76
2012-2016	Number of accidents: 33	Number of fatalities: 90



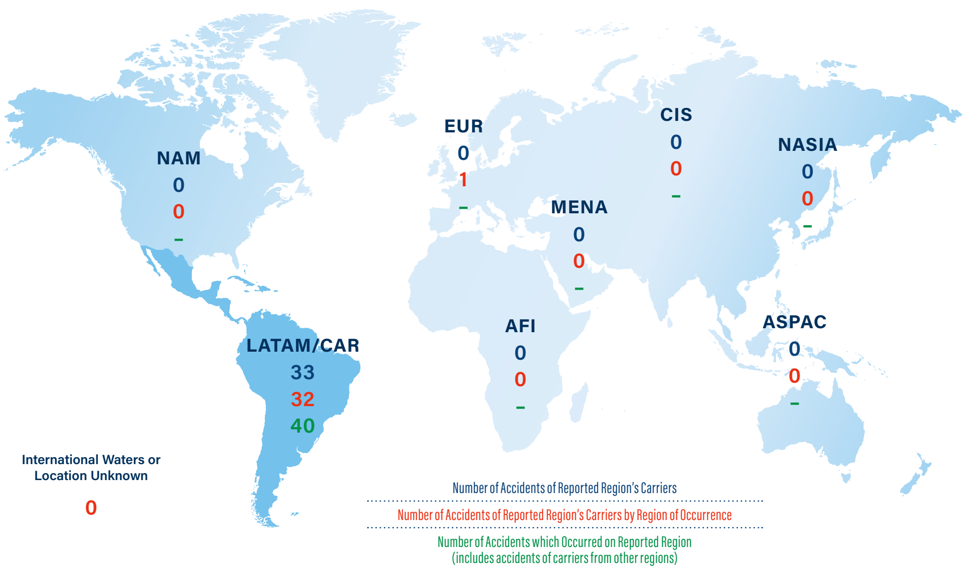
Accident Count % from Total	2016	'12-'16
IATA Member	33%	27%
Full-Loss Equivalents	20%	13%
Fatal	22%	15%
Hull Losses	22%	36%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	78%	22%	0%	78%	22%
2012-2016	82%	18%	0%	55%	45%

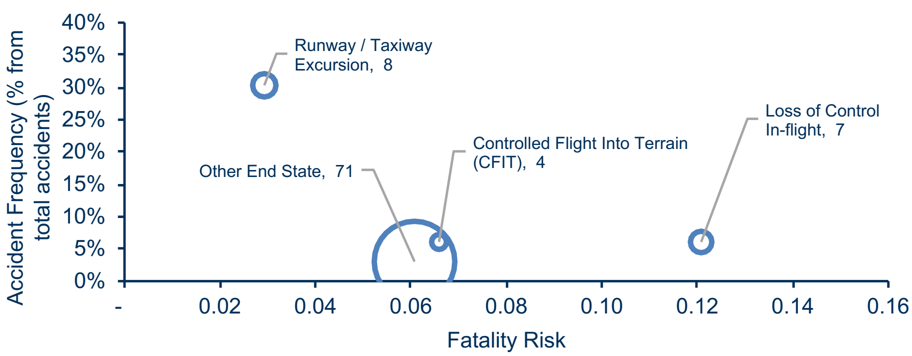
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Safety Management:
33%

Threats

Aircraft Malfunction:
46%

Flight Crew Errors

Manual Handling / Flight Controls:
13%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
17%

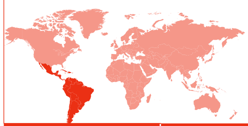
Countermeasure

Overall Crew Performance:
17%

➤ See detailed view

Latin America & the Caribbean Aircraft Accidents – Accident Rate*

2016 Accident rate: 2.80
2012-2016 Accident rate: 2.17



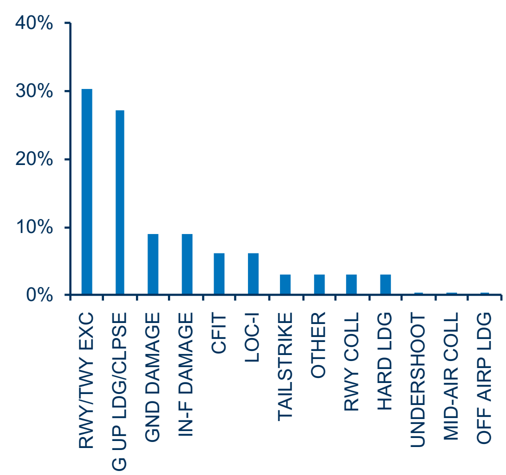
Accident Rate*	2016	'12-'16
IATA Member	1.38	0.99
Fatality Risk**	0.55	0.28
Fatal	0.62	0.33
Hull Losses	0.62	0.79

	Jet	Turboprop	
2016	2.78	2.88	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	1.56	4.10	

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

Accident Category Distribution (2012-2016)

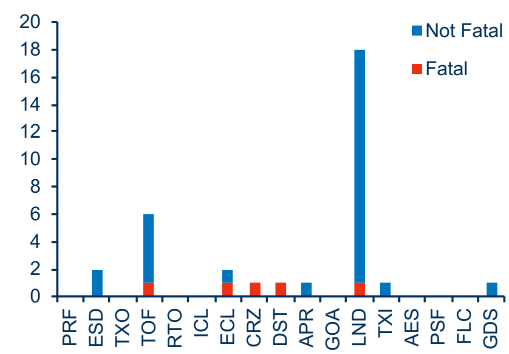
Distribution of accidents as percentage of total



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

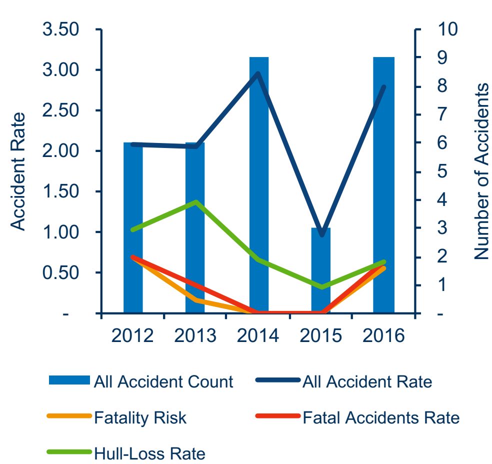
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



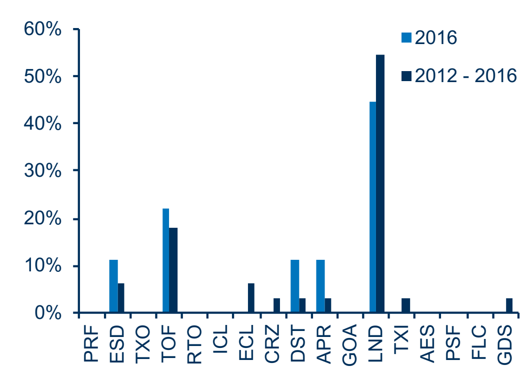
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



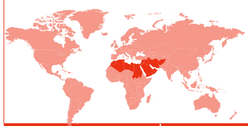
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



Middle East & North Africa Aircraft Accidents – Accident Count

2016	Number of accidents: 10	Number of fatalities: 128
2012-2016	Number of accidents: 26	Number of fatalities: 208



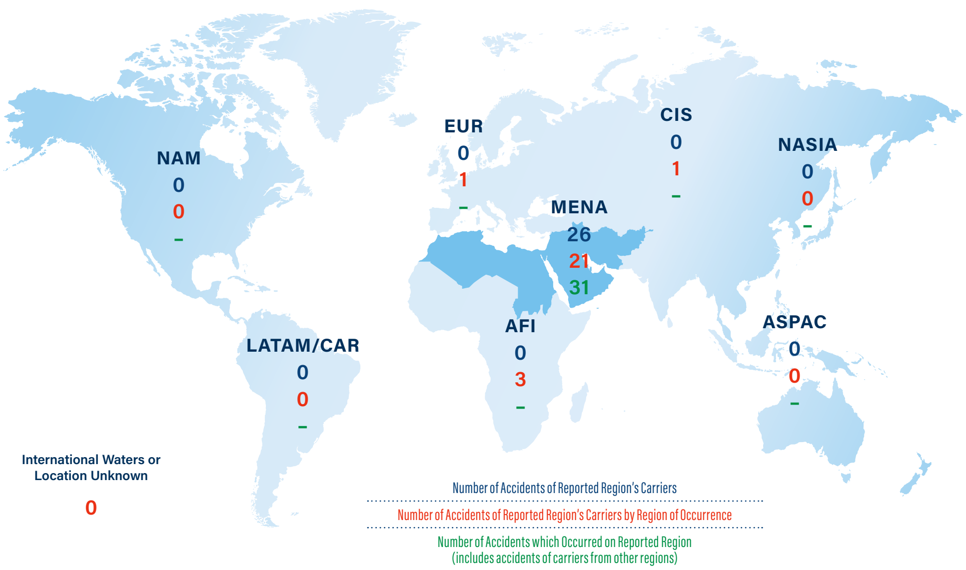
Accident Count % from Total	2016	'12-'16
IATA Member	90%	58%
Full-Loss Equivalents	20%	15%
Fatal	20%	15%
Hull Losses	40%	35%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	90%	0%	10%	90%	10%
2012-2016	96%	0%	4%	81%	19%

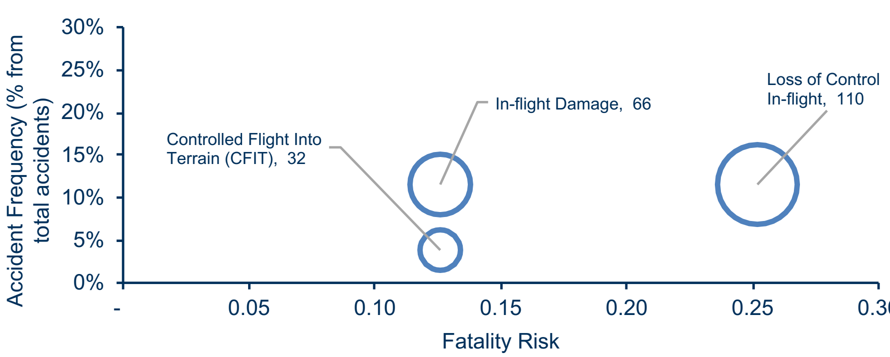
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Safety Management:
36%

Threats

Aircraft Malfunction:
36%

Flight Crew Errors

Manual Handling / Flight Controls:
32%

Undesired aircraft state

Loss of aircraft control while on the ground:
18%

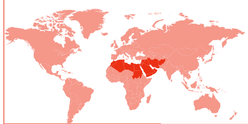
Countermeasure

Overall Crew Performance:
27%

➤ See detailed view

Middle East & North Africa Aircraft Accidents – Accident Rate*

2016	Accident rate: 5.80
2012-2016	Accident rate: 3.27



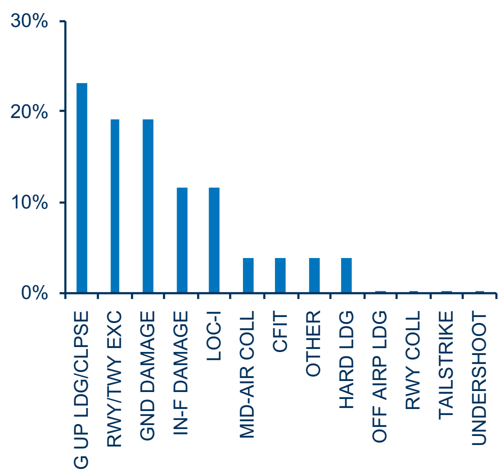
Accident Rate*	2016	'12-'16
IATA Member	5.96	2.26
Fatality Risk**	1.16	0.50
Fatal	1.16	0.50
Hull Losses	2.32	1.13

	Jet	Turboprop	
2016	5.60	8.62	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	2.86	8.33	

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

Accident Category Distribution (2012-2016)

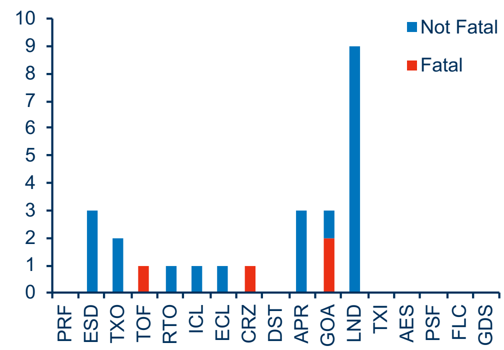
Distribution of accidents as percentage of total



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

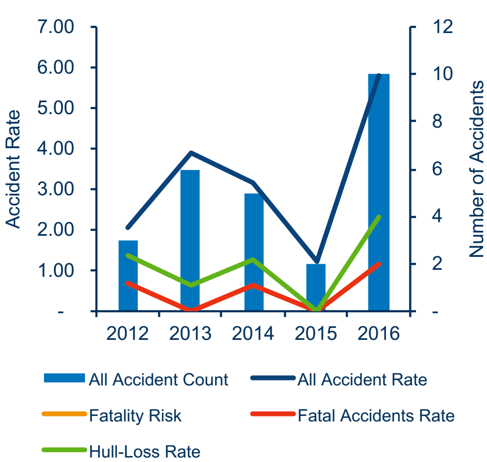
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



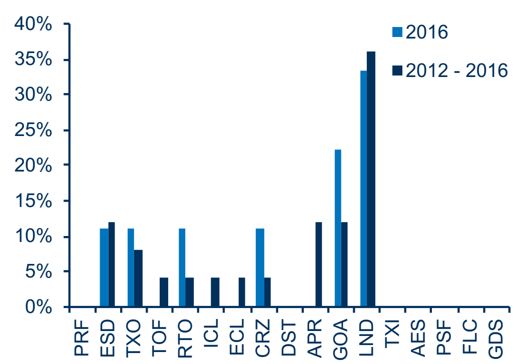
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



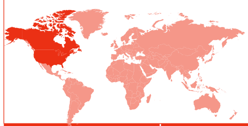
Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



North America Aircraft Accidents – Accident Count

2016	Number of accidents: 11	Number of fatalities: 1
2012-2016	Number of accidents: 69	Number of fatalities: 24



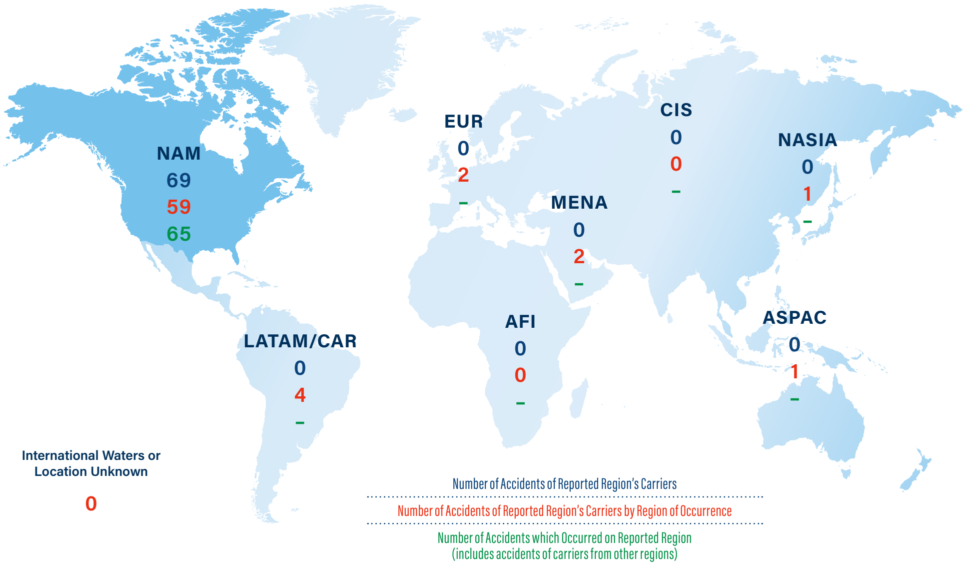
Accident Count % from Total	2016	'12-'16
IATA Member	64%	26%
Full-Loss Equivalents	9%	11%
Fatal	9%	13%
Hull Losses	36%	30%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	64%	36%	0%	73%	27%
2012-2016	68%	32%	0%	45%	55%

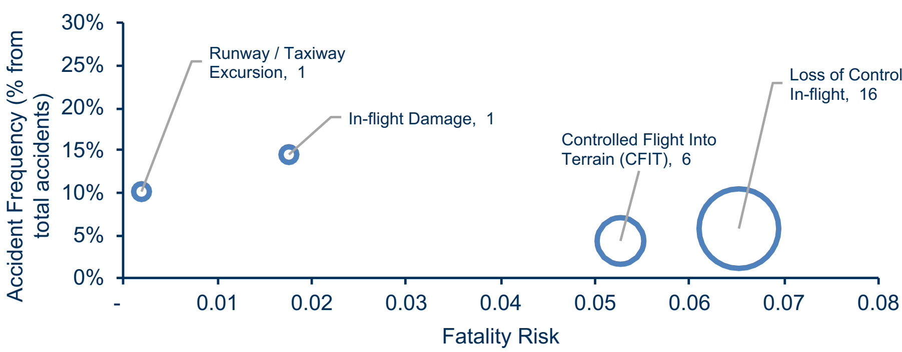
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
15%

Threats

Aircraft Malfunction:
31%

Flight Crew Errors

Manual Handling / Flight Controls:
20%

Undesired aircraft state

Vertical / Lateral / Speed Deviation:
16%

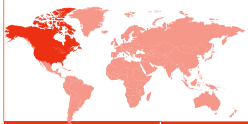
Countermeasure

Monitor / Cross-check:
9%

➤ See detailed view

North America Aircraft Accidents – Accident Rate*

2016 Accident rate: 0.94
2012-2016 Accident rate: 1.21



Accident Rate*	2016	'12-'16
IATA Member	1.58	0.89
Fatality Risk**	0.09	0.14
Fatal	0.09	0.16
Hull Losses	0.34	0.37

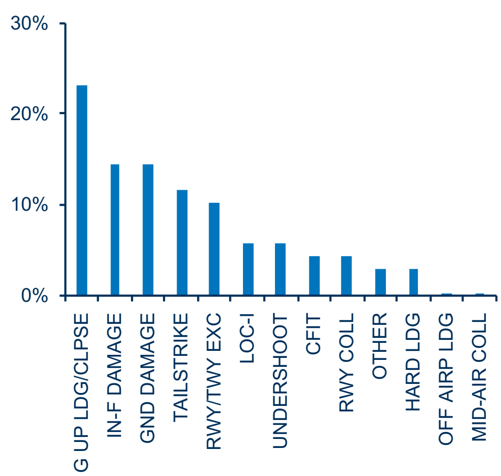
	Jet	Turboprop
2016	0.83	1.49
2012-2016	0.67	3.64

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 (2012-2016)

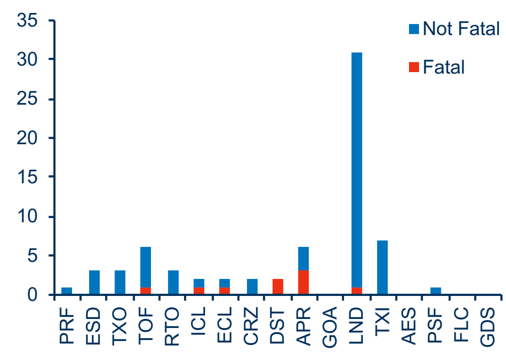
Distribution of accidents as percentage of total



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

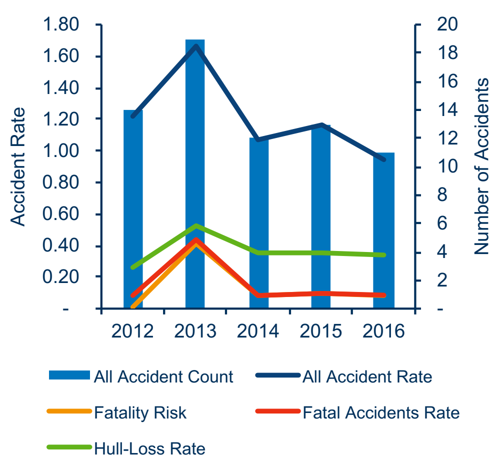
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



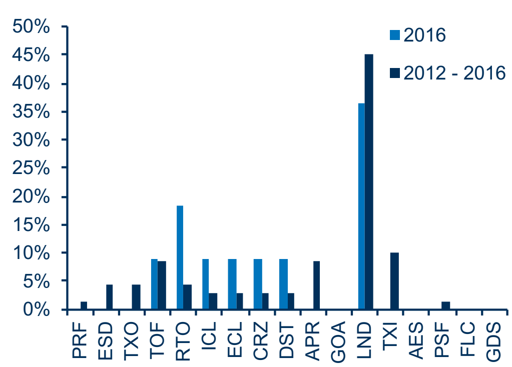
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



North Asia Aircraft Accidents – Accident Count

2016	Number of accidents: 1	Number of fatalities: 0
2012-2016	Number of accidents: 13	Number of fatalities: 91

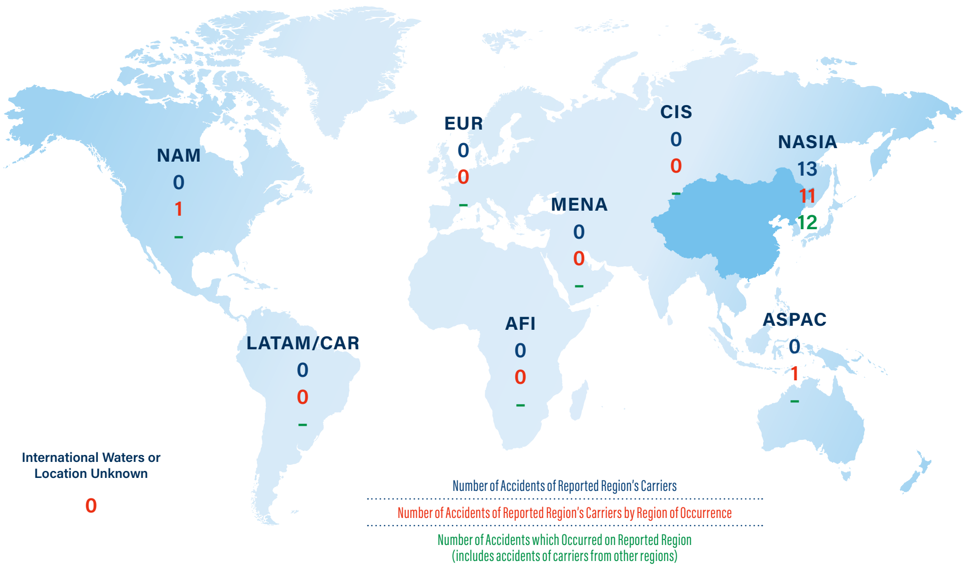
Accident Count % from Total	2016	'12-'16
IATA Member	100%	54%
Full-Loss Equivalents	0%	12%
Fatal	0%	15%
Hull Losses	0%	31%

	Passenger	Cargo	Ferry	Jet	Turboprop
2016	100%	0%	0%	100%	0%
2012-2016	77%	23%	0%	54%	46%

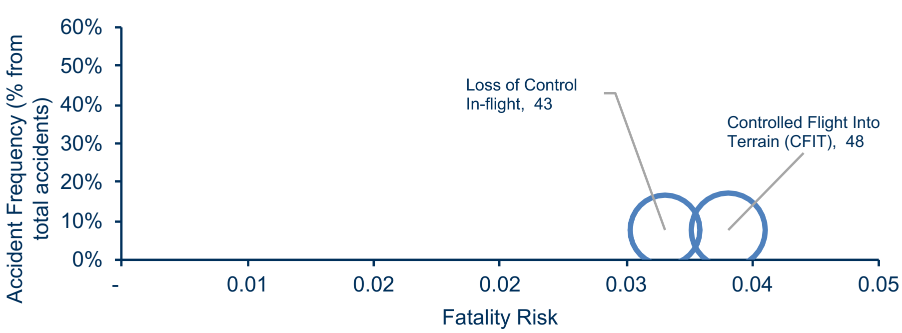
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2012-2016)

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



Accident Category Frequency and Fatality Risk (2012-2016)



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 buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Flight Ops: Training Systems:
33%

Threats

Meteorology:
58%

Flight Crew Errors

Manual Handling / Flight Controls:
67%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
33%

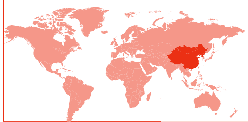
Countermeasure

Monitor / Cross-check:
67%

➤ See detailed view

North Asia Aircraft Accidents – Accident Rate*

2016 Accident rate: 0.19
2012-2016 Accident rate: 0.60



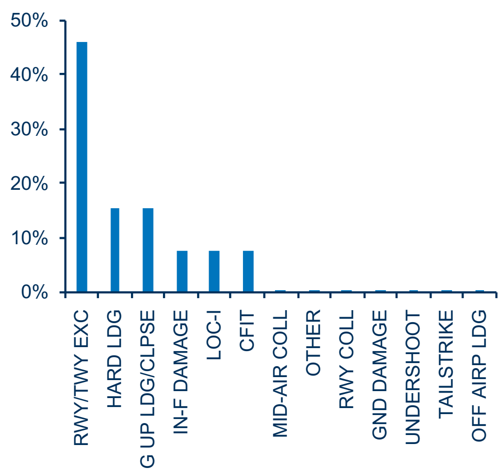
Accident Rate*	2016	'12-'16
IATA Member	0.22	0.38
Fatality Risk**	0.00	0.07
Fatal	0.00	0.09
Hull Losses	0.00	0.19

	Jet	Turboprop	
2016	0.19	0.00	Accident Rates for Passenger, Cargo and Ferry are not available.
2012-2016	0.34	8.45	

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

Accident Category Distribution (2012-2016)

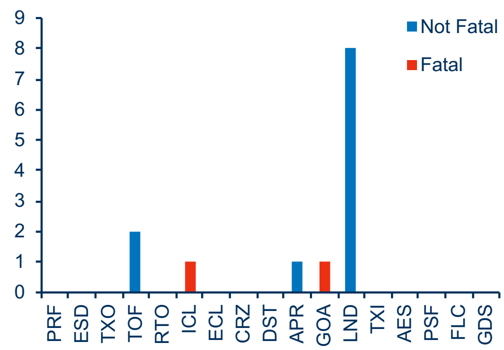
Distribution of accidents as percentage of total



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

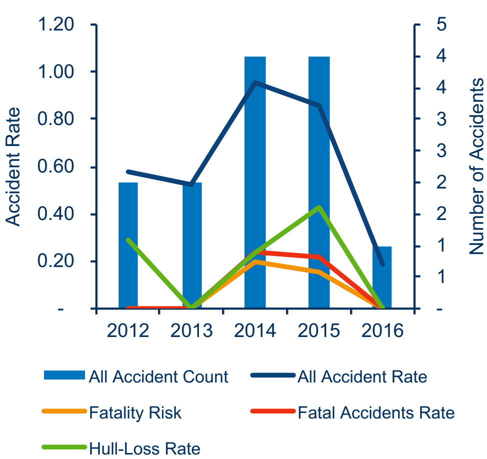
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



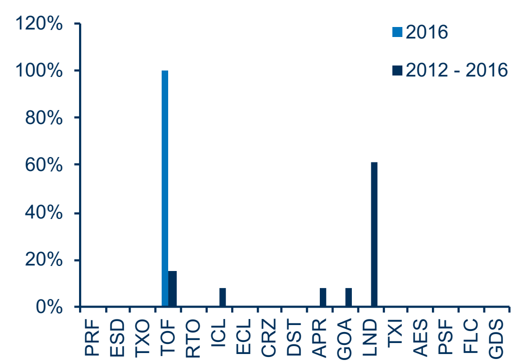
Regional Accident Rate (2012-2016)

Accidents per Million Sectors



Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



6

Analysis of Cargo Aircraft Accidents

2016 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	2,103	6	2.85	3	1.43	9	4.28
Passenger	23,177	7	0.30	26	1.12	33	1.42
Total	25,280	13	0.51	29	1.15	42	1.66

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	1,284	5	3.89	1	0.78	6	4.67
Passenger	4,303	3	0.70	13	3.02	16	3.72
Total	5,587	8	1.43	14	2.51	22	3.94

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

2016	Number of accidents: 15	Number of fatalities: 22
2012-2016	Number of accidents: 78	Number of fatalities: 123

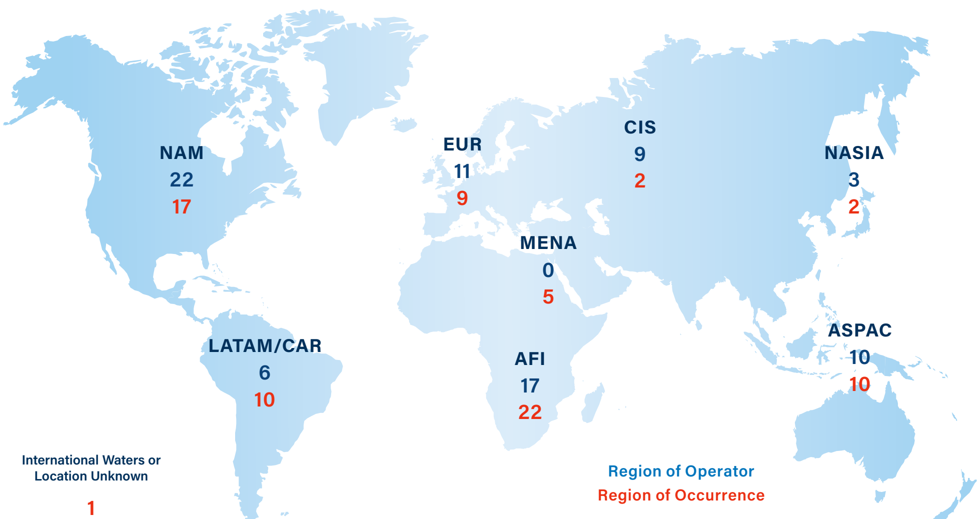
Accident Count % from Total	2016	'12-'16
IATA Member	20%	15%
Full-Loss Equivalents	36%	28%
Fatal	40%	31%
Hull Losses	73%	60%

	Jet	Turboprop
2016	60%	40%
2012-2016	37%	63%

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

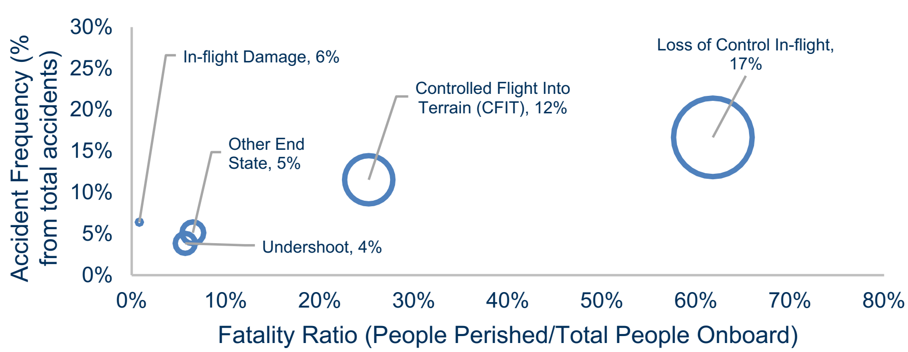
Number of Accidents per Region (2012-2016)

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 (2012-2016)



Note: Since the sector count broken down by cargo flights is not available, rates cold 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 in the cargo flights. Accident categories with no fatalities are not displayed.

Top Contributing Factors

Latent conditions

Regulatory Oversight:
33%

Threats

Aircraft Malfunction:
41%

Flight Crew Errors

Manual Handling / Flight Controls:
31%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
22%

Countermeasure

Overall Crew Performance:
16%

➤ See detailed view

Cargo Aircraft Accidents – Accident Rate*

Accident rate*: –

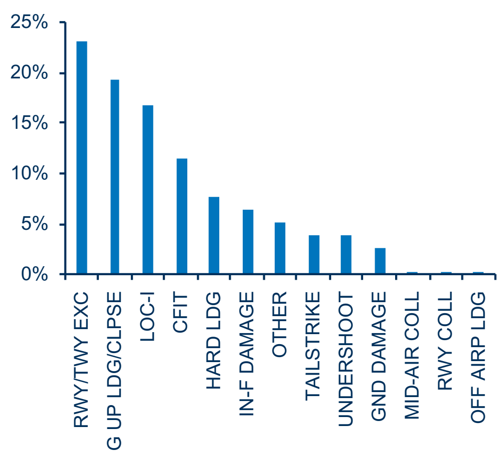
Accident Rate*	2016
IATA Member	–
Fatality Risk**	–
Fatal	–
Hull Losses	–

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 (2012-2016)

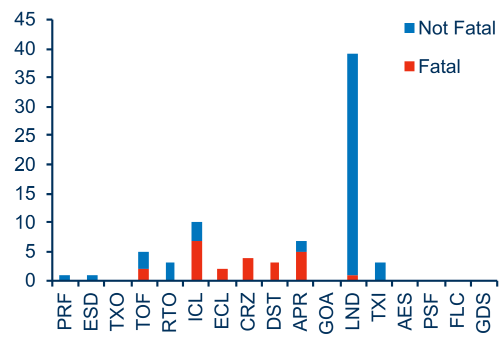
Distribution of accidents as percentage of total



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

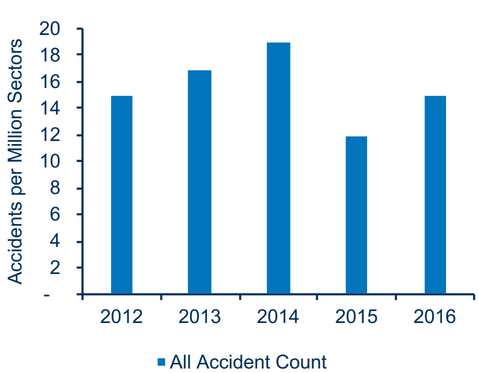
Accidents per Phase of Flight (2012-2016)

Total Number of Accidents (Fatal vs. Non-Fatal)



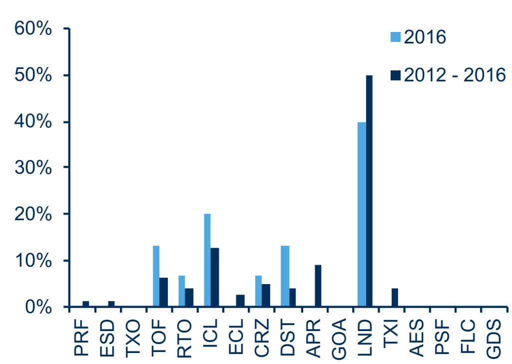
5-Year Trend (2012-2016)

See Annex 1 for the definitions of different metrics used



Accidents per Phase of Flight (2012-2016)

Distribution of accidents as percentage of total



7

Cabin Safety

CABIN SAFETY

The role of cabin crew is not solely to evacuate an aircraft in case of emergency, as almost all flights operated do not end in this manner. On every flight, cabin crew carry out numerous duties, both inside and outside the aircraft, which contribute to safe operations and prevent incidents from escalating into accidents.

While performing customer service duties as expected by the airline, a cabin crew member will always have an underlying safety aspect to their work and must remain aware of ever-changing situations inside the cabin (e.g., turbulence, unruly passengers, medical emergencies and the presence of smoke or fumes). Effective management of threats such as these will help minimize the risk of an accident occurring and/or positively influence the cabin end state.

Safety managers at airlines around the world are faced with keeping their cabin crew up-to-date with the latest changes in regulation and policy, all of which are aimed at reducing the safety risk. Furthermore, the hazards themselves evolve and change along with consumer markets and technologies.

IATA's role is to keep airlines informed of regulatory changes, best practices as well as new and emerging issues in the field of cabin safety, and to act as a resource for help.

CABIN SAFETY INITIATIVES

IATA seeks to contribute to the continuous reduction in the number and severity of incidents and accidents, as well as the costs associated with ensuring the safe operation of commercial aircraft. This is achieved through the recognition and analysis of worldwide trends as well as the initiation of corrective actions through the development and promotion of globally applicable recommended practices.

Safety promotion is a major component of Safety Management Systems (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 Cabin Operations Safety Conference enters its fourth year in 2017 and has become an established and popular venue for the exchange of ideas and education of Cabin Safety specialists: www.iata.org/cabin-safety-conference.

Image courtesy of Bombardier

IATA Cabin Operations Safety Task Force (COSTF)

The work of IATA is supported by our member airlines and delivers great results with their input. The members of COSTF are representatives from IATA member airlines who are experts in cabin safety, cabin operations, cabin safety training, accident/incident investigation; human factors and quality assurance.

COSTF meets regularly to discuss ongoing issues or concerns and to support IATA in our objectives. The mandate also includes reviewing the IOSA CAB Section 5 and the classification of cabin safety end states for the Accident Classification Task Force (ACTF).

COSTF Members (2017-2018)

Shane Constable AIR NEW ZEALAND	Alexandra Wolf LUFTHANSA
Gennaro Anastasio ALITALIA	Rosnina Abdullah MALAYSIA AIRLINES BERHAD
Brett Garner AMERICAN AIRLINES	Warren Elias QATAR AIRWAYS
Ruben Inion AUSTRIAN AIRLINES	Johnny Chin SINGAPORE AIRLINES
Catherine Chan (Vice Chair) CATHAY PACIFIC	Martin Ruedisueli (Chair) SWISS INTERNATIONAL AIR LINES
Anabel Brough EMIRATES	Carlos Mouzaco Dias TAP PORTUGAL
Jonathan Jasper (Secretary) IATA	Mary Gooding VIRGIN ATLANTIC AIRWAYS

IATA Cabin Operations Safety Best Practices Guide (3rd Edition)

The IATA Cabin Operations Safety Best Practices Guide was first issued in 2014. It includes best practice guidance on specific issues of concern to the industry in the following areas:

- Safety Management Systems
- Fatigue Risk Management
- Cabin Crew, complement, competency, training and standards
- Communication
- Safety Policies and Procedures
- Special Category Passengers
- Safety Equipment and Systems
- Health and Medical Care onboard
- Food and Hygiene

A full review and update of the Guide was carried out and the 3rd Edition was released in January 2017.

This and other guidance materials are available at: www.iata.org/cabin-safety.

Health and Safety Guidelines – Passengers and Crew

IATA creates guidelines regarding the health and safety of passengers and crew, including on suspected communicable disease:

- General guidelines for cabin crew
- Cabin announcement scripts to be read by cabin crew to passengers prior to arrival
- Universal precaution kit.

These guidelines and many others are available at: www.iata.org/health.

IOSA AND CABIN OPERATIONS SAFETY

The IATA Operational Safety Audit (IOSA) standards manual 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

For more information on IOSA and to download the latest version of the IOSA Standards Manual (ISM), go to:
www.iata.org/iosa.

STEADES™

IATA Global Aviation Data Management (GADM) includes a business intelligence tool called the Safety Trend Evaluation, Analysis and Data Exchange System (STEADES™) that provides access to data, analysis and global safety trends on established key performance indicators in comparison to worldwide benchmarks. STEADES™ enhances safety for IATA member airlines.

Examples of STEADES™ cabin safety analysis include:

- Inadvertent Slide Deployments (ISDs)
- Fire, smoke and fume events
- Passenger and cabin crew injuries
- Turbulence injuries or incidents
- Unruly passenger incidents
- Operational pressure

For more information on STEADES™, please visit
www.iata.org/steades.

ACCIDENTS

This section of the Safety Report 2016 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 (See Annex 1 of this report) are included in this analysis.

The following definitions apply to the end states in this section:

Abnormal Disembarkation: Passengers and/or crew exit the aircraft via boarding doors (normally assisted by internal aircraft or exterior stairs) after a non-life-threatening and non-catastrophic aircraft incident or accident and when away from the boarding gates or aircraft stands (e.g., on a runway or taxiway).

Evacuation (land): Passengers and/or crew evacuate the aircraft via escape slides/slide rafts, doors, emergency exits, or gaps in the fuselage; usually initiated in life-threatening and/or catastrophic events.

Evacuation (water): Passengers and/or crew evacuate the aircraft via escape slides/slide rafts, doors, emergency exits, or gaps in the fuselage and into or onto water.

Hull Loss/Nil Survivors: Aircraft impact resulting in a complete hull loss with no survivors.

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.

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 end result of an accident and highlight where cabin crew may have had a positive impact on the outcome and survivability of the aircraft occupants.

Cabin End States

	2016	2014-2016
Total 'Passenger-only' Accidents	49	161

The total number of accidents in 2016 is 49 compared to 56 in 2015 and is below the average accident count of 63.6 passenger accidents per year in the 2011 to 2015 period. The number of sectors for passenger flights was not available for analysis, therefore an accident rate could not be calculated.

	2014-2016					
	Normal Disembarkation	Abnormal Disembarkation	Land Evacuation	Water Evacuation	Hull Loss/ Nil survivors	Total
All	57	22	64	1	9	153*
IATA Member	29	7	20	1	4	61
IOSA-Registered	37	10	23	1	5	76
Fatal	0	0	1	1	9	11
Hull Loss	2	3	22	1	9	37
Jet	48	12	36	0	6	102
Turboprop	9	10	28	1	3	51

*Note: the difference between this value and the total number of passenger accidents is due to accidents with insuficient information in order to determine the Cabin End State.

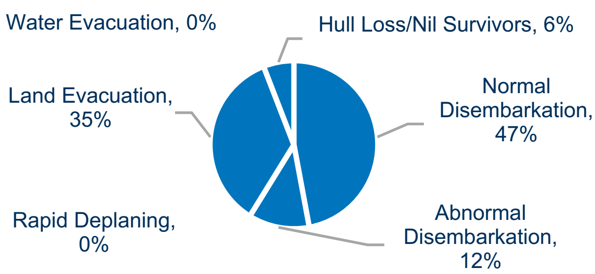
The above table shows the total count of each type of Cabin End State classification and is broken down by operator status, severity of damage to aircraft and aircraft type.

Of the 153 total accidents in the three year period 2014-2016, 37 hull losses were recorded; of these nine were not survivable. This demonstrates that, in the remaining 76% of hull loss accidents, cabin crew actions likely had an impact on survivability for passengers and crew.

In 99% of survivable accidents, passengers disembarked the aircraft onto land. Furthermore, in 54% of these cases, passengers disembarked normally onto steps or a passenger boarding bridge at an airport. Only 1% of survivable accidents resulted in an evacuation onto water.

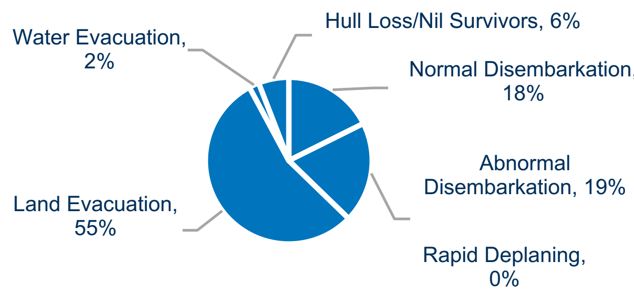
Cabin End States (cont'd)

Cabin End States (Jet)



47% of accidents on jet aircraft ended with a normal disembarkation and 35% resulted in an evacuation on land. This is partly due to the larger size of the aircraft involved, as a land evacuation uses evacuation systems such as slides. Where the need to leave the aircraft is not urgent, it is preferred to use normal disembarkation methods to protect the occupants from the risks involved in using evacuation systems.

Cabin End States (Turboprop)



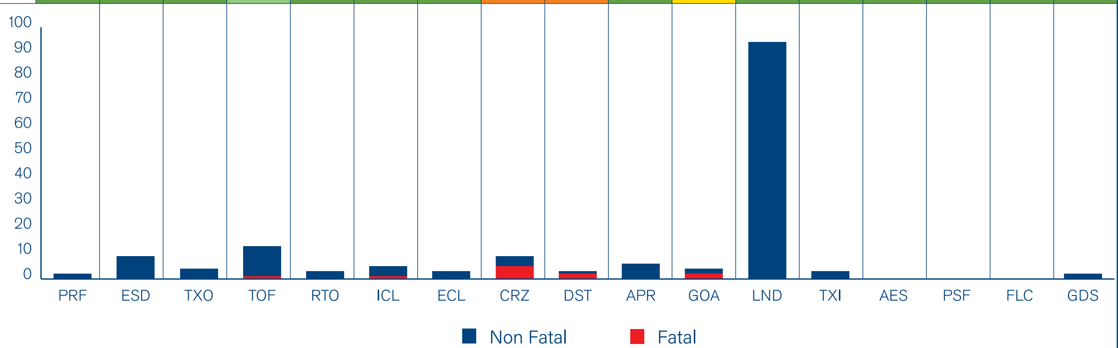
With turboprop aircraft, 55% of accidents resulted in an evacuation on land, whereas 19% resulted in abnormal disembarkation.

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

Cabin End States (cont'd)

Cabin End States per Phase of Flight

	PRF	ESD	TXO	TOF	RTO	ICL	ECL	CRZ	DST	APR	GOA	LND	TXI	AES	PSF	FLC	GDS
Total Accidents	2	9	4	13	3	5	3	9	3	6	4	94	3	0	0	0	2
Normal Disembarkation	100%	67%	25%	31%	0%	80%	100%	44%	33%	50%	25%	27%	0%	0%	0%	0%	100%
Abnormal Disembarkation	0%	11%	25%	15%	0%	0%	0%	0%	0%	17%	0%	18%	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%	11%	25%	31%	100%	0%	0%	0%	0%	33%	50%	51%	100%	0%	0%	0%	0%
Water Evacuation	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hull Loss/Nil Survivors	0%	0%	0%	8%	0%	0%	0%	56%	67%	0%	25%	0%	0%	0%	0%	0%	0%



Total Accidents: 160*

* 1 accident occurred at an unknown phase of flight
Note: please refer to Annex 1 for definition of each phase of flight

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 2014-2016, while the table and chart below give some additional contextual information.

Landing is by far the most critical stage for cabin crew to be prepared for an accident. Other important phases are Engine Start and Take-Off.

During the take-off and landing stages cabin crew are positioned at their crew seats and ready to act. This table shows the importance of cabin crew mental preparedness for an evacuation at these two most critical stages of flight.

Cabin End States (cont'd)

Accident End States and Cabin End States

	Total	Normal Disembarkation	Abnormal Disembarkation	Rapid Deplaning	Land Evacuation	Water Evacuation	Hull Loss/ Nil Survivors
Hard Landing	30	21	3	0	6	0	0
Runway / Taxiway Excursion	28	1	5	0	22	0	0
Gear-up Landing / Gear Collapse	28	1	5	0	22	0	0
In-flight Damage	20	14	2	0	3	0	1
Ground Damage	14	11	1	0	2	0	0
Runway Collision	7	1	4	0	2	0	0
Loss of Control In-flight	6	0	0	0	1	1	4
Other End State	5	1	0	0	2	0	2
Tailstrike	5	4	1	0	0	0	0
Undershoot	5	1	1	0	3	0	0
Controlled Flight Into Terrain (CFIT)	4	1	0	0	1	0	2
Mid-air Collision	1	1	0	0	0	0	0
Off Airport Landing / Ditching	0	0	0	0	0	0	0

This table shows the type of accidents and their associated Cabin End State and provides operators with useful information for cabin crew training exercises. It lists the accident types in order of frequency and reinforces that the majority of accidents happened on landing.

Of 86 accidents which occurred during or soon after landing (hard landing, runway/taxiway excursion and gear up landing/ gear collapse), 58% resulted in a land evacuation, whereas 27% resulted in normal disembarkation and 15% in abnormal disembarkation.

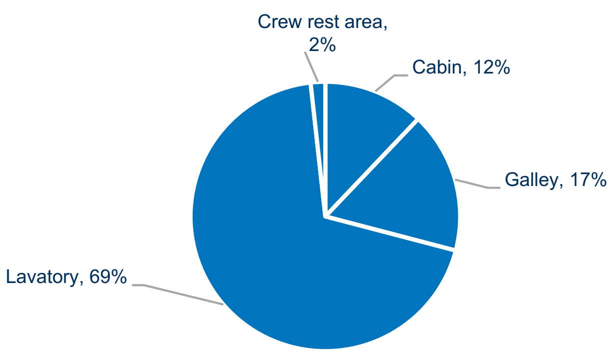
The STEADES database is comprised of de-identified safety incident reports from over 198 participating airlines throughout the world, with an annual reporting rate now exceeding 200,000 reports per year. As the submission of incident data is not complete for the final quarter of 2016, the date range used for all reports in this section is Q4 2015 - Q3 2016 inclusive. During these 12 months, a total of 205,614 reports were submitted and collated into STEADES, which equates to 1 report per 62 STEADES flights. There were 52,306 incident reports related to cabin operations, which is 25% of all STEADES incident reports and equates to 1 report per 243 STEADES flights.

Currently, the greatest areas of attention are fire and smoke incidents and the carriage and use of Portable Electronic Devices (PEDs) and lithium batteries in the cabin.

Fire and Smoke incidents

There were 4,223 reports relating to fire and smoke reports in the cabin. Figure 1 below shows the location of smoke and fire reports in the cabin.

Figure 1 – Location of smoke and fire



Of all the smoke and fire reports identified, 69% (2,921) occurred in a lavatory, however this includes 1,653 reports of passenger smoking in lavatories and 905 reports of false alarms caused by the use of aerosols, perfumes or insecticide sprays. After removing all passenger smoking and aerosols events from the dataset there were 1,574 reports, the galley areas become the biggest area of focus. Figure 2 below shows the location of these remaining reports.

Figure 2 – Location of incidents excluding passenger smoking

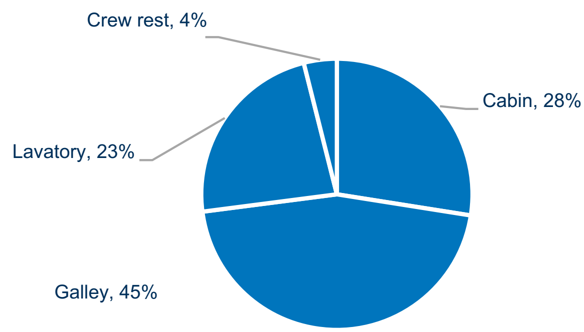
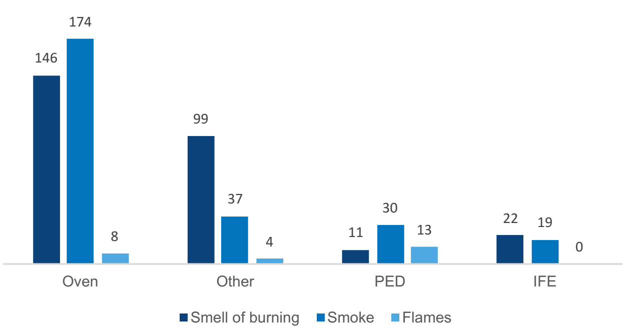


Figure 3 shows 563 reports which indicated smoke, flames or overheating, with source identified.

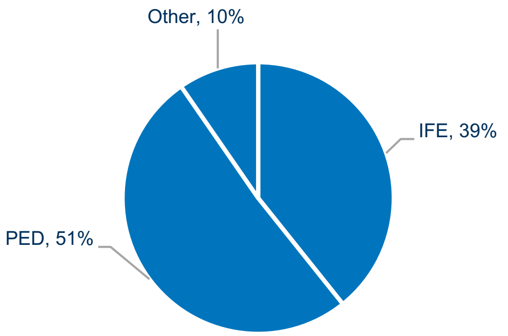
- IFE- In Flight Entertainment System
- PED – Portable Electronic Device
- Other includes all galley equipment other than ovens, such as water heaters, fridges and galley chilling systems, as well as other sources of ignition in the cabin and passenger belongings.

Figure 3 – Source of smoke and fire



Within the cabin area excluding the galleys, 39% of reports (53) related to In-flight Entertainment (IFE) systems, while 51% (69) relate to Portable Electronic Devices (PEDs). This includes PEDs provided by the operator for use in the cabin such as in-flight entertainment or onboard service/sales devices, but predominantly relates to passengers own devices. Throughout all reports, most of the incidents involving flames related to PEDs in the cabin. Figure 4 shows the source of smoke and fire excluding the galleys.

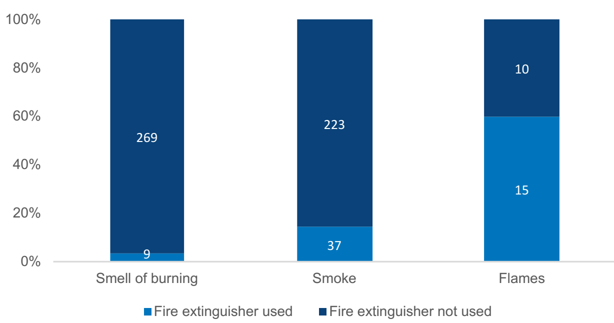
Figure 4 – Cabin smoke and fire incident excluding the galleys



Cabin crew training includes a variety of different firefighting techniques and awareness of different methods to be used according to each situation. For example, in the case of an overheating electronic device, the objective is to cool the device with water before the lithium battery cells ignite. In the case of smoke from an oven, the situation will often be resolved by switching off the power supply and closing the oven leaving it to cool. As a result, fire extinguishers are used in only a small minority of incidents.

In all 563 incidents cabin crew were able to deal with the potential and actual fire situation to a satisfactory conclusion. Overall fire extinguishers were only used in 11% of all incidents (61), the following graph identifies when a fire extinguisher was used and type of event.

Figure 5 – Use of extinguisher



Portable Electronic Devices (PEDs) and Lithium Batteries in the cabin

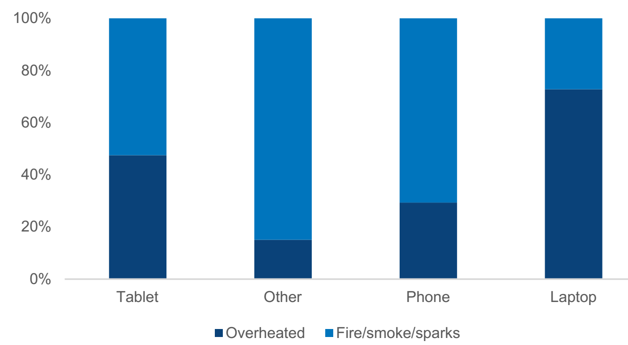
Passengers and crew carry a multitude of PEDs powered by lithium batteries and the majority of flights pass without incident. Operators might also carry many devices powered by lithium batteries for use on board aircraft, such as retail sales computers, electronic flight bags and tablet devices for In-Flight Entertainment.

Damaged or faulty lithium batteries pose a risk of ignition and PEDs require careful handling to ensure their continued safety. PEDs may become damaged through mishandling such as dropping or crushing. Additionally faulty manufacturing processes may impact reliability and safety of batteries. This results in increased risks of incidents on board aircraft if not carefully managed.

IATA issued guidance to operators in the handling of lithium battery fires in the cabin in 2008. This guidance has been regularly updated and has been fully incorporated into IATA's Cabin Operations Safety Best Practices Guide.

There were 1,565 reports related to PEDs and Lithium Batteries in the cabin between Q4 2015 and Q3 2016. 4% (70) of them resulted in overheat or ignition of a PED. Figure 1 shows the breakdown of all incidents by device type reported in relation to overheating or ignition of PEDs.

Figure 1 – Incidents by device type



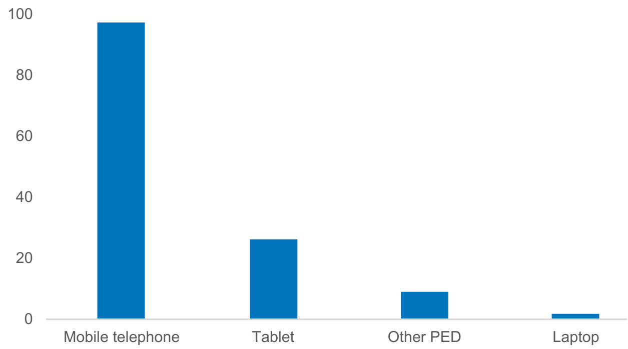
Reports of overheating devices were identified and managed by cabin crew before becoming a fire, sparks or smoke incident.

The category "Other" includes devices such as electronic cigarettes and power bank devices and were generally not in use and stowed inside passenger cabin baggage when the incident occurred which lead to more fire/smoke incidents as the device went from thermal runaway to ignition. Whereas, tablets, laptops and mobile telephones are generally more accessible to the passenger and therefore had higher chance of being detected and dealt with early during the overheat stage resulting in less fire/smoke reports.

Incidents (cont'd)

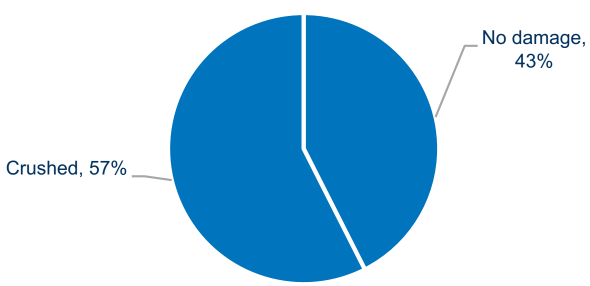
Smaller PEDs can easily become lost during flight and unless stowed safely, may fall down between seats or into seat mechanisms. A total of 134 incidents during this time period were found in STEADES database relating to devices lost in seats. Figure 2 shows the breakdown of devices lost in seats.

Figure 2 – Devices lost in seats



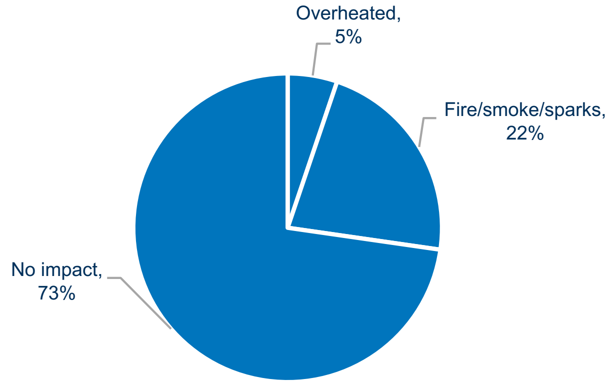
57% (77) of devices which fell into seat mechanisms became crushed when the seat was moved. 78% (60) of reports the seating class was able to be identified, 95% (57) of these occurred in first/business class where the PEDs got caught in the seat mechanism. Airlines typically have procedures for dealing with lost PEDs in seats, passengers should be made aware of what to do if they suspect their PEDs has been lost in the seat. Figure 3 shows the split between crushed PEDs verses those that were lost and not damaged.

Figure 3 – Outcome of devices lost in seats



Of the devices crushed in seats 5% (4 PEDs) overheated and 22% (17 PEDs) emitted fire/smoke/sparks within the seat mechanism as shown in Figure 4.

Figure 4 – Outcome of devices crushed in seats



Overall summary

Cabin crew have successfully managed and subsequently reported all of the incidents contained in this report using safety systems, equipment and procedures determined and provided by airlines. Effective management of cabin safety incidents such as these requires realistic and adaptable procedures, high quality training, risk awareness and confidence with Safety Management Systems. IATA continues to work closely with both member and non-member airlines to educate, inform and share knowledge and information on cabin safety issues worldwide through initiatives like the IATA Cabin Operations Safety Conference and IATA Cabin Operations Safety Taskforce.

More detailed analysis and information on both Cabin Fires and PEDs will be available to IATA STEADES members on the GADM STEADES website in May 2017.

8

Report Findings and IATA Prevention Strategies

TOP FINDINGS, 2012-2016

Of the 375 accidents between ‘12 and ‘16:

- 31% involved IATA members
- 15% were fatal
- 76% involved passenger aircraft, 21% involved cargo aircraft and 3% involved ferry flights.
- 53% involved jet aircraft and 47% involved turboprops
- 35% resulted in a hull loss
- 65% resulted in a substantial damage
- 54% occurred during landing
- 25% of the fatal accidents occurred during approach.

Top 3 Contributing Factors

Latent conditions (deficiencies in...)	1. Regulatory oversight 2. Safety management 3. Flight operations : Training Systems
Threats (Environmental)	1. Meteorology 2. Wind/Windshear/Gusty wind 3. Airport facilities
Threats (Airline)	1. Aircraft malfunction 2. Gear/tire 3. Maintenance events
Flight crew errors relating to latent conditions (deficiencies in...)	1. Manual handling/ flight controls 2. SOP adherence/ cross-verification 3. Failure to go around after destabilized approach
Undesired aircraft states	1. Long, floated, bounced, firm, off-centerline or crabbed landing 2. Vertical/lateral/speed deviation 3. Unstable approach
End states	1. Runway excursion 2. Gear-up landing/gear collapse 3. Hard Landing

PROPOSED COUNTERMEASURES

Every year, the ACTF 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 a particular country, or involve performance of front line personnel, such as pilots or ground personnel. They are valid for accidents involving both Eastern and Western-built jet and turboprop aircraft.

Based on statistical analysis, this section presents some countermeasures that can help airlines enhance safety, in line with the ACTF analysis of all accidents between 2012 and 2016.

The following tables present the top five countermeasures which should be addressed along with a brief description for each.

The last column of each table presents the percentage of accidents where countermeasures could have been effective, according to the analysis conducted by the ACTF.

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 or their own errors during operations

Countermeasures for other areas, such as ATC, ground crew, cabin crew or maintenance staff, are important but are not considered at this time.

COUNTERMEASURES FOR THE OPERATOR AND THE STATE

Subject	Description	% of accidents where counter-measures could have been effective (2012-2016)
Regulatory oversight by the state of the operator	States must be responsible for establishing a safety program, in order 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	**26%**
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.	**11%**

COUNTERMEASURES FOR FLIGHT CREWS

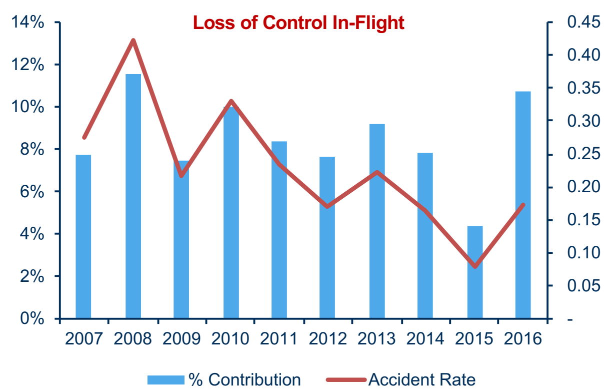
Subject	Description	% of accidents where counter-measures could have been effective (2012-2016)
Overall crew performance	Overall, crew members should perform well as risk managers. Includes flight, cabin, and ground crew as well as their interactions with ATC.	**22%**
Monitor/ cross-check	Crew members should actively monitor and cross-check flight path, aircraft performance, systems and other crew members. Aircraft position, settings and crew actions are verified.	**15%**
Contingency management	Crew members should develop effective strategies to manage threats to safety.	**8%**
Leadership	Captain should show leadership and coordinate flight deck activities. First Officer is assertive when necessary and is able to take over as the leader.	**6%**
Captain Should Show Leadership	In command, decisive and encourages crew participation.	**5%**
FO is assertive when necessary	FO speaks up and raises concerns.	**3%**

LOSS OF CONTROL IN-FLIGHT

Background:

The generally high reliability and usefulness of automated systems poses the question of whether the high amount of flight hours spent in fully automated flight is responsible for pilots being increasingly reluctant to revert to manual flying skills when needed. While aircraft are highly automated, the automation is not designed to recover an aircraft from all unusual attitudes. Therefore, flight crews must still be capable of manually operating the aircraft, especially in edge-of-the-envelope situations.

Flight crews are seemingly more apprehensive about manually flying their aircraft or changing the modes of automation when automated systems fail, when aircraft attitudes reach unusual positions, or when airspeeds are not within the appropriate range. This is due in no small part to not fully understanding what level of automation is being used or the crew's need to change that level due to the level of automation being degraded for a given reason. The graph below indicates the percentage of all accidents that were Loss of Control In-flight (LOC-I) over the past ten years. The discussion below focuses on a 5-year period.



Discussion:

The last five years have seen a total of 30 LOC-I accidents (27 involved fatalities), with an average of approximately six LOC-I accidents per year. Turboprop aircraft contributed to 63% of the accidents.

The accident rate for the 5-year period was of 0.16 LOC-I accidents per million sectors. The breakdown is 0.07 for jets and 0.56 for turboprops.

These accidents come from a variety of scenarios and it is difficult to single out the most critical scenario. However, looking at accident data, LOC-I is often linked to an operation of the aircraft well below stall speed. Even with fully protected aircraft, stall awareness and stall recovery training, as well as approach to stall recovery training, needs to be addressed on a regular basis.

Weather is also a key contributing factor to LOC-I accidents, with 36% of loss of control accidents having occurred in degraded meteorological conditions, in most of the cases involving thunderstorms and icing.

It is recommended that airline training departments pay attention to the contents of the Upset Recovery Toolkit, which is still valid and which contains very useful information. Upset recovery training - as with any other training - largely depends on the skills and knowledge of the instructor. It is therefore recommended that the industry place a particular emphasis on instructor training.

Upset recovery training, aerobatics and unusual attitude training included as part of an operator's flight crew training syllabus gives crew a chance to experience potentially dangerous situations in a safe and controlled environment, which better prepares them if they should encounter a similar situation while flying on the line. Regrettably, current flight simulator technology is limited in how accurately it can reproduce these scenarios.

Somatogravic illusion (the feeling where the perceived and actual acceleration vectors differ considerably) can create spatial disorientation and lead to catastrophic events such as LOC-I. Training is available to assist crews facing spatial disorientation situations. Simulator training may be of limited value for somatogravic illusions. The simulator is an illusion already so may be unrepresentative if we attempt to reproduce such illusions.

In modern aircraft, failure of a relatively simple system (e.g., radio altimeter) may have a cascade effect that can result in a catastrophic outcome. Crew training should emphasize solving complex, cascading failures that originate from a single source.

Automation is a tool that can be helpful to flight crew, however it is never a replacement for the airmanship skills required to operate the aircraft. Manual Handling/Flight Controls was a contributing factor in 36% of the LOC-I accidents in the 2012-2016 period. Training for scenarios that could lead to an upset (e.g. low-energy approaches, engine failures, etc.) must be continuously reinforced to address areas of safety concern, as well as the usual training protocols which achieve a baseline proficiency in aircraft handling.

Recommendations to Operators:

Operators are encouraged to follow up on current research activities, such as the SUPRA-Project (Simulation of Upset Recovery in Aviation) by NLR/TNO in The Netherlands and activity by the International Committee for Aviation Training in Extended Envelopes (ICATEE), established by the Flight Simulation Group of RAeS. ICAO and SkyBrary also have materials dealing with LOC-I.

Airlines should consider the introduction of upset recovery training, aerobatic training or other unusual attitude recovery training into their syllabus to better prepare flight crews for similar events in routine operations. Training should be designed to take pilots to the edge of the operating envelope in a safe environment so that they are better prepared to deal with real-life situations.

Training syllabi should be updated to include abnormal events that flight crew may routinely face (e.g., stalls and icing) as well as conventional training such as engine failure on take-off.

Operators should consider incorporating procedures to allow for manual flying of the airplane in line operations, under some circumstances. Such operations should be encouraged to get flight crews comfortable with manual control and to exercise these skills on a regular basis. The FAA SAFO 13002 Manual

Flying Skills outlines recommendations that include all phases of operations: initial, recurrent, initial operation experience, and operator guidance for "Line Operations when appropriate". Efforts to restore and maintain manual flying skills must be comprehensive and ongoing. Periodic simulator training should include unusual attitude exercises that are realistic to include extremes of center of gravity, weight, altitude, and control status.

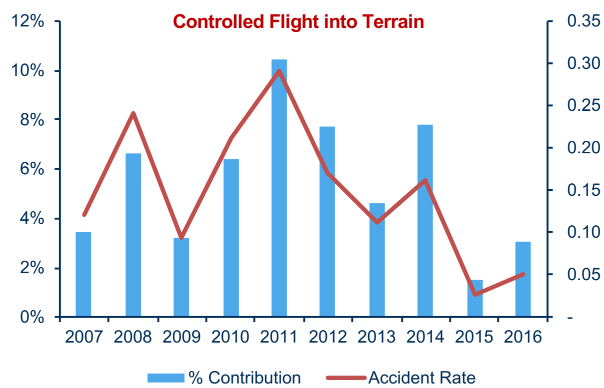
Operators should be aware of limitations of simulators to represent conditions out of the flight envelope as they have not been calibrated against flight data. The simulator response may differ from what is experienced in the aircraft, thus there is a possibility of providing negative training.

Training should also not rely too much on certain aircraft flight control protections. Increased focus on training scenarios under degraded flight control protection should be considered.

CONTROLLED FLIGHT INTO TERRAIN

Background:

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



The vast majority of CFIT accidents between 2012 and 2016 occurred during the approach phase, with 75% of these accidents on turboprops.

The accident rate for the 5-year period was of 0.10 CFIT accidents per million sectors. The breakdown was 0.02 for jets and 0.47 for turboprops.

There is a very strong correlation between the lack of instrument landing systems (ILS) or state-of-the-art approach procedures, such as performance-based navigation (PBN). The malfunction or the lack of ground-based nav-aids was a contributing factor in 64% of the CFIT accidents in the 2012-2016 period.

Discussion:

The lack of precision approaches has been noted as a major contributing factor to CFIT accidents. The implementation of precision approaches or PBN approaches is seen as a method to reduce the risk of CFIT accidents. Where this is impractical, the use of Continuous Angle Non-Precision Approaches (CANPA) can help with the transition from approach to landing by providing a more stable descent profile than traditional "dive and drive" methods used for non-precision approaches.

Some airlines are prohibiting circling approaches in favor of using RNAV or RNP approaches instead. Some airlines discuss the operational impact of circling approaches and perform a risk evaluation. Forward knowledge of terrain through prior experience does not eliminate the need to adhere to EGPWS warnings. It was predicted that at some point a pilot will ignore a valid EGPWS warning, believing to know their actual position relative to the ground, and that this would lead to a CFIT accident.

Most pilots do not appreciate how close the approaching terrain is when the EGPWS alarm is sounded. There is often little or no visual reference available and a very short time to react.

Be mindful of operational pressures and manage them properly. Trust the safety equipment provided in the aircraft. Ensure proper QNH settings on early-generation EGPWS units to avoid false warnings that could lead crews to suppress alarms (e.g., placing the system into "TERRAIN" mode). Modern EGPWS systems use GPS altitude to reduce the rate of these instances.

Recommendations to Operators

Operators should support the concept of CANPA to reduce the risk of approach and landing CFITs, and train their pilots to select CANPA instead of "Dive and Drive".

Airlines should ensure that as many aircraft as possible are equipped with approved GPS so that accurate positioning and altitude data is available. In the case of retrofitted navigation systems through supplemental-type certificates (STC), airlines should pay particular attention to the human-machine interface requirements, so that navigation source switching does not become a hazard. A proper change management process can help identify and mitigate risks that are created by the introduction of the new hardware (e.g., by making the appropriate changes to SOPs).

Crews are encouraged to use Regulator, OEM and Operator-approved navigation equipment only. Unapproved equipment can lead to a false impression of high navigation accuracy. All crewmembers should be aware of the nature and limitations of the safety systems installed. For example, it is important to understand the difference between terrain information derived from a navigation database and that which is derived from a direct reading sensor such as radar altimeter. Effective procedures, and individual discipline, also need to address the issues of which approach procedure and track to choose, what data to follow, and how to handle being off track. Effective CRM training and drills should mitigate errors and fatigue, and enhance the escape from dangerous situations. With modern NAV displays driven by GPS and FMS, it is easy to assume that the desired track line is correct and safe.

Airlines are encouraged to maintain their equipment and ensure that the terrain/obstacle data being used by the system is current. Airlines should develop procedures to ensure that the EGPWS database is kept as up-to-date as possible. In addition, operators are recommended to ensure that the terrain warning system and its sensors are also up to date. Each operator should ensure that the latest modifications are incorporated in their particular 'TAWS' or EGPWS computer and with GPS providing aircraft position data directly to the computer. These provide earlier warning times and minimize unwanted alerts and warnings.

Flight operations departments are encouraged to review their circling approach policies and are encouraged to reduce the number of circling approaches, possibly through increasing the visibility requirements. They are also encouraged to conduct a risk analysis of the various approach options. Operators are advised to use published Global Navigation Satellite System (GNSS) approaches rather than "circle to land" when a certified GPS is installed on board and the crew is trained for the procedures.

Airlines are encouraged to familiarize theirs crews with the proximity of terrain once the EGPWS has triggered an alarm (perhaps use a simulator with a very high fidelity visual system). Many crews falsely believe that there is ample time to react once an EGPWS alert is sounded. While many operators include this as part of their training program, it is essential information that should be included in all training programs.

Remind crews that if an EGPWS alert triggers during an instrument approach, the alert should be respected at all times. Incorrect altimeter settings, incorrect or missing low temperature adjustment, radio altimeter failures, etc. can all lead to cases where the true altitude of the aircraft is not known by the crew.

Recommendations to Industry

The industry is encouraged to further their work on implementing PBN approaches in areas where a precision approach is not practical. Where these are not available, it is recommended to review the adoption of Continuous Angle Non-Precision Approaches (CANPA) for non-precision approaches.

CFIT accidents are occurring mainly in areas of the world where the use of Terrain Awareness Warning Systems (TAWS) is not mandatory. It is recommended that these states mandate the use of TAWS in air transport aircraft as it demonstrates a clear benefit for CFIT reduction. These aircraft will need to be fitted with accurate navigation features (i.e., stand alone or, better, dual GPS for both navigation and terrain surveillance benefit). Most air transport aircraft are fitted or could be fitted with such systems. Without an accurate position it's more difficult to have an appropriate TAWS functioning.

Authorities are recommended to investigate mandating procedures that ensure EGPWS databases are kept accurate and up-to-date. This has to be emphasized in light of two cases in 2011 were the EGPWS database was never updated. These updates are critical as they include terrain and runway ends.

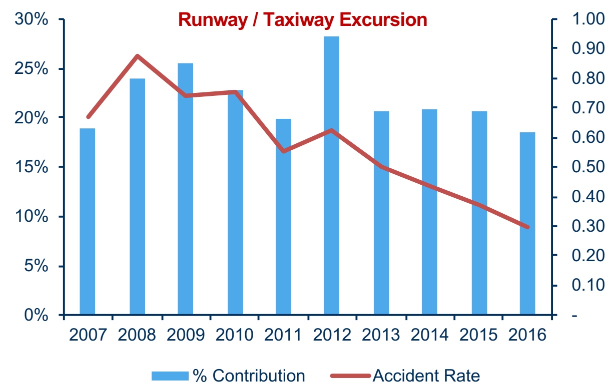
In some countries an EGPWS supplier has to contact the state to get access to terrain data. Governments are encouraged to automatically provide to manufacturers the respective terrain data in cases where a new airport opens.

Authorities are encouraged to comply with ICAO recommendations and guidelines regarding PBN implementation.

RUNWAY EXCURSIONS

Background:

In 2016 Runway Excursions contributed to 22% of the accidents. The following graph indicates the percentage of accidents classified as runway excursion over the previous ten years and its yearly rate. Runway excursions include landing overruns, take-off overruns, landing veer-offs, take-off veer-offs and taxiway excursions meeting the IATA definition of an accident. It is worth noting not all runway excursions meet this definition. Therefore, other studies which include serious incidents may indicate a higher number of events.



Over the five year period from 2012 to 2016, 83 percent of runway excursions occurred in the landing phase of flight. There are many factors noted to have contributed to runway. Long, floated or bounced landings were noted in 46 percent of all runway excursion accidents during this period, while a continued landing after an unstable approach was a factor in 14 percent of the runway excursions.

Poor weather conditions (present in 49 percent of the accidents) and airport facilities (37%) still represent the largest components for environmental factors, while errors in the manual handling of the aircraft were noted to have contributed to 48 percent of runway excursions.

Aircraft malfunctions, such as brake or engine malfunction are also a factor that should be noted, having contributed to 11 percent of all runway excursions.

While the occurrence rates of aircraft flying unstable approaches or landing on contaminated runways are low, the proportion of runway excursions from those precursors remains high.

While there was a correlation between runway excursions and wet or contaminated runways, there is also need for flight crews to be conscious of the risk of excursion even in favorable conditions, with a high percentage of the excursions having occurred in good meteorological conditions. This underscores the need for crews to be vigilant in the landing phase of flight, regardless of the runway conditions.

Discussion:

Airlines can better use Flight Data Analysis (FDA) programs to understand the root causes of unstable approaches:

- FDA can help the airline determine correlations of interest between unstable approaches and specific airports (e.g., ATC restrictions), individual pilots, specific fleets, etc.
- Personal FDA debriefs on the request of a flight crew member should be encouraged

Airlines should address not only unstable approaches but also destabilization after being stabilized, especially at low altitude (below MDA/DH) and consequently go-arounds / rejected landings.

Being stable at 500 feet does not guarantee that the landing will occur -– a go-around may still be necessary.

Auto-land and other automation tools only work within certain limitations which need to be well understood by the crew.

Recommendations to Operators:

These highlights could work as defenses for avoiding runway excursions:

- Landing in the touchdown zone
- Defining the touchdown aiming point as the target
- Parameters of stable approach based on the manufacturer information
- Deviation call outs by the Pilot Monitoring
- Recommend the use of metrics to measure SMS affectivity and ensure continuance improvement.
- Implement a flight data monitoring system.
- Validate the FDM parameters with the flight Ops department based on manufacturer's criteria.

Stable approaches are the first defense against runway excursions. The final, more important, defense is landing in the touchdown zone.

Airlines are recommended to modify their approach procedures to call out "STABILIZED" or "NOT STABILIZED" at a given point on the approach to ensure a timely go-around is carried out when necessary. This type of callout is especially useful in situations where a high crew social gradient (social power distance from a new or unassertive first officer to a domineering or challenging captain) exists, or when cultural conditioning could hinder crew member communication. Note: some companies prefer the use of the callout "GO AROUND" if stabilization criteria are not met at their respective gates. Bear in mind that, even when stabilization criteria are met at certain points, destabilization can require a go-around at any time. In this context, a company backed "no fault" go-around policy would establish crew member confidence about making the decision to go-around when established conditions make a go-around necessary.

Airlines are encouraged to set windows in the approach at specific points (e.g."Plan to be at X feet and Y knots at point Z").This is especially useful at airports with special approaches. Brief key points in each window and how they are different from the standard approach procedure. Establish a policy specifying that if these parameters are not met a go-around must be executed.

Pilots should make an early decision to use the maximum available braking capability of the aircraft whenever landing performance is compromised, seems to be compromised or doubt exists that the aircraft can be stopped on the runway. Pilots should be mindful of what is called 'procedural memory'. It is recommended that training departments address the issue. Pilots must be aware that late application of reverse thrust is less effective than early application on account of the time required for engines to spool up and produce maximum thrust. The application of reverse thrust (when installed) is paramount on braking action challenged runways – it is much more effective at higher speeds when aircraft braking is not as effective on wet or slippery runways.

Investigate technology to help crews determine the actual touchdown point and estimate the point where the aircraft is expected to stop. Various manufacturers offer or are developing these systems. Work is ongoing to enhance runway remaining displays on both heads-up display (HUD) and primary flight display (PFD) panels. The airline industry should monitor the validity of predicted stopping indicators, especially in situations of contaminated surfaces or less than optimum performance of brakes, spoilers, and thrust reversers. While a display can give a prediction based upon the deceleration rate, it cannot anticipate changes in surface friction which will result in actual performance that is less than predicted.

Operators are advised to conduct a field survey to determine the actual landing and take-off distances in comparison to their predicted (calculated) values. Consideration for runway conditions at the time of the survey should be incorporated. This data may be obtainable from the operator's FDA program.

Operators should encourage flight crews and dispatchers to calculate stopping distances on every landing using charts and tools as recommended by the National Transportation Safety Board (NTSB) and described by the FAA in their Safety Alert for Operators (SAFO) 06012. Crews should understand and build margins into these numbers.

Operators are encouraged to set a safety focus where actual take-off/landing distances are compared with calculated take-off and landing distances to give pilots a feel for how big a bias there is between data from the manufacturer and the average pilot. For example, if the calculation shows a stop margin of "XX" meters at V1, then use FDA data and compare what the actual stop margin at V1 was on this particular flight.

Recommendations to Industry:

1. Encourage implementation of SMS for all commercial airlines and maintenance facilities.
2. Encourage a policy of a rejected landing in the case of long landings.
3. Measure the long landings at the simulators.
4. Require training in bounced landing recovery techniques.
5. Train pilots in crosswind and tailwind landings up to the maximum OEM-certified winds.
6. Encourage airlines to develop campaigns to establish SOPs as culturally normative actions.

Technology to assist in landing during severe weather is available, but is not widely installed. Airports authorities are encouraged to cooperate with other industry and commercial stakeholders to see if a viable safety and business case can be created to install such resources.

Regulators and airports are encouraged to use RESA (Runway End Safety Area), EMAS (Engineered Material Arrestor System), and similar runway excursion prevention technologies and infrastructure to help reduce the severity of runway excursions. Where these systems are in place, their presence should be communicated to crews by indicating them on charts or, possibly, including signage that indicates EMAS ahead. Regulators should also investigate standardizing runway condition reporting in an effort to simplify decisions faced by flight crews when determining required runway length for landing. Standardized reporting must be harmonized with the airplane performance information supplied by airplane manufacturers.

Airports are encouraged to improve awareness of the touch-down zone. Borrowing time-tested military concepts, such as touch-down zone markings every 1000 feet, can greatly improve a flight crew's situational awareness during landing rollout.

Scientific communities are encouraged to evaluate the usefulness of current technologies with regards to accurate and timely measurement of winds and wind shear to determine how this information can be relayed to flight crews to increase situational awareness.

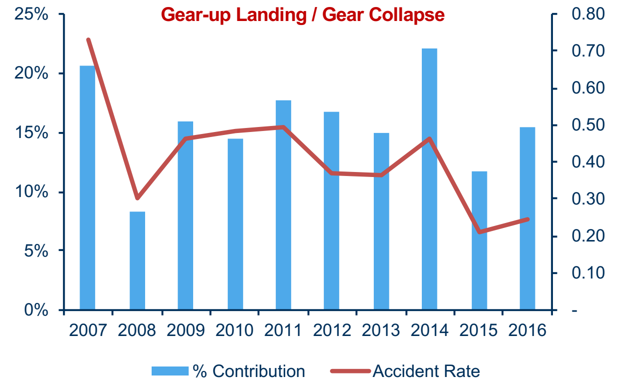
Airports should refrain from publishing requirements limiting the use of reverse thrust due to noise issues because this practice contributes to runway excursions as crews do not utilize the full capability of stopping devices. This is particularly true at airports with high-intensity operations.

AIRCRAFT TECHNICAL FAILURES AND MAINTENANCE SAFETY

Background:

2016 continued to see a significant decrease in the number (and rate) of accidents involving a gear up landing or a gear collapse. In 86% of the accidents, aircraft malfunction was a contributing factor, while 47% involved a maintenance-related event.

Of the 61 gear up landing/gear collapse accidents in the 2012-2016 period, maintenance operations and non-adherence to SOPs were contributors in 30% of the accidents.



Discussion:

Commercial pressures have forced virtually all airlines to out-source at least a portion of their heavy and/or routine mainte-nance operations.

The capability of any maintenance and repair organization (MRO) chosen to perform an airline's maintenance must match the airline's size (both number of aircraft and number of flights) and their normal maintenance practices. Very few MROs are capable of completing a large work package (due to deferred maintenance on MEL items) to a high standard under normal airline time pressures. MRO certification is not a guaranty of work quality.

After a heavy maintenance check, many larger airlines will have a "shakedown cruise" to gauge the quality of work performed by the MRO and determine the short-term (e.g., 30 day) reliability of the aircraft. This helps to identify issues before the aircraft goes back into service and ensures a higher degree of reliability and completion factor for the airline.

In many cases, too much effort and legislation is put into oversight of the documentation trail, rather than the repair work being physically performed on the aircraft. For example, whoever certifies an aircraft as airworthy must be certificated, however those who perform maintenance the work do not necessarily have to possess any licensing credentials. There are some anecdotal cases where the primary concern was that the paperwork for a work-package was not done, where the when in reality the work itself had not been completed.

The issue of aircraft parts was also discussed. This aspect ties into both bogus parts and what are termed as "rogue parts". A rogue part is one that is reused without being properly certified or checked for serviceability. For example, a part may be written-up in a crew aircraft maintenance discrepancy report. However, after the part receives a clean bench check, it is placed back on the "serviceable" shelf for re-use at a later date. Another interpretation of a rogue part is an old part (sometimes as much as 30 years old) being inappropriately refurbished and then certified as serviceable. Parts need to be checked for serviceability regardless of age or certification status.

Maintenance configuration control was also discussed. Specifically, are the installed parts in the aircraft supposed to be there according to the actual in-service documentation? This issue is not limited to older aircraft as recent models can also be affected by similar lapses. There are also anecdotes regarding operations replacing parts as a means to extend MEL periods due to financial constraints. This is separate from the rotation of parts for the purpose of troubleshooting.

Maintenance human error continues to be a leading factor in maintenance aircraft incident events. To address these errors the industry needs to identify the root cause of such events. Maintenance departments should adopt similar safety programs and tools as are used during Flight Operations. For example, the principles of Crew Resource Management (CRM) can be applied to Maintenance Resource Management, Line Oriented Safety Audits (LOSA) can be developed for maintenance and ramp operations, and Fatigue Risk Management Systems (FRMS) can be implemented for Maintenance. All of these programs and tools can help proactively identify the root cause of errors so that proper mitigation steps can be taken to prevent these errors from becoming significant events.

Flight crews also have a role in maintenance-related safety. The number and combination of MEL items, combined with other factors (e.g., weather) can lead to degraded safety levels. Also, temporary revisions to procedures are affected depending on the MEL items. Operators are reminded that MELs are meant as a way to legally fly the aircraft to a location where it can be repaired, and not as a maximum time limit on how long the aircraft can remain in service before maintenance must be performed. Ensuring this aspect of maintenance-related activities is well understood within its own flight and maintenance organizations will ensure that aircraft are repaired correctly and on-time. Flight crews should not be forced to make operational decisions and "push" their limits while flying revenue flights.

Recommendations to Operators:

Functional check flights (FCF) or shakedown cruises after heavy aircraft maintenance are recommended to verify that the aircraft is operating normally. This will also increase in-service reliability and enhance the airline's completion factor after heavy maintenance is performed.

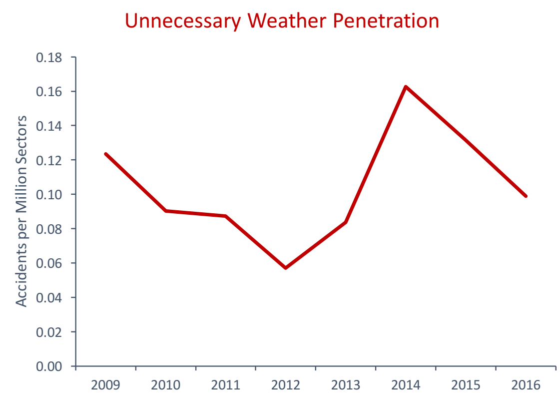
The Flight Safety Foundation (FSF) has published a FCF Compendium document containing information that can be used to reduce risk. The information contained in the guidance document is generic and may need to be adjusted to apply to an airline's specific aircraft. Operators are encouraged to retrieve this material.

Maintenance Repair Operator (MRO)/Airline Maintenance departments should implement a LOSA system for their maintenance activity.

CONTINUATION OF AIRLINE OPERATION DURING SEVERE WEATHER

Background:

Airline operations may be completely suspended by severe weather in some parts of the world. Meteorological threats were identified as factors in 31 percent of accidents in 2016 and 31 percent of accidents during the period of 2012 to 2016. Unnecessary weather penetration was a factor in 7 percent of the accidents in 2016. The graph below shows the rate of accidents where this contributing factor was present.



Not only aerodromes are encouraged to provide aviation weather services to Air Traffic Services (ATS) units, airline operators, flight crew members, dispatchers and airport management by supplying the necessary meteorological information in a timely and accurate manner, but crews also need to be able to identify and avoid poor weather conditions whenever possible and applicable. The ACTF believes that there is a need for improved real-time weather information available in the cockpit, improved awareness of weather phenome by all the key personnel involved with the planning and execution of a flight and technology development for advanced forecast and presentation of weather pertinent to a particular flight.

Discussion:

Weather has a large-scale effect on operations. Operators need to be aware of commercial factors relating to weather delays such as public expectations and passenger compensation criteria (where in effect).

Aerodrome's ATS observations and forecasts are to be disseminated to aircraft pilots and flight dispatchers for pre-flight planning.

Auto-land and other automation tools only work within certain limitations. Technology to assist in landing during severe weather is available but is not widely installed.

All aerodromes need to issue alerts for low-level wind shear and turbulence within three nautical miles of the runway thresholds for relay by air traffic controllers to approaching and departing aircraft.

Continuous improvement of various warning services is needed to develop capabilities for real-time downlink of weather data obtained by aircraft and uplink of weather information required in the cockpit.

Recommendations to Operators:

Operators should consider tools that allow dispatch offices to provide crews with the most up-to-date weather information possible.

Ensure that aerodrome's ATS observations and forecasts are disseminated to aircraft pilots and flight dispatchers for pre-flight planning.

Airlines should develop a contingency plan, involving dispatch and crew support, that clearly defines guidance at an organizational level on who is responsible to cease operations.

The applicability of limits for wind and gusts should be clearly defined in the Operations Manual.

All aerodromes need to have a meteorological office that issues alerts of low-level wind shear and turbulence within three nautical miles of the runway thresholds for relay by air traffic controllers to approaching and departing aircraft.

Recommendations to Industry:

Scientific communities are encouraged to evaluate the usefulness of current technologies with regards to accurate and timely measurement of gusty winds and how such information can be quickly relayed to flight crews to increase situational awareness.

Develop capabilities for real-time downlink of weather data obtained by aircraft and uplink of weather information required in the cockpit

CREW RESOURCE MANAGEMENT

Background:

Social and communication skills are a vital part of overall crew performance. Ultimately, an electronic system cannot be designed for every possible threat and efficient crew interaction is critical for the mitigation of potential threats.

Discussion:

Crew Resource Management (CRM) continues to be an important factor in aviation safety, especially in more conservative social environments. While implemented at many operators, CRM is not universally applied and many airlines have ineffective or no formalized CRM training programs in place.

In cultural environments where a high social gradient exists, strict standard operating procedures (SOPs) help establish clear lines of communication and allow for first officers to pass critical situational information to the captain without compromising their position or causing the captain to "lose face".

Effective crew pairing with respect to seniority and experience can promote optimal conditions for crew performance.

Recommendations to Operators:

CRM training should include and emphasize assertiveness and identify specific cases where the social gradient or rank distance between the captain and first officer is high enough to impede effective communications. Focus on specific cultural factors when applicable.

Encourage captains to allow first officers to demonstrate assertiveness and leadership. Communicate that despite rank or position, the captain is still human and is capable of making mistakes. Ensure that captains understand they are not infallible.

Specific call-outs of information or decision requirements at critical points in the flight may help the first officer to overcome the social gradient between the crew members. Properly developed SOPs with clear instructions may empower first officers to take over the flight controls when the situation requires assertiveness.

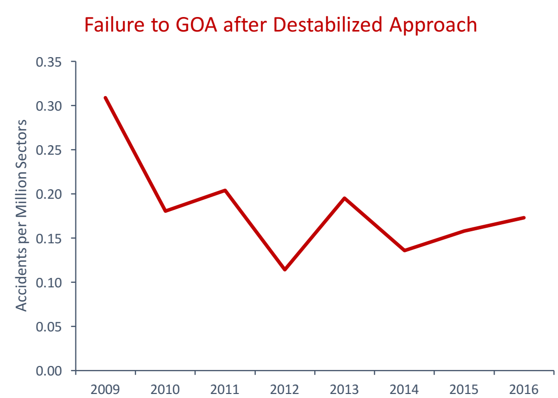
A process for debriefing CRM issues that arose during line operation will give the individual pilot essential feedback on his/her performance.

GO AROUNDS

Background:

Failure to go around after a destabilized approach was a contributing factor in 10 percent of the accidents between 2012 and 2016. While focus on go arounds is of extreme importance, the handling of the aircraft after a go around is initiated needs to be a topic of discussion, especially on circumstances not foreseen during simulator training.

Rate of accidents where 'Failure to go around after destabilized approach' was a contributing factor



Discussion:

The go-around procedure is rarely flown and is a challenging maneuver. Crews must be sufficiently familiar with flying go-arounds through initial and recurrent training.

Somatogravic head-up illusions during the unfamiliar forward acceleration in a go-around can lead to the incorrect perception by the flight crew that the nose of the aircraft is pitching up. This illusion can cause pilots to respond with an inappropriate nose down input on the flight controls during the execution of a go-around. Such responses have led to periodic accidents.

There are also cases when the crew engage the autopilot to reduce the workload, but instead put the aircraft in an undesired situation due to a lack of situational awareness with the automation.

Airlines should not limit training scenarios to the initiation of a go-around at the approach minimum or missed approach point. Training scenarios should focus on current operational threats as well as traditional situations.

Recommendations to Operators

Airlines are recommended to modify their approach procedures to call out "STABILIZED" or "GO-AROUND" at a given point to ensure a timely go-around is carried out. While a STABLE or STABILIZED callout might be required at either 1000 feet or 500 feet above touchdown, the "GO-AROUND" command can and must be made at any time prior to deployment of thrust reversers.

When developing crew training programs, operators are encouraged to create unexpected go-around scenarios at intermediate altitudes with instructions that deviate from the published procedure; this addresses both go-around decision-making and execution. The training should also include go-around execution with all engines operating, including level-off at a low altitude and go-arounds from long flares and bounced landings. Operators should also consider go-arounds not only at heavy weight and one engine inoperative, which are the typical scenarios, but also at light weight with both engines operative in order to experience the higher dynamics. Crews should fly the go-around pitch and Flight Director bars and adapt the thrust to remain within flight parameters.

Training should emphasize the significance of thrust reverser deployment for a go-around decision. From a technical point of view, a go-around may always be initiated before reverser deployment and never after reverser application.

Introduce destabilized approach simulator training scenarios, which emphasize that deviations from the stabilized approach profile at low altitudes (below MDA/ DH) should require execution of a go-around.

It has often been said that failure to execute a go-around is usually associated with a mind set to land. There are very few situations where a go-around is not an option and it is important for crews to have an understanding of when they must land and when to leave themselves an out.

Airlines should incorporate training on somatogravic illusions during the initiation of a go-around. Simulators that combine the possibilities of both the hexapod and the human centrifuge are already available and in use, (e.g., for military training).They can be used to demonstrate the illusions during go-around initiation and train pilots for a correct reaction on the heads-up illusion. As preventive means, crews are recommend to brief the go-around, not delay it, respect minima, monitor the flight parameters and fly the go-around pitch and the Flight Director bars where available.

Airlines should consider the time loss due to go around as necessary for safe operations. Therefore, commercial pressure should not be imposed on flight crews. Pilots may be reluctant to go-around if they feel the fuel state does not support it. A go-around should be considered as potentially occurring on every flight and so the flight must be fueled to allow for a go-around without resulting in a low-fuel situation. A no fault go-around policy should be promoted by the operators. If pilots are fearful of disciplinary action they will be less likely to go around when they should.

Recommendations to Industry

Authorities should examine if initial go-around altitudes may be increased wherever possible to give flight crews additional time to both reconfigure the aircraft and adjust to their new situation.

Industry should support the development of operational feasible simulators which can generate sustained g-forces for generic go-around training with regard to somatogravic illusions.

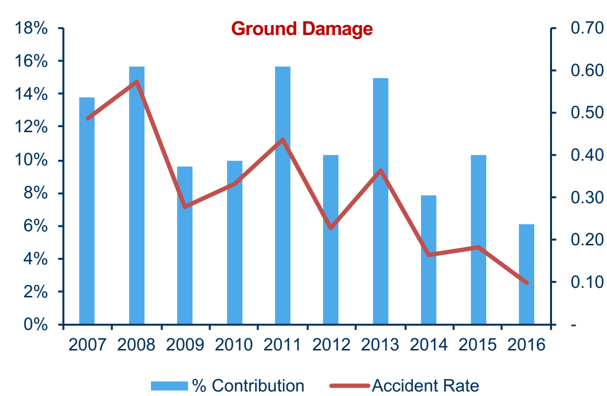
Air traffic controllers should be reminded that any aircraft might execute a balked landing or missed approach. This will involve startle and surprise for the ATC just as it might for the flight crew involved. They should understand that the flight crew will immediately be involved in stabilizing the flight path, changing configuration, and communicating with each other. The flight crew will communicate with ATC as soon as they are able and ATC should be prepared to clear other traffic, provide or approve an altitude and direction of flight. They should also understand that the aircraft might be entering a fuel critical state such that routing and sequencing for diversion or subsequent landing must be without undue delay.

GROUND OPERATIONS & GROUND DAMAGE PREVENTION

Background:

In 2016 there were four accidents categorized as ground damage. The rate was of 0.10 accidents per million sectors. 100% were in jet aircraft with a rate of 0.12. The rate for the five-year period was of 0.17 and 0.35, respectively for jet and turboprop aircraft.

The graph below indicates the percentage of ground damage accidents over the previous ten years and its rate in accident per million sectors. This downward trend, however, need to be treated carefully because it does not include damage caused by ground operations-related incidents that do not fit the accident criteria. Ground damage continues to be a major cost for operators, and requires a cooperative safety approach with all involved parties including airlines, ground service providers, airport authorities and government.



Discussion:

Actual hands-on experience with a real aircraft is required to accurately gauge the size and position of the wings and airframe when moving on the ramp. This is particularly true as new aircraft with larger wingspans are being added to airline fleets. The risk of ground events is expected to increase as growth in traffic outpaces growth in airport capacity resulting in more aircraft operating in a limited space.

Crews need to exercise increased vigilance during taxi operations in congested airports, near challenging gates or stands in close proximity to obstacles. Operators and crews should note:

- Not to rely solely on ground marshals or wing walkers for obstacle avoidance and/or clearance while taxiing.
- Turboprops can be especially prone to ground damage. Several cases of turboprops taxiing into ground carts were noted.
- ATC clearance to taxi is not an indication that it is safe to begin taxiing - surroundings must be monitored at all times.

Ground staff should be informed to respect lines and other markings depicting protected zones. As surface markings can differ from one airport to another, the ground crew is better positioned to assure the safe positioning of the aircraft when approaching a parking spot or gate. Issues such as ground vehicles failing to give right of way to moving aircraft, movable stands, carts and other equipment being placed incorrectly, not being removed, or blowing into moving aircraft continue to affect safety on the ground.

Ground markings should be clear and well understood by ramp workers. Confusing and/or overlapping lines can contribute to improperly positioned aircraft and result in ground damage. Lines can be difficult to see in wet conditions; this can be helped through the use of contrast painting (i.e., a black border to taxi lines where the surface is concrete).

Damage to composite materials will not necessarily show visible signs of distress or deformation. Engineering and maintenance must remain on constant vigilance when dealing with newer aircraft that contain major composite structures.

Due to hesitation of some ground staff in submitting ground damage reports, the data available is not enough to be more effective in finding accident precursors, identifying hazards and mitigating risks.

All service providers such as aircraft operators, maintenance organizations, air traffic service providers and aerodrome operators need to be compliant with ICAO SMS Doc.9859 to strengthen the concept of a proactive and predictive approach to reducing ground damage events.

IATA Safety Audit for Ground Operations (ISAGO) certifications may benefit all service providers in understanding high risk areas within ground operations in all aerodromes.

Recommendations to Operators

Ensure crews receive taxi training that includes time spent in real aircraft (with wing walkers indicating the actual position of the wings to the pilot) to help accurately judge the size of the aircraft and its handling on the ground.

Ensure crews inform ATC of aircraft position while waiting to enter the ramp area in preparation for a final parking slot to increase situational awareness and indicate that the aircraft may not be fully clear of the taxiway.

Consider the utilization of stop locations for aircraft entering the ramp similar to those used while leaving ramp areas. Stop locations should ensure adequate clearance from movement areas while transitioning from ground control.

Lapses in SOPs such as not setting the parking brake can lead to ground damage and even ramp injuries or fatalities. Crew training with regards to effective communication during the taxi procedure should be applied and reinforced.

Inform crews of the unique nature of composite materials and reinforce that severely damaged composite materials may show no visible signs of distress.

Train crews regarding the handling and responsibilities of taxi instructions. The taxi clearance does not ensure that no obstacles are present for the crew. The crews must be aware of their surroundings and know to request assistance when in doubt; particular attention must be paid to wingtip clearances.

Ensure compliance with ICAO Safety Management System (SMS) Document 9859.

Encourage all ground staff to report all ground damage events, incidents or violations through the Safety Reporting System and/or Aviation Confidential Reporting System (ACRS).

Recommendations to Industry

Lack of information on charts, in particular airport taxi charts, can lead to ground damage. Chart providers are encouraged to include as much information as possible on charts while maintaining legibility.

Additionally, potential hazards and areas of confusion must be identified clearly.

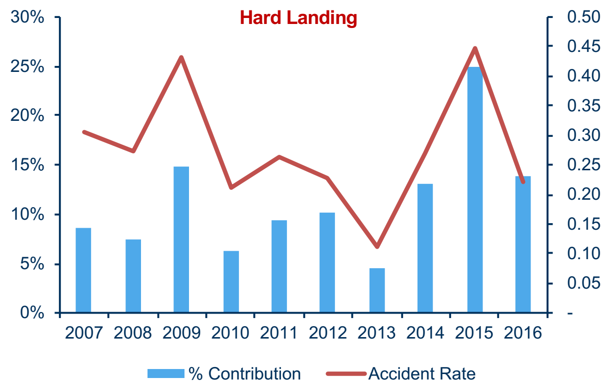
Manufacturers are asked to investigate the use of technology to assist crews in determining the proximity of aircraft to obstacles. Similar technology has been available in automobiles for several years and would be extremely useful in low-visibility situations or when the pilot's view is obstructed.

While a flight crew can be expected to avoid collisions with fixed structures and parked aircraft by maintaining the correct relationship with taxi lane markings, the situation will be improved with enhancements that provide both moving real time ground mapping as well as real time traffic display. Technology exists for every aircraft and ground vehicle to emit position information. It is expected that ADS-B out and in will provide the necessary ground collision prevention in conjunction with well-engineered ramps and taxi lanes.

HARD LANDING

Background:

2016 represents a decrease in the occurrence of hard landing accidents when compared to 2015.



Frequent contributing factors to hard landings in the last five years were:

- Flight Operations (Training Systems): 24%
- Meteorology: 48%
- Errors in the manual handling of the aircraft: 74%
- Long, floated or bounced landing: 65%

Discussion:

Meteorological phenomena and other factors that lead to a (late) destabilization of the final approach have again been identified as typical precursors of hard landings that led to accidents. Additionally, hard landings often either lead to or have been the result of bounced landings. For this reason in particular the importance of flying stabilized approaches all the way to the landing as well as the recovery of bounced landings continue to be critical areas for crew training activities.

At the same time there are still limitations in the ability of simulators to induce occurrences such as bounced landings at a level of fidelity that is sufficiently high to avoid the danger of "negative training".

Recommendations to Operators

Bounced landing recovery remains a challenging maneuver for crews and thus continues to be a critical simulator training issue. At the same time limitations of training devices have to be respected. When designing training programs, operators are encouraged to be mindful of the risk of "negative training" (e.g., by asking the trainee to perform a long or bounced landing to practice the recovery thereof).Focus rather has to be on training for the correct landing parameters (e.g., pitch, power, visual picture) on every landing. This is to develop sufficient awareness and motor-skills to always perform the landing the way the airplane manufacturer recommends and to always land at the correct location on the runway, regardless of how favorable or unfavorable the conditions are. Focus also has to be on the fact that the landing is to be rejected should the aforementioned landing parameters not be met.

In addition to the above, and as discussed in other parts of this publication, airlines are recommended to modify their approach procedures to include a call out such as "STABILIZED" or "GO AROUND" at a certain gate to ensure a timely go-around is carried out. Emphasis should also be put on pilots to understand that a destabilization can occur at any altitude and that the set parameters are to be met at all times after the gate and until landing. To provide training that is consistent with this, it is recommended to include training of go-arounds from low altitudes and rejected landings (as well as due to long flares and bounced landings) in the recurrent training program.

Operators are recommended to set procedures that do not require late disconnection of the Auto Pilot. There are events when the crew has no time to enter into the aircraft loop by disconnecting at low altitudes, such as 200 ft, particularly in adverse conditions such as crosswind or gusts, in which case the approach may destabilize on very short final. Pilots need to get a 'feel' for the aircraft.

Introducing scenarios that are common precursors to hard landings in the training environment remains a challenge. In the short term, the challenge could possibly be overcome by workarounds such as introducing very low altitude wind shear on approach. However, operators are encouraged to work with simulator manufacturers to overcome the challenges more systematically in the long term.

Operators are also encouraged to train pilots on landing in real aircraft whenever possible.

Recommendations to Industry

Aircraft manufacturers are encouraged to provide better guidelines to be used in determining when a hard landing has occurred. These guidelines should be based on measurable factors. As noted above, simulator manufacturers, operators and industry partners are encouraged to work together to develop training devices that are better able to recreate the precursors to a hard landing.

Regulators are encouraged to evaluate landing training requirements.

IN-FLIGHT DECISION MAKING

Background:

With financial pressure to airlines getting higher and airports being more and more congested, the chance of a diversion from the original destination airport will grow.

Discussion:

Many airlines offer strategies to their pilots for decision making in abnormal conditions and failure cases. Often, they are sound concepts based on TEM models and they are demonstrated to crews on a regular basis.

However, very few strategies can be found for normal operations in terms of giving the crews guidelines for desirable conditions and triggers for diversion enroute and at destination.

Standard alternate airports are mainly based on official weather minima. In the case of a real diversion, crews may find themselves in conditions that are the same or even worse than at the original destination, now however with considerably less fuel.

The difference between a legal alternate and a sound and valid new option is often not considered by crews when diverting, nor is this trained.

This may end up in a cul-de-sac situation with minimum fuel or, in the worst case, in a hopeless situation with no fuel.

Often, the airlines' operational control centers do not have all necessary operational information about possible diversion alternates available.

Recommendations to Operators

Create and train a model for inflight decision making in normal daily operations.

These models should be a solid concept that allows crews to have a stringent and timely strategy for diversion airport assessment.

As a minimum, a diversion airport should always have adequate weather conditions which may be different from legal minima. Operational conditions should be such that the traffic situation and system outages present no constraint to a safe landing. The airport layout should allow for more than one possibility to land (e.g., at least a parallel taxiway).

Enable operational control centers or dispatch to have access to enroute alternate airport databases and means to transfer this information to flight crews enroute.

Recommendations to Industry

Develop and maintain databases for hazards enroute or at specific airports and make them available to airline crews and operational control centers.

ACTF DISCUSSION & STRATEGIES

FINAL STATEMENTS

Accidents are reaching all-time-lows, but work must go on! The focus the industry gave on high risk accidents, namely CFIT, LOC-I and Runway Excursion are paying off. The rates for these accidents have been in constant decline.

However, a false sense of security could lead us back into an upward trend. LOC-I and CFIT are still the accidents with the lowest survivability ratio. The constant decline in their yearly rates could mean that the low-hanging fruits have been largely removed, which means safety professionals around the world need to work even harder in order to mitigate the occurrence of those factors that, although unlikely to occur, have catastrophic consequences.

In addition to the discussion points above, the ACTF would like to highlight:

Harmonization of regulations

Based upon the findings of the ACTF, governments who have adopted a model of cross border cooperation to harmonize aviation regulations have provided a safer environment for commercial aviation. The ACTF recommends adoption of this format. Further, governments should pay greater attention to ensuring conflicts of interest between certification agencies and operators are eliminated.

Shared responsibility of regulators

With multiple latent conditions being present in all accidents reviewed in 2016 it is the opinion of the ACTF that only airline management can mitigate these conditions and therefore, management has to fully adopt to the safety concepts specific to a high reliability industry. Since management is endorsed by the regulators the regulators have a shared responsibility in overseeing the involvement of the airline's SMS nominated personnel.

Selection processes

ACTF findings indicate aircrew selection processes and standards are an area of future concern. ACTF case reviews have indicated aircrew selection processes are an emerging threat. While not currently an overriding problem the increased need, worldwide, for pilots indicates selection processes could pose a danger if superior judgments skills are not emphasized. Therefore, it is recommended selection processes and standards be reviewed.

With organizational latent conditions present in 2016 accidents reviewed by the ACTF selection processes cannot be restricted to flight crew, but has to include management. It appears today's assessment procedures for management personnel do not fully address the specific requirements of aviation as a high reliability industry.

In the opinion of the ACTF the latent conditions in all of the accidents for 2016 can be mitigated when airline management adopts the safety concepts of a high reliability industry and in particular adopts organizational procedures designed to mitigate risk and SMS is the vehicle for doing this. Achieving this full operationalization of SMS principles requires leadership embracing a proactive safety culture, and demonstrating the value of the SMS.

Go-arounds after abnormal runway contact

A significant number of cases in 2016 involved poor decision making and inferior aircraft handling after abnormal runway contact. There is still an opportunity for training, in particular, for go-around training after touchdown. Bear in mind the dynamic behaviors resulting from abnormal landings cannot currently be realistically reproduced in aircraft simulators. The ACTF recommends research into simulator fidelity to better portray the actual events being pursued.

The ACTF recommends SMS requirements for flight data monitoring be applied to commercial aircraft operators independent of aircraft mass. This is applicable to future aircraft designs and capability.

Pilot to Pilot Comms

Pilot monitoring skills and pilot to pilot communications have been factors in several ACTF case studies. Lack of assertiveness, and poor inter-personal communication skills have contributed to accidents again in 2016. The ACTF recommends airline training managers review the effectiveness of their CRM programs. This review will aid in reinforcing and building CRM best practices. Robust selection processes are also essential to identifying candidates with effective inter-personal skills.

Startle effect

Accidents reviewed by the ACTF have indicated a breakdown in aircrew ability to react accurately in sudden onset situations. This includes over reaction, miscommunication, and misinterpretation of information. The ACTF recommends development of aviation specific programs in stress resilience management.

Fire evacuations following engine failure

Recent ground fire events and accidents leading to passenger evacuation brought the attention of the ACTF to the need to recommend enhancement of crew coordination and communication between cockpit, cabin and ground crew (fire fighters) in all scenarios where the need for an evacuation is evident.

A number of engine and wing fires in the last 14 months have resulted in emergency evacuations. A review of the evacuations showed many undesirable activities continue to occur. These include but are not limited to; engines continuing to run during the evacuation, passengers evacuating with carry-on luggage and most importantly lack of communication between flight, ground (marshalling and emergency responders) and cabin crew. ACTF recommends an industry focus group look closely at the evacuations and determine if improvements in standardized procedures, and communications can be made.

Maintenance processes/maintenance use of checklists in the cockpit processes

Although not classified as aviation accidents, there have been hull losses and incidents in 2016 due to technicians not following procedures or checklists when performing actions in the cockpit, such as high power engine tests. It is recommended that maintenance organizations verify the effectiveness of their respective SMS program. The ACTF encourages that maintenance departments determine whether Aircraft Maintenance Manual procedures are written in an ergonomic, easy-to-follow manner. Further, the ACTF encourages that checklists are developed for potentially hazardous tasks.

Go-arounds

The ACTF has observed that Go-Arounds from altitudes other than the missed approach point have again contributed to accidents in 2016. Factors contributing to this include failure to follow basic aviation priorities (aviate, navigate and communicate) and ACTF recommends operators train Go-Arounds from various altitudes and weights with emphasis on following aviation priorities. The training should familiarize crews with the energy management, configuration and tracking requirements of such maneuvers. Consideration should be given to training with both engines operative, lower than normal weights and go-arounds from the flare or after runway contact.

Guidance is available from the IATA, the BEA and IFALPA on training and crew considerations for these Go-Arounds.

The ACTF has seen that go-arounds commanded after abnormal runway contact have contributed to accidents in 2016. The ACTF recommends additional training to instruct aircrews to deal with these situations.

LOC-I Accidents and Manual Flying Skills

The ACTF has reviewed a number of accidents and incidents which were classified as Loss of Control In Flight (LOC-I). The LOC-I accident rate in particular is more prevalent in turboprop aircraft versus jet aircraft. LOC-I accidents evolve, in general, from several factors among the most prevalent are: 1) Reluctance of aircrew to reassess or disable automated functions of the aircraft, 2) reluctance to assume manual control of the aircraft, and 3) weather related phenomena and spatial disorientation. LOC-I. The ACTF believes the occurrence of LOC-I accidents and incidents will be positively affected if commercial air carriers were to place greater emphasis on training in the automation mode control, aircrew ability assess and if needed deselect portions of automated controls in adverse situations, establish programs to promote manual flight skills and simulator training on handling unusual events (UPRT), and spatial disorientation.

"North America (NAM) and North Asia (NASIA) had the lowest rates, at 0.94 and 0.19 accidents per million sectors"

9

STEADES Air Traffic Services (ATS) Analysis

IATA Global Aviation Data Management (GADM) comprises of several safety exchange programs including; operational safety reports, flight data information, ground damage reports and accident information. Members routinely submit data to IATA where it is processed, de-identified and used for analysis towards improving safety across the aviation industry.

The analysis was conducted on Safety Reports 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 198 participating airlines worldwide, with an annual reporting rate of 220,000 reports and covering 36%[1] of total global flights. The STEADES database incorporates a number of quality control processes that assure analysis results.

ANALYSIS

This analysis was requested by the IATA Safety Group (SG) to assess Air Traffic Services (ATS) performance based on STEADES reports.

The analysis aims to identify where:

- ATS performance which could potentially contribute to a degradation in safety
- Flight crew not adequately following ATC instructions

A query of all Air Traffic Management (ATM) related reports between January 2011 and December 2015 resulted in a dataset of over 61,000 STEADES ATM reports. The analysis focused on two areas, a high-level global view using all of the reports and an in-depth analysis using the Threat and Error Management (TEM) framework, on a smaller number of reports using a random data sample.

Limitations

- The data presented is based on events reported by flight crew and therefore influenced by airline reporting cultures.
- The reports were not verified by any Air Navigation Service Providers (ANSP).
- The number of reports received concerning specific event types represents the lower measure of the true number of such events that are occurring.
- The analysis cannot confirm if events associated with the categories analyzed were solicited equally among all participating STEADES airlines nor if such events were reported routinely or under reported by flight crew.
- STEADES does not contain any data from sources other than participating airlines.
- The analysis is based on descriptors provided and assigned by airlines and influenced by the pilots' perception at the time of the event.

Global View

ATM reports represent 7.2% of the all STEADES reports, positioning it as the fifth most reported event type in the STEADES Database.

Over the five-year period, STEADES ATM reports equated to one report per 721 flights, which is equivalent to 34 reports per day.

1 Flights are based on IATA SRS (Schedule Reference Service) database. STEADES / World ratio: 36.3% of the world's flights in 2015

Yearly Distribution

The total number of ATM reports submitted to STEADES increased from 2011 to 2013 and has remained stable since 2013. However, in terms of reporting rate, STEADES ATM reports have decreased from 1.56 per 1,000 STEADES flights in 2011 to 1.13 per 1,000 STEADES flights in 2015.

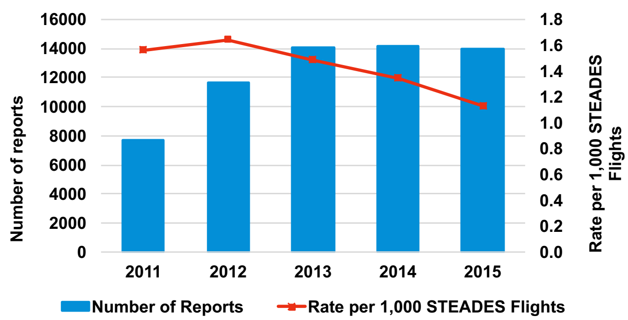


Figure 1 – ATS Yearly Distribution

Phase of Flight

The most prevalent phases of flight in terms of ATS report are Descent and Approach, representing 39% of reports and Cruise with 17%.

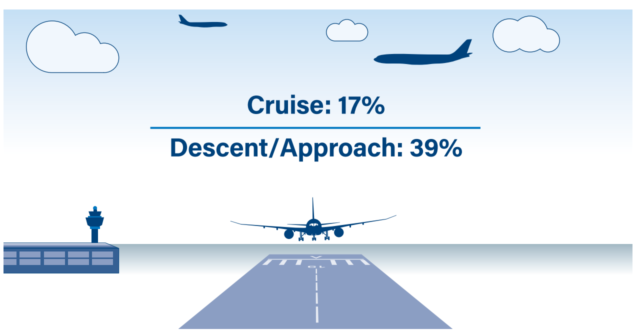


Figure 2 – Global Top Phases of Flight

ATM Risk

To understand the different levels of risks that the STEADES ATM issues represent, a Safety Risk Index (SRI) methodology was developed. The IATA Safety Group and an IATA ATM expert reviewed and prioritized the STEADES ATM descriptors in order of severity.

Each ATM report was allocated a severity score based on the prioritization. Where reports had multiple descriptors, the descriptor with the highest severity was assigned to the report. See Appendix 1 for definitions, prioritization and severity scores.

Once the severity scores were assigned, the SRI was calculated for each descriptor category by multiplying the severity score by the number of reports in that category to give a total severity score per category.
E.g. Airprox 125 x 4,867 = ***608,375***

From a SRI perspective, the Top ATM Global Safety Risk Indexes were:

1. **Airprox**
2. **Inadequate Separation**
3. **Wake Turbulence Encountered**
4. **Comms. with ATC lost**
5. **Callsign Confusion**

Figure 3 – Global ATM SRIs

STEADES In-depth Analysis – Air Traffic Services using the TEM Model

A random data sample was taken from the STEADES ATM reports. The sample comprised of 382 reports giving 95% level of confidence and error rate of 5%. Of these reports, 22.8% did not contain sufficient information or were out of scope and therefore not used. The final in-depth analysis dataset consisted of 295 reports that were individually read and coded using the TEM model.

Threats

88% (261) of reports indicated a threat, 64% of all threats related to ATS issues and 14% related to a flight crew issue.

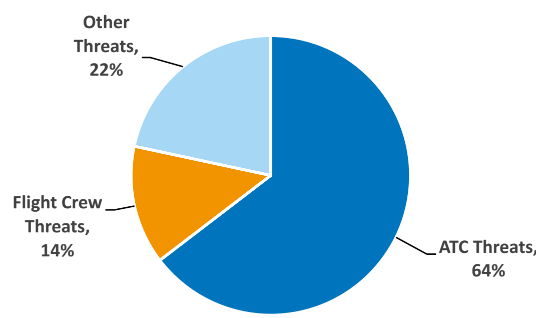


Figure 4 – Threats

The top three ATC threats accounted for 58% of the ATC threats identified:

- Inadequate separation (perceived by flight crew).
- Inappropriate clearances
- ATC poor coordination and communication.

The top two flight crew threats accounted for 100% of the threats Identified:

- Flight crew coordination & communication
- Flight crew inexperience

Errors

64% (189) of reports identified an error, 58% of all errors identified related to errors associated with ATC and 42% related to flight crew errors.

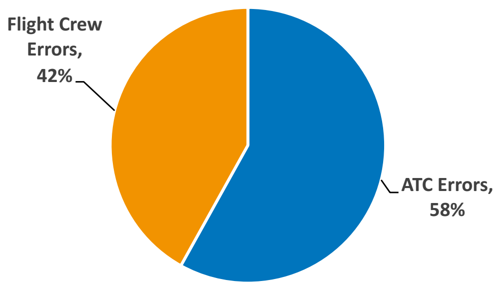


Figure 5 – Errors

The top three ATC errors accounted for 80% of the ATC errors identified:

- Incorrect clearance provided by ATC
- ATC communication errors
- Insufficient separation (perceived by flight crew).

The top three flight crew errors represented 80% of the flight crew errors:

- Flight crew mis-selection
- Flight crew procedural non-compliance.
- Flight crew handling & equipment

Undesired Aircraft States (UAS)

74% (219) reports indicated an UAS, 64% of the UAS related to an UAS resulting from an ATC issues and 14% of reports from a flight crew issue.

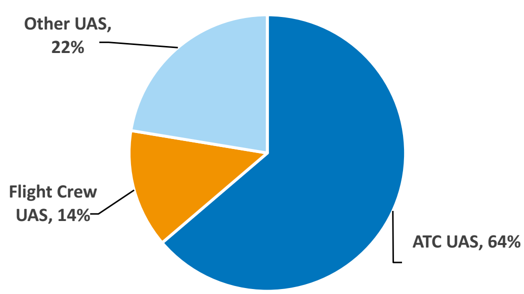


Figure 6 – Undesired Aircraft States

The top three UAS resulting from an ATC issue accounted 64% of the ATC UAS identified:

- Speed deviations
- Loss of separation (perceived by flight crew)
- TCAS TA/RA alert.

The top three UAS resulting from a flight crew issue accounted for 85% of the flight crew UAS identified:

- Altitude or speed deviation
- Unable to communicate
- Incorrect ground maneuvering

Actions

77% (226) of reports identified an action, 65% of the actions taken related to ATC threats and 13% of actions related to flight crew threats.

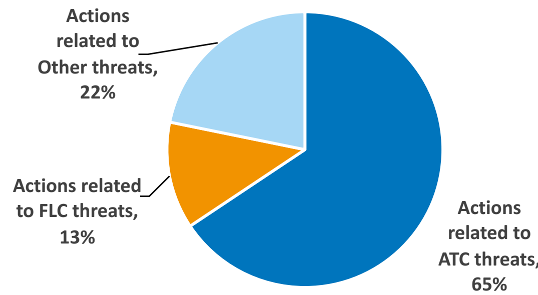


Figure 7 – Actions

The top three actions relating to ATC threats accounted for 66% of all ATC actions taken:

- Flight crew followed ATC
- Avoidance maneuver performed
- Go around.

The top three actions relating to flight crew threats accounted for 90% of the flight crew actions:

- Flight crew followed ATC
- Avoidance manoeuvre performed
- Flight crew aircraft handling

Overall ATS related Threats, Errors, UAS and Actions accounted for around 63% of the concerns identified in the reports, flight crew issues relating to ATS reports accounted for around 21% of issues with the remaining 16% relating to factors outside the control of both the flight crew and ATC such as weather and the operational environment.

CONCLUSION

The overall conclusion for both the Global and In-depth analysis STEADES ATS are:

- The TEM model analysis showed that pilot perceptions of poor ATS performance represents approximately 60% of all contributing factors.
- Flight crew errors are approximately 40% of contributory factors, including not following ATS instructions and Human Factors related errors. This indicates that enhancing adherence to standard communications, standard operating procedures, ATC clearances and application of CRM principles in both pilot to pilot and the pilot to ATC interfaces could contribute to further safety improvements.
- The most common Threat identified was a loss of separation, but the most common rectifying action was flight crew following corrected ATC instructions, indicating that there is a large element of self-correction from ATC.

FUTURE WORK

- IATA will continue to work for improved ATS standards and infrastructure through regional initiatives, ICAO and industry bodies.
- Operators can contribute in their field of operation with regular ATC liaison to share learning from events towards enhancements in safety.
- ATM-Other and ATC Service Standards, represent almost 56% of all existing ATS STEADES descriptors, therefore additional categorization is needed for future studies in order to give more detailed analyses.
- Analysis of ATS standards in relation to runway safety.
- A comparative analysis of ATS standards focused at country level across the IATA regions.
- Work to expand the STEADES contributions from those regions where reporting is currently disproportionately low.

The full STEADES ATS Analysis has been published on the STEADES pages of the GADM website for STEADES members.

If you are interested in joining STEADES or any of the other GADM programs, please contact us at GADM@iata.org

Image courtesy of ATR

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 International Air Transport Association (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.

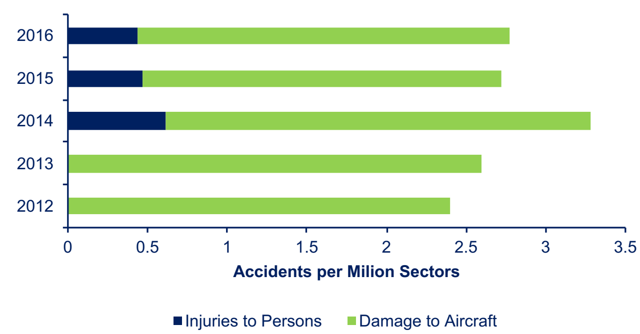
The GSIE developed a harmonized accident rate beginning in 2011. This was accomplished through close co-operation between ICAO and IATA to align accident definitions, criteria and analysis methods used to calculate the harmonized rate, which is considered a key safety indicator for commercial aviation operations worldwide. The joint analysis includes accidents meeting 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.

ANALYSIS OF HARMONIZED ACCIDENTS

A total of 113 accidents were considered as part of the harmonized accident criteria in 2016. These include scheduled and non-scheduled commercial operations, including ferry flights, for aircraft with a maximum certificated take-off weight above 5700kg. The GSIE harmonized accident rate for the period from 2012 (the first year the rate was calculated) to 2016 is shown below. As of 2013, a breakdown of the rate in terms of the operational safety component, covering accidents involving damage to aircraft and the medical/injury component pertaining to accidents with serious or fatal injuries to persons, but little or no damage to the aircraft itself, is also presented.

GSIE HARMONIZED ACCIDENT RATE



DEFINITIONS AND METHODS

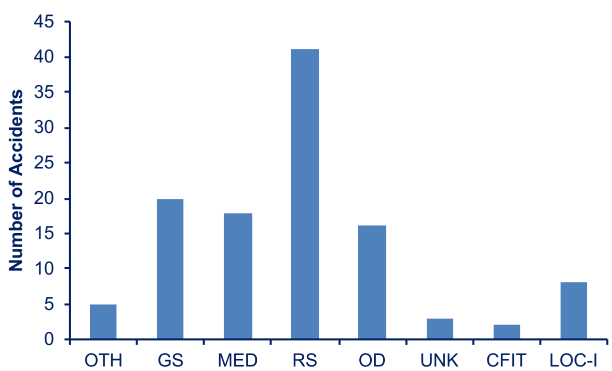
In order to build upon the harmonized accident rate presented in the last two safety reports, ICAO and IATA worked closely to develop a common taxonomy that would allow for a seamless integration of accident data between the two organizations. A detailed explanation of the harmonized accident categories and how the relate to the Commercial Aviation Safety Team/ICAO Common Taxonomy Team (CICTT) occurrence categories can be found at the end of this section.

A common list was developed by ICAO and IATA using the CICTT Phases of Flight.

HARMONIZED ACCIDENT CATEGORIES

The fundamental differences in the approaches of the ICAO (CICTT Occurrence Categories) and IATA (Flight-crew centric Threat and Error Management Model) classification systems required the harmonization of accident criteria being used. The breakdown of accidents by harmonized category can be seen in the figure below.

Accidents by Category



Accident Categories

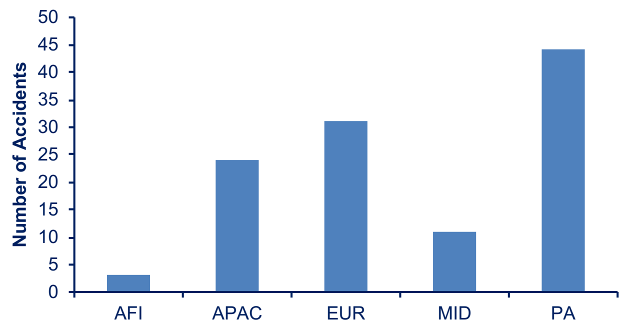
Controlled Flight into Terrain (CFIT)
Loss of Control In-flight (LOC-I)
Runway Safety (RS)
Ground Safety (GS)
Operational Damage (OD)
Injuries to and/or Incapacitation of Persons (MED)
Other (OTH)
Unknown (UNK)

Full details of categories can be found at the end of this section.

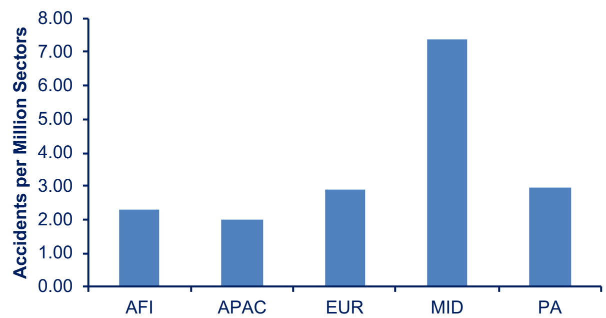
ACCIDENTS BY REGION OF OCCURRENCE

A harmonized regional analysis is provided using the ICAO Regional Aviation Safety Group regions. The number of accidents and harmonized accident rate by region are shown in the figure below:

Number of Accidents



Accident Rate



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.

Addendum A

Top Contributing Factors – Section 4

2016 Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Safety Management	39%
Regulatory Oversight	33%
Flight Operations	30%
Flight Ops: SOPs & Checking	30%
Selection Systems	19%
Management Decisions	17%
Flight Ops: Training Systems	9%
Maintenance Operations	7%
Maintenance Ops: SOPs & Checking	7%
Design	6%
Maintenance Ops: Training Systems	4%
Ops Planning & Scheduling	2%
Technology & Equipment	2%
Dispatch	2%
Change Management	2%
Dispatch Ops: SOPs & Checking	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	37%
SOP Adherence / SOP Cross-verification	33%
Failure to GOA after Destabilized Approach	13%
Callouts	11%
Pilot-to-Pilot Communication	9%
Automation	7%
Abnormal Checklist	6%

2016 Aircraft Accidents

FLIGHT CREW ERRORS (cont'd)

	Percentage Contribution
Documentation	2%
Briefings	2%
Systems / Radios / Instruments	2%
Dispatch	2%
Wrong Weight & Balance / Fuel Information	2%
ATC	2%
Crew to External Communication	2%

THREATS

	Percentage Contribution
Aircraft Malfunction	44%
Meteorology	31%
Gear / Tire	20%
Wind/Windshear/Gusty wind	20%
Airport Facilities	17%
Fire / Smoke (Cockpit/Cabin/Cargo)	13%
Contaminated runway/taxiway - poor braking action	11%
Operational Pressure	11%
Poor visibility / IMC	11%
Maintenance Events	11%
Nav Aids	9%
Ground-based nav aid malfunction or not available	9%
Thunderstorms	9%
Lack of Visual Reference	9%
Fatigue	7%
Air Traffic Services	7%
Contained Engine Failure/Powerplant Malfunction	6%
Dispatch / Paperwork	6%
Avionics / Flight Instruments	4%
Icing Conditions	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Extensive / Uncontained Engine Failure	4%
Wildlife/Birds/Foreign Object	4%
Airport perimeter control/fencing/wildlife control	2%
Manuals/Charts/Checklists	2%
Spatial Disorientation/somatogravic illusion	2%
Structural Failure	2%

2016 Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	22%
Unstable Approach	15%
Operation Outside Aircraft Limitations	13%
Vertical / Lateral / Speed Deviation	13%
Continued Landing after Unstable Approach	13%
Abrupt Aircraft Control	11%
Loss of aircraft control while on the ground	9%
Unnecessary Weather Penetration	7%
Engine	6%
Brakes / Thrust Reversers / Ground Spoilers	4%
Rejected Take-off after V1	4%
Flight Controls / Automation	4%
Controlled Flight Towards Terrain	2%
Runway / taxiway incursion	2%
Ramp movements	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	22%
Monitor / Cross-check	19%
Contingency Management	13%
Taxiway / Runway Management	7%
Leadership	7%
Captain should show leadership	7%
Evaluation of Plans	7%
Workload Management	6%
FO is assertive when necessary	6%
Automation Management	4%
Communication Environment	4%
Plans Stated	2%
Inquiry	2%

Note: 11 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

2012-2016 Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	31%
Safety Management	26%
Flight Operations	16%
Flight Ops: Training Systems	11%
Flight Ops: SOPs & Checking	10%
Maintenance Operations	7%
Maintenance Ops: SOPs & Checking	7%
Design	7%
Selection Systems	6%
Management Decisions	6%
Technology & Equipment	4%
Change Management	3%
Maintenance Ops: Training Systems	2%
Ground Operations	1%
Ops Planning & Scheduling	1%
Dispatch Ops: SOPs & Checking	1%
Dispatch	1%
Ground Ops: Training Systems	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	33%
SOP Adherence / SOP Cross-verification	25%
Failure to GOA after Destabilized Approach	10%
Pilot-to-Pilot Communication	6%
Callouts	5%
Automation	3%
Abnormal Checklist	3%
Crew to External Communication	2%
Ground Crew	2%
Normal Checklist	1%
Systems / Radios / Instruments	1%
Briefings	1%
ATC	1%
Wrong Weight & Balance / Fuel Information	1%
Documentation	1%

2012-2016 Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	31%
Aircraft Malfunction	25%
Wind/Windshear/Gusty wind	18%
Airport Facilities	15%
Gear / Tire	15%
Maintenance Events	11%
Poor visibility / IMC	11%
Contaminated runway/taxiway - poor braking action	9%
Ground-based nav aid malfunction or not available	9%
Nav Aids	9%
Lack of Visual Reference	8%
Thunderstorms	8%
Air Traffic Services	6%
Ground Events	6%
Wildlife/Birds/Foreign Object	5%
Fire / Smoke (Cockpit/Cabin/Cargo)	4%
Operational Pressure	4%
Fatigue	4%
Optical Illusion / visual mis-perception	3%
Poor/faint marking/signs or runway/taxiway closure	3%
Airport perimeter control/fencing/wildlife control	3%
Contained Engine Failure/Powerplant Malfunction	2%
Terrain / Obstacles	2%
Icing Conditions	2%
Extensive / Uncontained Engine Failure	2%
Dispatch / Paperwork	2%
Brakes	1%
Inad overrun area/trench/ditch/prox of structures	1%
Spatial Disorientation / somatogravic illusion	1%
Hydraulic System Failure	1%
Crew Incapacitation	1%
Secondary Flight Controls	1%
Flight Controls	1%
Avionics / Flight Instruments	1%
Traffic	1%

2012-2016 Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	24%
Vertical / Lateral / Speed Deviation	18%
Unstable Approach	11%
Continued Landing after Unstable Approach	10%
Operation Outside Aircraft Limitations	8%
Abrupt Aircraft Control	8%
Unnecessary Weather Penetration	7%
Loss of aircraft control while on the ground	6%
Brakes / Thrust Reversers / Ground Spoilers	3%
Flight Controls / Automation	3%
Engine	3%
Controlled Flight Towards Terrain	2%
Ramp movements	2%
Rejected Take-off after V1	1%
Weight & Balance	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	22%
Monitor / Cross-check	15%
Contingency Management	8%
Leadership	6%
Captain should show leadership	5%
FO is assertive when necessary	3%
Taxiway / Runway Management	3%
Automation Management	3%
Communication Environment	3%
Workload Management	2%
Evaluation of Plans	2%
Plans Stated	1%

Note: 73 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

2012-2016 Fatal Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	46%
Safety Management	43%
Flight Operations	29%
Flight Ops: SOPs & Checking	20%
Selection Systems	17%
Technology & Equipment	17%
Flight Ops: Training Systems	14%
Management Decisions	14%
Ops Planning & Scheduling	6%
Change Management	3%
Design	3%
Dispatch Ops: SOPs & Checking	3%
Dispatch	3%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	46%
Manual Handling / Flight Controls	26%
Pilot-to-Pilot Communication	20%
Callouts	14%
Abnormal Checklist	9%
Automation	6%
Systems / Radios / Instruments	6%
Briefings	3%
Dispatch	3%
ATC	3%
Documentation	3%
Crew to External Communication	3%
Wrong Weight & Balance / Fuel Information	3%

2012-2016 Fatal Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	43%
Aircraft Malfunction	31%
Nav Aids	26%
Ground-based nav aid malfunction or not available	26%
Poor visibility / IMC	23%
Lack of Visual Reference	20%
Thunderstorms	17%
Fatigue	14%
Contained Engine Failure/Powerplant Malfunction	11%
Wind/Windshear/Gusty wind	11%
Air Traffic Services	9%
Operational Pressure	9%
Icing Conditions	6%
Dispatch / Paperwork	6%
Spatial Disorientation / somatogravic illusion	6%
Terrain / Obstacles	6%
Maintenance Events	3%
Flight Controls	3%
Airport Facilities	3%
Avionics / Flight Instruments	3%
Fire / Smoke (Cockpit/Cabin/Cargo)	3%
Contaminated runway/taxiway - poor braking action	3%
Structural Failure	3%
Primary Flight Controls	3%
Crew Incapacitation	3%
Wildlife/Birds/Foreign Object	3%
Optical Illusion / visual mis-perception	3%
Gear / Tire	3%

2012-2016 Fatal Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	34%
Unnecessary Weather Penetration	23%
Operation Outside Aircraft Limitations	23%
Controlled Flight Towards Terrain	14%
Abrupt Aircraft Control	9%
Continued Landing after Unstable Approach	6%
Long/floated/bounced/firm/off-center/crabbed land	6%
Flight Controls / Automation	6%
Unstable Approach	6%
Engine	6%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	37%
Monitor / Cross-check	29%
Leadership	23%
Captain should show leadership	20%
Contingency Management	17%
Communication Environment	14%
FO is assertive when necessary	11%
Evaluation of Plans	9%
Workload Management	6%
Automation Management	6%
Plans Stated	3%
Inquiry	3%

Addendum A
Top Contributing Factors – Section 4

2012-2016 Non-Fatal Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	29%
Safety Management	23%
Flight Operations	15%
Flight Ops: Training Systems	10%
Flight Ops: SOPs & Checking	9%
Maintenance Operations	8%
Maintenance Ops: SOPs & Checking	8%
Design	7%
Management Decisions	4%
Selection Systems	4%
Change Management	3%
Technology & Equipment	3%
Maintenance Ops: Training Systems	2%
Ground Operations	2%
Dispatch Ops: SOPs & Checking	1%
Ground Ops: Training Systems	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	34%
SOP Adherence / SOP Cross-verification	22%
Failure to GOA after Destabilized Approach	11%
Callouts	4%
Pilot-to-Pilot Communication	4%
Automation	3%
Crew to External Communication	2%
Abnormal Checklist	2%
Ground Crew	2%
Normal Checklist	2%
Systems / Radios / Instruments	1%
Briefings	1%

2012-2016 Non-Fatal Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	29%
Aircraft Malfunction	24%
Wind/Windshear/Gusty wind	18%
Gear / Tire	16%
Airport Facilities	16%
Maintenance Events	12%
Contaminated runway/taxiway - poor braking action	10%
Poor visibility / IMC	9%
Thunderstorms	7%
Lack of Visual Reference	7%
Nav Aids	6%
Ground Events	6%
Ground-based nav aid malfunction or not available	6%
Wildlife/Birds/Foreign Object	6%
Air Traffic Services	5%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%
Operational Pressure	3%
Optical Illusion / visual mis-perception	3%
Poor/faint marking/signs or runway/taxiway closure	3%
Airport perimeter control/fencing/wildlife control	3%
Fatigue	2%
Terrain / Obstacles	2%
Extensive / Uncontained Engine Failure	2%
Brakes	2%
Inad overrun area/trench/ditch/prox of structures	1%
Hydraulic System Failure	1%
Icing Conditions	1%
Dispatch / Paperwork	1%
Contained Engine Failure/Powerplant Malfunction	1%
Traffic	1%
Secondary Flight Controls	1%
Crew Incapacitation	1%

2012-2016 Non-Fatal Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	26%
Vertical / Lateral / Speed Deviation	16%
Unstable Approach	12%
Continued Landing after Unstable Approach	10%
Abrupt Aircraft Control	7%
Loss of aircraft control while on the ground	6%
Operation Outside Aircraft Limitations	6%
Unnecessary Weather Penetration	5%
Brakes / Thrust Reversers / Ground Spoilers	4%
Engine	2%
Flight Controls / Automation	2%
Ramp movements	2%
Weight & Balance	1%
Rejected Take-off after V1	1%
Controlled Flight Towards Terrain	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	20%
Monitor / Cross-check	13%
Contingency Management	7%
Leadership	4%
Taxiway / Runway Management	4%
Captain should show leadership	3%
Automation Management	3%
FO is assertive when necessary	2%
Workload Management	2%
Evaluation of Plans	2%
Communication Environment	1%
Plans Stated	1%

Top Contributing Factors – Section 4

2012-2016 IOSA Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	21%
Safety Management	18%
Flight Operations	16%
Flight Ops: Training Systems	12%
Design	10%
Flight Ops: SOPs & Checking	8%
Maintenance Operations	7%
Maintenance Ops: SOPs & Checking	7%
Change Management	5%
Selection Systems	5%
Management Decisions	4%
Technology & Equipment	4%
Maintenance Ops: Training Systems	3%
Ground Operations	2%
Ops Planning & Scheduling	2%
Ground Ops: Training Systems	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	32%
SOP Adherence / SOP Cross-verification	24%
Callouts	9%
Failure to GOA after Destabilized Approach	9%
Pilot-to-Pilot Communication	8%
Automation	6%
Ground Crew	3%
Abnormal Checklist	3%
Crew to External Communication	3%
Systems / Radios / Instruments	1%
Briefings	1%
Normal Checklist	1%
Ground Navigation	1%
ATC	1%

2012-2016 IOSA Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	27%
Aircraft Malfunction	26%
Wind/Windshear/Gusty wind	18%
Gear / Tire	17%
Maintenance Events	14%
Airport Facilities	10%
Ground Events	10%
Air Traffic Services	9%
Contaminated runway/taxiway - poor braking action	8%
Thunderstorms	7%
Poor visibility / IMC	7%
Fire / Smoke (Cockpit/Cabin/Cargo)	7%
Wildlife/Birds/Foreign Object	6%
Fatigue	5%
Lack of Visual Reference	5%
Ground-based nav aid malfunction or not available	4%
Nav Aids	4%
Operational Pressure	4%
Optical Illusion / visual mis-perception	3%
Airport perimeter control/fencing/wildlife control	1%
Extensive / Uncontained Engine Failure	1%
Icing Conditions	1%
Spatial Disorientation / somatogravic illusion	1%
Terrain / Obstacles	1%
Traffic	1%
Contained Engine Failure/Powerplant Malfunction	1%
Flight Controls	1%
Poor/faint marking/signs or runway/taxiway closure	1%
Dangerous Goods	1%
Brakes	1%
Avionics / Flight Instruments	1%
Secondary Flight Controls	1%
Hydraulic System Failure	1%
Inad overrun area/trench/ditch/prox of structures	1%

2012-2016 IOSA Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	21%
Vertical / Lateral / Speed Deviation	16%
Unstable Approach	11%
Abrupt Aircraft Control	10%
Operation Outside Aircraft Limitations	10%
Continued Landing after Unstable Approach	8%
Loss of aircraft control while on the ground	7%
Unnecessary Weather Penetration	4%
Brakes / Thrust Reversers / Ground Spoilers	4%
Engine	4%
Flight Controls / Automation	3%
Ramp movements	3%
Rejected Take-off after V1	2%
Controlled Flight Towards Terrain	1%
Weight & Balance	1%
Wrong taxiway / ramp / gate / hold spot	1%
Proceeding toward wrong taxiway / runway	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	21%
Monitor / Cross-check	15%
Contingency Management	10%
Leadership	8%
Captain should show leadership	7%
Automation Management	4%
FO is assertive when necessary	4%
Communication Environment	4%
Taxiway / Runway Management	3%
Workload Management	3%
Evaluation of Plans	1%
Plans Stated	1%

Note: 14 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

2012-2016 Non-IOSA Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	39%
Safety Management	31%
Flight Operations	16%
Flight Ops: SOPs & Checking	11%
Flight Ops: Training Systems	10%
Management Decisions	7%
Selection Systems	7%
Maintenance Ops: SOPs & Checking	7%
Maintenance Operations	7%
Technology & Equipment	5%
Design	4%
Dispatch Ops: SOPs & Checking	2%
Dispatch	1%
Maintenance Ops: Training Systems	1%
Change Management	1%
Ground Operations	1%
Ground Ops: SOPs & Checking	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	34%
SOP Adherence / SOP Cross-verification	27%
Failure to GOA after Destabilized Approach	10%
Pilot-to-Pilot Communication	4%
Abnormal Checklist	2%
Normal Checklist	2%
Callouts	2%
Documentation	1%
Systems / Radios / Instruments	1%
Crew to External Communication	1%
Wrong Weight & Balance / Fuel Information	1%
Automation	1%
Dispatch	1%
ATC	1%
Ground Crew	1%
Briefings	1%

2012-2016 Non-IOSA Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	34%
Aircraft Malfunction	25%
Airport Facilities	18%
Wind/Windshear/Gusty wind	17%
Poor visibility / IMC	13%
Gear / Tire	13%
Nav Aids	12%
Ground-based nav aid malfunction or not available	12%
Lack of Visual Reference	11%
Contaminated runway/taxiway - poor braking action	10%
Thunderstorms	9%
Maintenance Events	8%
Poor/faint marking/signs or runway/taxiway closure	5%
Wildlife/Birds/Foreign Object	5%
Contained Engine Failure/Powerplant Malfunction	4%
Operational Pressure	4%
Airport perimeter control/fencing/wildlife control	4%
Optical Illusion / visual mis-perception	4%
Air Traffic Services	3%
Terrain / Obstacles	3%
Dispatch / Paperwork	3%
Fire / Smoke (Cockpit/Cabin/Cargo)	2%
Fatigue	2%
Ground Events	2%
Brakes	2%
Inad overrun area/trench/ditch/prox of structures	2%
Icing Conditions	2%
Extensive / Uncontained Engine Failure	2%
Crew Incapacitation	2%
Hydraulic System Failure	1%
Spatial Disorientation / somatogravic illusion	1%
Structural Failure	1%
Flight Controls	1%
Primary Flight Controls	1%
Manuals / Charts / Checklists	1%
Secondary Flight Controls	1%
Avionics / Flight Instruments	1%

2012-2016 Non-IOSA Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	26%
Vertical / Lateral / Speed Deviation	20%
Unstable Approach	11%
Continued Landing after Unstable Approach	11%
Unnecessary Weather Penetration	8%
Operation Outside Aircraft Limitations	7%
Abrupt Aircraft Control	5%
Loss of aircraft control while on the ground	4%
Controlled Flight Towards Terrain	3%
Brakes / Thrust Reversers / Ground Spoilers	2%
Flight Controls / Automation	2%
Engine	2%
Weight & Balance	1%
Ramp movements	1%
Unauthorized Airspace Penetration	1%
Landing Gear	1%
Runway / taxiway incursion	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	23%
Monitor / Cross-check	15%
Contingency Management	7%
Leadership	5%
Captain should show leadership	4%
Taxiway / Runway Management	4%
FO is assertive when necessary	3%
Evaluation of Plans	3%
Automation Management	2%
Workload Management	2%
Communication Environment	2%
Plans Stated	1%
SOP Briefing/Planning	1%
Inquiry	1%

Note: 59 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

Controlled Flight into Terrain

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	82%
Technology & Equipment	55%
Safety Management	55%
Flight Operations	27%
Selection Systems	18%
Management Decisions	18%
Flight Ops: SOPs & Checking	18%
Flight Ops: Training Systems	9%

THREATS

	Percentage Contribution
Nav Aids	64%
Ground-based nav aid malfunction or not available	64%
Meteorology	55%
Poor visibility / IMC	45%
Lack of Visual Reference	36%
Terrain / Obstacles	18%
Fatigue	18%
Thunderstorms	18%
Manuals / Charts / Checklists	9%
Air Traffic Services	9%
Operational Pressure	9%
Optical Illusion / visual mis-perception	9%
Wind/Windshear/Gusty wind	9%
Poor/faint marking/signs or runway/taxiway closure	9%
Spatial Disorientation / somatogravic illusion	9%
Dispatch / Paperwork	9%
Airport Facilities	9%
Crew Incapacitation	9%

Controlled Flight into Terrain

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	64%
Manual Handling / Flight Controls	18%
Failure to GOA after Destabilized Approach	9%
Callouts	9%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	55%
Unnecessary Weather Penetration	27%
Continued Landing after Unstable Approach	9%
Unstable Approach	9%
Long/floated/bounced/firm/off-center/crabbed land	9%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	55%
Monitor / Cross-check	45%
Contingency Management	18%
FO is assertive when necessary	9%
Leadership	9%

Note: 8 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
Safety Management	32%
Flight Operations	32%
Regulatory Oversight	27%
Flight Ops: SOPs & Checking	23%
Selection Systems	18%
Flight Ops: Training Systems	18%
Ops Planning & Scheduling	9%
Management Decisions	9%
Design	5%
Change Management	5%

THREATS

	Percentage Contribution
Aircraft Malfunction	45%
Meteorology	36%
Contained Engine Failure/Powerplant Malfunction	23%
Lack of Visual Reference	18%
Fatigue	14%
Thunderstorms	14%
Wind/Windshear/Gusty wind	14%
Poor visibility / IMC	14%
Nav Aids	9%
Ground-based nav aid malfunction or not available	9%
Operational Pressure	9%
Icing Conditions	9%
Air Traffic Services	9%
Spatial Disorientation / somatogravic illusion	5%
Maintenance Events	5%
Avionics / Flight Instruments	5%
Gear / Tire	5%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%

Loss of Control In-flight

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	41%
Manual Handling / Flight Controls	36%
Pilot-to-Pilot Communication	27%
Callouts	23%
Abnormal Checklist	18%
Automation	14%
Systems / Radios / Instruments	9%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Operation Outside Aircraft Limitations	32%
Vertical / Lateral / Speed Deviation	27%
Unnecessary Weather Penetration	18%
Abrupt Aircraft Control	14%
Flight Controls / Automation	14%
Engine	9%
Unstable Approach	5%
Continued Landing after Unstable Approach	5%
Long/floated/bounced/firm/off-center/crabbed land	5%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	36%
Monitor / Cross-check	27%
Captain should show leadership	27%
Leadership	27%
Communication Environment	18%
Contingency Management	14%
Automation Management	9%
FO is assertive when necessary	9%
Workload Management	5%
Evaluation of Plans	5%

Note: 8 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 2 accidents in the past 5 years.

Top Contributing Factors – Section 4

Runway/Taxiway Excursion

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	45%
Safety Management	40%
Flight Operations	17%
Flight Ops: Training Systems	14%
Flight Ops: SOPs & Checking	12%
Selection Systems	5%
Change Management	5%
Design	3%
Management Decisions	3%
Dispatch Ops: SOPs & Checking	2%
Maintenance Ops: SOPs & Checking	2%
Maintenance Operations	2%
Ops Planning & Scheduling	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	48%
SOP Adherence / SOP Cross-verification	32%
Failure to GOA after Destabilized Approach	17%
Pilot-to-Pilot Communication	6%
Normal Checklist	3%
Callouts	3%
Automation	3%
Briefings	2%

Runway/Taxiway Excursion

THREATS

	Percentage Contribution
Meteorology	49%
Airport Facilities	37%
Contaminated runway/taxiway - poor braking action	35%
Wind/Windshear/Gusty wind	25%
Poor visibility / IMC	17%
Lack of Visual Reference	14%
Thunderstorms	14%
Nav Aids	12%
Ground-based nav aid malfunction or not available	12%
Aircraft Malfunction	11%
Air Traffic Services	6%
Gear / Tire	5%
Poor/faint marking/signs or runway/taxiway closure	5%
Fatigue	5%
Terrain / Obstacles	3%
Brakes	3%
Optical Illusion / visual mis-perception	2%
Crew Incapacitation	2%
Maintenance Events	2%
Operational Pressure	2%
Icing Conditions	2%
Contained Engine Failure/Powerplant Malfunction	2%

Runway/Taxiway Excursion

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	46%
Vertical / Lateral / Speed Deviation	18%
Loss of aircraft control while on the ground	14%
Unstable Approach	14%
Continued Landing after Unstable Approach	14%
Operation Outside Aircraft Limitations	8%
Brakes / Thrust Reversers / Ground Spoilers	8%
Abrupt Aircraft Control	6%
Unnecessary Weather Penetration	6%
Flight Controls / Automation	3%
Rejected Take-off after V1	2%
Engine	2%
Weight & Balance	2%

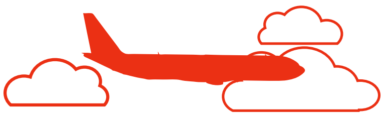
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	31%
Monitor / Cross-check	22%
Contingency Management	15%
Taxiway / Runway Management	11%
FO is assertive when necessary	6%
Leadership	6%
Captain should show leadership	5%
Evaluation of Plans	3%
Plans Stated	3%
Automation Management	2%
Workload Management	2%
Communication Environment	2%
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.

Top Contributing Factors – Section 4

In-flight Damage



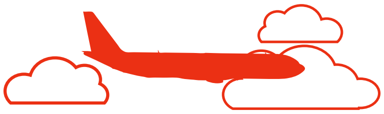
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	18%
Design	15%
Safety Management	12%
Maintenance Ops: SOPs & Checking	9%
Maintenance Operations	9%
Management Decisions	6%
Flight Ops: SOPs & Checking	3%
Flight Operations	3%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	18%
Callouts	3%
Pilot-to-Pilot Communication	3%
Systems / Radios / Instruments	3%
Automation	3%

In-flight Damage



THREATS

	Percentage Contribution
Aircraft Malfunction	39%
Wildlife/Birds/Foreign Object	27%
Fire / Smoke (Cockpit/Cabin/Cargo)	18%
Extensive / Uncontained Engine Failure	15%
Meteorology	15%
Maintenance Events	12%
Airport Facilities	9%
Thunderstorms	9%
Nav Aids	6%
Ground-based nav aid malfunction or not available	6%
Flight Controls	6%
Contaminated runway/taxiway - poor braking action	6%
Wind/Windshear/Gusty wind	6%
Airport perimeter control/fencing/wildlife control	3%
Structural Failure	3%
Dangerous Goods	3%
Primary Flight Controls	3%
Gear / Tire	3%
Air Traffic Services	3%
Secondary Flight Controls	3%
Poor visibility / IMC	3%
Dispatch / Paperwork	3%
Contained Engine Failure/Powerplant Malfunction	3%
Optical Illusion / visual mis-perception	3%

In-flight Damage

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Operation Outside Aircraft Limitations	6%
Vertical / Lateral / Speed Deviation	6%
Unstable Approach	3%
Abrupt Aircraft Control	3%
Unnecessary Weather Penetration	3%
Long/floated/bounced/firm/off-center/crabbed land	3%
Continued Landing after Unstable Approach	3%

COUNTERMEASURES

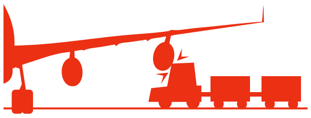
	Percentage Contribution
Contingency Management	6%
Automation Management	6%
Communication Environment	3%
Captain should show leadership	3%
Evaluation of Plans	3%
Leadership	3%

Note: 2 accidents 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

Ground Damage



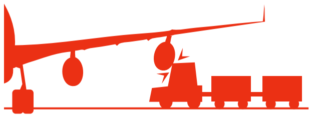
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	24%
Safety Management	18%
Ground Operations	12%
Maintenance Ops: SOPs & Checking	6%
Maintenance Operations	6%
Ground Ops: Training Systems	6%
Design	6%
Flight Operations	3%
Change Management	3%
Flight Ops: SOPs & Checking	3%
Ground Ops: SOPs & Checking	3%

FLIGHT CREW ERRORS

	Percentage Contribution
Crew to External Communication	15%
SOP Adherence / SOP Cross-verification	15%
Ground Crew	15%
Abnormal Checklist	6%
Systems / Radios / Instruments	3%
ATC	3%
Ground Navigation	3%
Manual Handling / Flight Controls	3%
Normal Checklist	3%

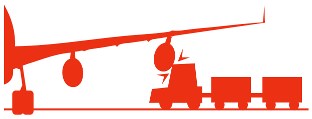
Ground Damage



THREATS

	Percentage Contribution
Ground Events	48%
Aircraft Malfunction	18%
Maintenance Events	12%
Fire / Smoke (Cockpit/Cabin/Cargo)	12%
Air Traffic Services	9%
Hydraulic System Failure	6%
Airport Facilities	6%
Brakes	6%
Secondary Flight Controls	3%
Optical Illusion / visual mis-perception	3%
Meteorology	3%
Gear / Tire	3%
Operational Pressure	3%
Inad overrun area/trench/ditch/prox of structures	3%
Poor/faint marking/signs or runway/taxiway closure	3%
Traffic	3%
Thunderstorms	3%

Ground Damage



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Ramp movements	15%
Loss of aircraft control while on the ground	12%
Brakes / Thrust Reversers / Ground Spoilers	9%
Wrong taxiway / ramp / gate / hold spot	3%
Engine	3%
Proceeding toward wrong taxiway / runway	3%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	15%
Monitor / Cross-check	12%
Taxiway / Runway Management	6%
Leadership	3%
Workload Management	3%
FO is assertive when necessary	3%

Note: 6 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

Undershoot

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	55%
Safety Management	45%
Flight Operations	36%
Flight Ops: SOPs & Checking	27%
Management Decisions	18%
Flight Ops: Training Systems	9%
Technology & Equipment	9%
Change Management	9%

THREATS

	Percentage Contribution
Meteorology	73%
Wind/Windshear/Gusty wind	45%
Poor visibility / IMC	45%
Nav Aids	36%
Ground-based nav aid malfunction or not available	36%
Airport Facilities	18%
Optical Illusion / visual mis-perception	18%
Air Traffic Services	9%
Poor/faint marking/signs or runway/taxiway closure	9%
Contaminated runway/taxiway - poor braking action	9%
Icing Conditions	9%
Operational Pressure	9%
Lack of Visual Reference	9%

Undershoot

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	45%
Manual Handling / Flight Controls	45%
Failure to GOA after Destabilized Approach	18%
Pilot-to-Pilot Communication	9%
Callouts	9%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	64%
Unnecessary Weather Penetration	36%
Unstable Approach	18%
Continued Landing after Unstable Approach	18%
Loss of aircraft control while on the ground	9%

COUNTERMEASURES

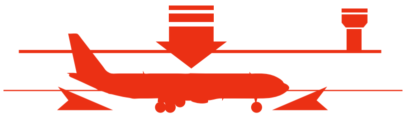
	Percentage Contribution
Overall Crew Performance	27%
Captain should show leadership	9%
Leadership	9%
Monitor / Cross-check	9%

Note: 1 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

Hard Landing



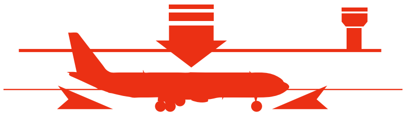
LATENT CONDITIONS

	Percentage Contribution
Flight Operations	26%
Flight Ops: Training Systems	24%
Regulatory Oversight	20%
Safety Management	17%
Flight Ops: SOPs & Checking	13%
Selection Systems	13%
Management Decisions	4%
Dispatch Ops: SOPs & Checking	2%
Dispatch	2%
Change Management	2%
Technology & Equipment	2%

THREATS

	Percentage Contribution
Meteorology	48%
Wind/Windshear/Gusty wind	39%
Thunderstorms	13%
Lack of Visual Reference	9%
Poor visibility / IMC	7%
Operational Pressure	7%
Airport Facilities	7%
Optical Illusion / visual mis-perception	7%
Ground-based nav aid malfunction or not available	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Nav Aids	4%
Gear / Tire	2%
Dispatch / Paperwork	2%
Terrain / Obstacles	2%
Aircraft Malfunction	2%
Airport perimeter control/fencing/wildlife control	2%
Fatigue	2%

Hard Landing



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	74%
Failure to GOA after Destabilized Approach	28%
SOP Adherence / SOP Cross-verification	28%
Callouts	7%
Pilot-to-Pilot Communication	2%
Automation	2%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	65%
Unstable Approach	37%
Vertical / Lateral / Speed Deviation	33%
Abrupt Aircraft Control	28%
Continued Landing after Unstable Approach	24%
Unnecessary Weather Penetration	7%
Operation Outside Aircraft Limitations	7%
Loss of aircraft control while on the ground	4%
Flight Controls / Automation	2%
Engine	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	37%
Monitor / Cross-check	17%
Contingency Management	7%
Automation Management	4%
Workload Management	2%
Captain should show leadership	2%
Evaluation of Plans	2%
Taxiway / Runway Management	2%
Leadership	2%

Note: 2 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

Gear-up Landing/Gear Collapse

LATENT CONDITIONS

	Percentage Contribution
Maintenance Ops: SOPs & Checking	30%
Maintenance Operations	30%
Design	19%
Regulatory Oversight	16%
Safety Management	14%
Maintenance Ops: Training Systems	12%
Management Decisions	5%
Flight Ops: Training Systems	2%
Flight Operations	2%

THREATS

	Percentage Contribution
Aircraft Malfunction	86%
Gear / Tire	86%
Maintenance Events	47%
Airport Facilities	5%
Inad overrun area/trench/ditch/prox of structures	5%
Wind/Windshear/Gusty wind	2%
Hydraulic System Failure	2%
Meteorology	2%

Gear-up Landing/Gear Collapse

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	2%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	2%
Long/floated/bounced/firm/off-center/crabbed land	2%

COUNTERMEASURES

	Percentage Contribution
—	—

Note: 18 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

Tailstrike

LATENT CONDITIONS

	Percentage Contribution
Flight Operations	26%
Regulatory Oversight	26%
Flight Ops: Training Systems	21%
Change Management	11%
Technology & Equipment	11%
Design	5%
Flight Ops: SOPs & Checking	5%
Safety Management	5%

THREATS

	Percentage Contribution
Meteorology	32%
Wind/Windshear/Gusty wind	26%
Fatigue	11%
Ground-based nav aid malfunction or not available	5%
Spatial Disorientation / somatogravic illusion	5%
Terrain / Obstacles	5%
Wildlife/Birds/Foreign Object	5%
Nav Aids	5%
Poor visibility / IMC	5%
Lack of Visual Reference	5%

Tailstrike

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	84%
SOP Adherence / SOP Cross-verification	26%
Pilot-to-Pilot Communication	11%
Failure to GOA after Destabilized Approach	11%
Wrong Weight & Balance / Fuel Information	5%
Automation	5%
Documentation	5%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	37%
Operation Outside Aircraft Limitations	32%
Vertical / Lateral / Speed Deviation	21%
Continued Landing after Unstable Approach	21%
Unstable Approach	16%
Weight & Balance	11%
Unnecessary Weather Penetration	5%
Brakes / Thrust Reversers / Ground Spoilers	5%
Abrupt Aircraft Control	5%
Flight Controls / Automation	5%

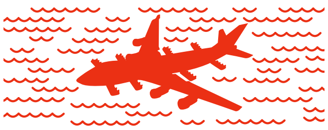
COUNTERMEASURES

	Percentage Contribution
Monitor / Cross-check	26%
Overall Crew Performance	21%
Leadership	16%
Contingency Management	16%
Captain should show leadership	16%
Automation Management	11%
FO is assertive when necessary	5%
Workload Management	5%

Note: 2 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

Off-Airport Landing/Ditching

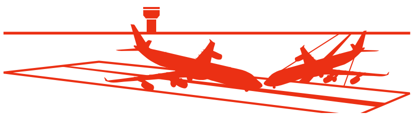


At least three accidents are required before the accident classification is provided.
This category only contained 2 accidents in the past 5 years.

Addendum A

Top Contributing Factors – Section 4

Runway Collision



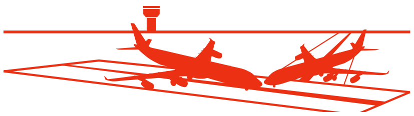
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	50%
Safety Management	30%
Technology & Equipment	10%
Maintenance Operations	10%
Management Decisions	10%
Maintenance Ops: SOPs & Checking	10%

THREATS

	Percentage Contribution
Airport Facilities	60%
Airport perimeter control/fencing/wildlife control	60%
Wildlife/Birds/Foreign Object	60%
Meteorology	40%
Poor visibility / IMC	30%
Lack of Visual Reference	20%
Wind/Windshear/Gusty wind	20%
Contaminated runway/taxiway - poor braking action	20%
Icing Conditions	10%
Air Traffic Services	10%
Terrain / Obstacles	10%
Thunderstorms	10%
Optical Illusion / visual mis-perception	10%

Runway Collision



FLIGHT CREW ERRORS

	Percentage Contribution
—	—

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Runway / taxiway incursion	10%
Ramp movements	10%
Vertical / Lateral / Speed Deviation	10%

COUNTERMEASURES

	Percentage Contribution
—	—

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	23%
Flight Operations	16%
Flight Ops: Training Systems	11%
Maintenance Operations	8%
Maintenance Ops: SOPs & Checking	8%
Design	8%
Flight Ops: SOPs & Checking	8%
Selection Systems	6%
Management Decisions	5%
Technology & Equipment	4%
Change Management	4%
Ground Operations	2%
Maintenance Ops: Training Systems	1%
Ops Planning & Scheduling	1%
Ground Ops: Training Systems	1%
Dispatch Ops: SOPs & Checking	1%
Dispatch	1%
Ground Ops: SOPs & Checking	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	32%
SOP Adherence / SOP Cross-verification	26%
Failure to GOA after Destabilized Approach	9%
Callouts	6%
Pilot-to-Pilot Communication	6%
Automation	4%
Abnormal Checklist	2%
Systems / Radios / Instruments	2%
Crew to External Communication	2%
Briefings	2%
Ground Crew	1%
Normal Checklist	1%
Wrong Weight & Balance / Fuel Information	1%
Documentation	1%
ATC	1%
Dispatch	1%

Jet Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	33%
Aircraft Malfunction	22%
Wind/Windshear/Gusty wind	19%
Gear / Tire	15%
Maintenance Events	14%
Airport Facilities	13%
Contaminated runway/taxiway - poor braking action	11%
Poor visibility / IMC	10%
Thunderstorms	10%
Lack of Visual Reference	8%
Air Traffic Services	8%
Nav Aids	7%
Ground-based nav aid malfunction or not available	7%
Ground Events	6%
Wildlife/Birds/Foreign Object	6%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%
Fatigue	5%
Optical Illusion / visual mis-perception	4%
Operational Pressure	3%
Terrain / Obstacles	3%
Poor/faint marking/signs or runway/taxiway closure	2%
Dispatch / Paperwork	2%
Extensive / Uncontained Engine Failure	2%
Inad overrun area/trench/ditch/prox of structures	1%
Airport perimeter control/fencing/wildlife control	1%
Crew Incapacitation	1%
Secondary Flight Controls	1%
Traffic	1%
Spatial Disorientation / somatogravic illusion	1%
Icing Conditions	1%
Hydraulic System Failure	1%
Flight Controls	1%
Dangerous Goods	1%
Brakes	1%
Avionics / Flight Instruments	1%

Jet Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	27%
Vertical / Lateral / Speed Deviation	19%
Unstable Approach	11%
Continued Landing after Unstable Approach	10%
Operation Outside Aircraft Limitations	8%
Abrupt Aircraft Control	8%
Unnecessary Weather Penetration	6%
Brakes / Thrust Reversers / Ground Spoilers	5%
Loss of aircraft control while on the ground	5%
Flight Controls / Automation	3%
Ramp movements	3%
Engine	2%
Weight & Balance	1%
Rejected Take-off after V1	1%
Controlled Flight Towards Terrain	1%
Proceeding toward wrong taxiway / runway	1%
Runway / taxiway incursion	1%
Unauthorized Airspace Penetration	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	19%
Monitor / Cross-check	16%
Contingency Management	10%
Leadership	7%
Captain should show leadership	6%
Taxiway / Runway Management	5%
FO is assertive when necessary	5%
Automation Management	4%
Workload Management	3%
Communication Environment	3%
Evaluation of Plans	2%
Plans Stated	1%
Inquiry	1%
SOP Briefing/Planning	1%

Note: 23 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	29%
Flight Operations	17%
Flight Ops: SOPs & Checking	13%
Flight Ops: Training Systems	10%
Management Decisions	7%
Selection Systems	6%
Maintenance Operations	5%
Technology & Equipment	5%
Maintenance Ops: SOPs & Checking	5%
Design	4%
Maintenance Ops: Training Systems	3%
Change Management	2%
Dispatch Ops: SOPs & Checking	2%
Ops Planning & Scheduling	1%
Ground Ops: Training Systems	1%
Dispatch	1%
Ground Operations	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	35%
SOP Adherence / SOP Cross-verification	24%
Failure to GOA after Destabilized Approach	10%
Pilot-to-Pilot Communication	6%
Abnormal Checklist	3%
Callouts	3%
Ground Crew	2%
Crew to External Communication	2%
Automation	2%
Normal Checklist	2%
Ground Navigation	1%
Systems / Radios / Instruments	1%

Turboprop Aircraft Accidents

THREATS

	Percentage Contribution
Aircraft Malfunction	30%
Meteorology	28%
Airport Facilities	17%
Wind/Windshear/Gusty wind	16%
Gear / Tire	14%
Poor visibility / IMC	12%
Nav Aids	10%
Ground-based nav aid malfunction or not available	10%
Lack of Visual Reference	8%
Contaminated runway/taxiway - poor braking action	7%
Thunderstorms	6%
Contained Engine Failure/Powerplant Malfunction	6%
Maintenance Events	6%
Operational Pressure	5%
Airport perimeter control/fencing/wildlife control	5%
Wildlife/Birds/Foreign Object	5%
Ground Events	5%
Poor/faint marking/signs or runway/taxiway closure	4%
Fire / Smoke (Cockpit/Cabin/Cargo)	3%
Icing Conditions	2%
Optical Illusion / visual mis-perception	2%
Brakes	2%
Terrain / Obstacles	2%
Fatigue	2%
Extensive / Uncontained Engine Failure	2%
Inad overrun area/trench/ditch/prox of structures	2%
Dispatch / Paperwork	2%
Air Traffic Services	2%
Primary Flight Controls	1%
Spatial Disorientation / somatogravic illusion	1%
Structural Failure	1%
Crew Incapacitation	1%
Hydraulic System Failure	1%
Flight Controls	1%
Manuals / Charts / Checklists	1%
Avionics / Flight Instruments	1%

Turboprop Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	20%
Vertical / Lateral / Speed Deviation	17%
Unstable Approach	12%
Continued Landing after Unstable Approach	10%
Operation Outside Aircraft Limitations	8%
Unnecessary Weather Penetration	7%
Loss of aircraft control while on the ground	7%
Abrupt Aircraft Control	7%
Controlled Flight Towards Terrain	4%
Engine	4%
Flight Controls / Automation	2%
Brakes / Thrust Reversers / Ground Spoilers	2%
Rejected Take-off after V1	1%
Wrong taxiway / ramp / gate / hold spot	1%
Landing Gear	1%
Weight & Balance	1%
Ramp movements	1%

COUNTERMEASURES

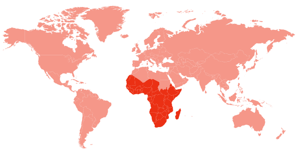
	Percentage Contribution
Overall Crew Performance	27%
Monitor / Cross-check	14%
Contingency Management	6%
Leadership	5%
Captain should show leadership	5%
Evaluation of Plans	3%
Communication Environment	2%
Workload Management	2%
Automation Management	2%
Plans Stated	1%
Taxiway / Runway Management	1%
FO is assertive when necessary	1%

Note: 50 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

Top Contributing Factors – Section 5

Africa Aircraft Accidents



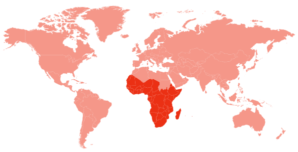
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	52%
Safety Management	44%
Management Decisions	11%
Maintenance Ops: SOPs & Checking	7%
Technology & Equipment	7%
Flight Ops: SOPs & Checking	7%
Flight Operations	7%
Flight Ops: Training Systems	7%
Maintenance Operations	4%
Dispatch Ops: SOPs & Checking	4%
Selection Systems	4%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	26%
SOP Adherence / SOP Cross-verification	19%
Failure to GOA after Destabilized Approach	15%
Pilot-to-Pilot Communication	11%
Callouts	4%
Systems / Radios / Instruments	4%
Abnormal Checklist	4%

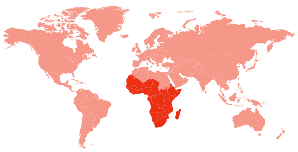
Africa Aircraft Accidents



THREATS

	Percentage Contribution
Airport Facilities	33%
Contaminated runway/taxiway - poor braking action	19%
Aircraft Malfunction	19%
Meteorology	19%
Gear / Tire	19%
Airport perimeter control/fencing/wildlife control	15%
Maintenance Events	15%
Thunderstorms	11%
Wildlife/Birds/Foreign Object	11%
Ground-based nav aid malfunction or not available	11%
Nav Aids	11%
Wind/Windshear/Gusty wind	7%
Poor visibility / IMC	7%
Hydraulic System Failure	4%
Ground Events	4%
Lack of Visual Reference	4%
Secondary Flight Controls	4%
Operational Pressure	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Crew Incapacitation	4%

Africa Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	26%
Vertical / Lateral / Speed Deviation	19%
Abrupt Aircraft Control	11%
Unstable Approach	7%
Continued Landing after Unstable Approach	7%
Weight & Balance	4%
Unauthorized Airspace Penetration	4%
Flight Controls / Automation	4%
Engine	4%
Operation Outside Aircraft Limitations	4%
Brakes / Thrust Reversers / Ground Spoilers	4%
Landing Gear	4%
Unnecessary Weather Penetration	4%

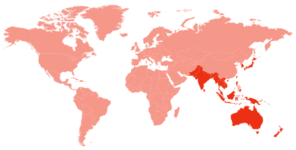
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	19%
Captain should show leadership	11%
Leadership	7%
Monitor / Cross-check	7%
Contingency Management	7%
FO is assertive when necessary	4%
Communication Environment	4%
Plans Stated	4%

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.

Top Contributing Factors – Section 5

Asia/Pacific Aircraft Accidents



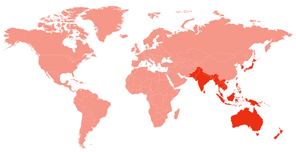
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	53%
Safety Management	35%
Flight Operations	20%
Flight Ops: Training Systems	16%
Flight Ops: SOPs & Checking	9%
Selection Systems	7%
Maintenance Ops: SOPs & Checking	5%
Maintenance Operations	5%
Management Decisions	4%
Change Management	4%
Design	4%
Maintenance Ops: Training Systems	1%
Technology & Equipment	1%
Ground Operations	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	45%
SOP Adherence / SOP Cross-verification	35%
Failure to GOA after Destabilized Approach	12%
Pilot-to-Pilot Communication	8%
Callouts	4%
Crew to External Communication	3%
Abnormal Checklist	3%
Automation	3%
Ground Crew	3%
ATC	1%

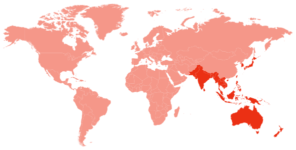
Asia/Pacific Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	31%
Aircraft Malfunction	18%
Wind/Windshear/Gusty wind	15%
Nav Aids	15%
Airport Facilities	15%
Ground-based nav aid malfunction or not available	15%
Thunderstorms	9%
Poor visibility / IMC	9%
Contaminated runway/taxiway - poor braking action	8%
Lack of Visual Reference	8%
Gear / Tire	7%
Wildlife/Birds/Foreign Object	7%
Maintenance Events	7%
Ground Events	5%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%
Poor/faint marking/signs or runway/taxiway closure	4%
Fatigue	4%
Contained Engine Failure/Powerplant Malfunction	4%
Air Traffic Services	3%
Operational Pressure	3%
Terrain / Obstacles	3%
Airport perimeter control/fencing/wildlife control	3%
Extensive / Uncontained Engine Failure	1%
Flight Controls	1%
Optical Illusion / visual mis-perception	1%
Spatial Disorientation / somatogravic illusion	1%
Dangerous Goods	1%
Primary Flight Controls	1%
Brakes	1%
Hydraulic System Failure	1%
Crew Incapacitation	1%
Inad overrun area/trench/ditch/prox of structures	1%

Asia/Pacific Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	32%
Vertical / Lateral / Speed Deviation	23%
Unstable Approach	19%
Continued Landing after Unstable Approach	16%
Abrupt Aircraft Control	9%
Operation Outside Aircraft Limitations	9%
Unnecessary Weather Penetration	5%
Ramp movements	5%
Brakes / Thrust Reversers / Ground Spoilers	4%
Loss of aircraft control while on the ground	4%
Flight Controls / Automation	3%
Engine	1%
Controlled Flight Towards Terrain	1%
Runway / taxiway incursion	1%

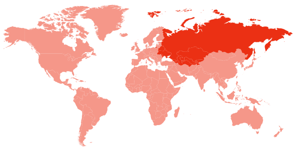
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	27%
Monitor / Cross-check	18%
Contingency Management	9%
Leadership	8%
Captain should show leadership	5%
Automation Management	4%
FO is assertive when necessary	4%
Communication Environment	4%
Evaluation of Plans	1%
Taxiway / Runway Management	1%

Note: 11 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 5

Commonwealth of Independent States (CIS) Aircraft Accidents



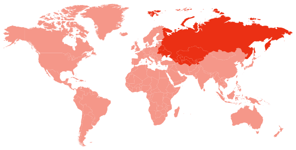
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	53%
Safety Management	47%
Flight Operations	16%
Flight Ops: SOPs & Checking	11%
Selection Systems	11%
Flight Ops: Training Systems	5%
Maintenance Operations	5%
Design	5%
Technology & Equipment	5%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	42%
Manual Handling / Flight Controls	37%
Callouts	5%
Pilot-to-Pilot Communication	5%
Normal Checklist	5%

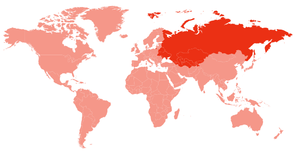
Commonwealth of Independent States (CIS) Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	58%
Poor visibility / IMC	37%
Wind/Windshear/Gusty wind	21%
Lack of Visual Reference	21%
Aircraft Malfunction	21%
Ground-based nav aid malfunction or not available	11%
Airport Facilities	11%
Air Traffic Services	11%
Nav Aids	11%
Operational Pressure	11%
Gear / Tire	11%
Thunderstorms	11%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%
Crew Incapacitation	5%
Optical Illusion / visual mis-perception	5%
Contaminated runway/taxiway - poor braking action	5%
Contained Engine Failure/Powerplant Malfunction	5%
Maintenance Events	5%
Icing Conditions	5%
Dispatch / Paperwork	5%
Poor/faint marking/signs or runway/taxiway closure	5%
Terrain / Obstacles	5%

Commonwealth of Independent States (CIS) Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	37%
Long/floated/bounced/firm/off-center/crabbed land	26%
Unnecessary Weather Penetration	26%
Continued Landing after Unstable Approach	5%
Flight Controls / Automation	5%
Abrupt Aircraft Control	5%
Unstable Approach	5%
Operation Outside Aircraft Limitations	5%
Controlled Flight Towards Terrain	5%

COUNTERMEASURES

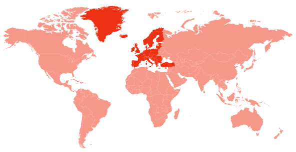
	Percentage Contribution
Overall Crew Performance	32%
Contingency Management	16%
Taxiway / Runway Management	11%
Evaluation of Plans	5%
Captain should show leadership	5%
Monitor / Cross-check	5%
Automation Management	5%
Leadership	5%

Note: 6 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

Top Contributing Factors – Section 5

Europe Aircraft Accidents



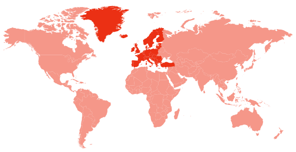
LATENT CONDITIONS

	Percentage Contribution
Flight Operations	14%
Flight Ops: Training Systems	12%
Safety Management	10%
Regulatory Oversight	10%
Design	9%
Flight Ops: SOPs & Checking	7%
Ground Operations	4%
Change Management	4%
Technology & Equipment	4%
Maintenance Operations	4%
Maintenance Ops: SOPs & Checking	4%
Ground Ops: Training Systems	3%
Selection Systems	3%
Dispatch	1%
Ground Ops: SOPs & Checking	1%
Management Decisions	1%
Dispatch Ops: SOPs & Checking	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	36%
SOP Adherence / SOP Cross-verification	28%
Failure to GOA after Destabilized Approach	14%
Callouts	6%
Automation	3%
Abnormal Checklist	3%
Documentation	1%
Crew to External Communication	1%
Systems / Radios / Instruments	1%
Wrong Weight & Balance / Fuel Information	1%
Pilot-to-Pilot Communication	1%
Ground Crew	1%

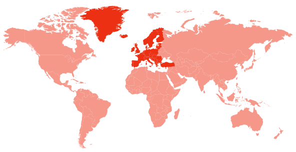
Europe Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	30%
Wind/Windshear/Gusty wind	23%
Aircraft Malfunction	22%
Gear / Tire	13%
Airport Facilities	10%
Ground Events	10%
Thunderstorms	9%
Air Traffic Services	7%
Maintenance Events	6%
Contaminated runway/taxiway - poor braking action	6%
Fire / Smoke (Cockpit/Cabin/Cargo)	4%
Poor visibility / IMC	4%
Fatigue	4%
Lack of Visual Reference	4%
Extensive / Uncontained Engine Failure	3%
Poor/faint marking/signs or runway/taxiway closure	3%
Operational Pressure	3%
Optical Illusion / visual mis-perception	3%
Inad overrun area/trench/ditch/prox of structures	3%
Wildlife/Birds/Foreign Object	1%
Avionics / Flight Instruments	1%
Dispatch / Paperwork	1%
Airport perimeter control/fencing/wildlife control	1%
Contained Engine Failure/Powerplant Malfunction	1%
Icing Conditions	1%

Europe Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	26%
Vertical / Lateral / Speed Deviation	14%
Unstable Approach	13%
Continued Landing after Unstable Approach	12%
Operation Outside Aircraft Limitations	10%
Loss of aircraft control while on the ground	9%
Abrupt Aircraft Control	7%
Unnecessary Weather Penetration	4%
Brakes / Thrust Reversers / Ground Spoilers	1%
Ramp movements	1%
Weight & Balance	1%
Proceeding toward wrong taxiway / runway	1%
Engine	1%

COUNTERMEASURES

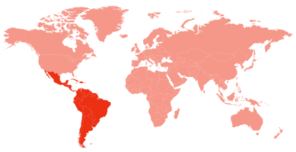
	Percentage Contribution
Overall Crew Performance	23%
Monitor / Cross-check	13%
Contingency Management	7%
Taxiway / Runway Management	4%
Leadership	3%
Captain should show leadership	3%
Evaluation of Plans	1%
Automation Management	1%

Note: 7 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

Top Contributing Factors – Section 5

Latin America & the Caribbean Aircraft Accidents



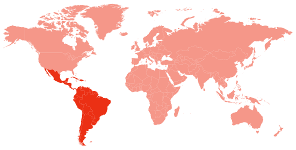
LATENT CONDITIONS

	Percentage Contribution
Safety Management	33%
Regulatory Oversight	29%
Maintenance Operations	17%
Maintenance Ops: SOPs & Checking	17%
Flight Ops: SOPs & Checking	13%
Management Decisions	13%
Flight Operations	13%
Design	8%
Selection Systems	8%
Maintenance Ops: Training Systems	8%
Dispatch	4%
Dispatch Ops: SOPs & Checking	4%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	13%
SOP Adherence / SOP Cross-verification	13%
Pilot-to-Pilot Communication	8%
Failure to GOA after Destabilized Approach	8%
Dispatch	4%
Wrong Weight & Balance / Fuel Information	4%
Crew to External Communication	4%
Briefings	4%
Documentation	4%
Systems / Radios / Instruments	4%
ATC	4%

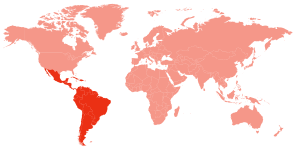
Latin America & the Caribbean Aircraft Accidents



THREATS

	Percentage Contribution
Aircraft Malfunction	46%
Gear / Tire	29%
Maintenance Events	29%
Airport Facilities	21%
Meteorology	17%
Contaminated runway/taxiway - poor braking action	17%
Dispatch / Paperwork	8%
Thunderstorms	8%
Brakes	8%
Operational Pressure	8%
Nav Aids	8%
Ground-based nav aid malfunction or not available	8%
Optical Illusion / visual mis-perception	8%
Manuals / Charts / Checklists	4%
Ground Events	4%
Fatigue	4%
Wind/Windshear/Gusty wind	4%
Lack of Visual Reference	4%
Air Traffic Services	4%
Fire / Smoke (Cockpit/Cabin/Cargo)	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Poor visibility / IMC	4%
Contained Engine Failure/Powerplant Malfunction	4%
Hydraulic System Failure	4%
Traffic	4%
Airport perimeter control/fencing/wildlife control	4%
Wildlife/Birds/Foreign Object	4%

Latin America & the Caribbean Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	17%
Vertical / Lateral / Speed Deviation	8%
Unstable Approach	8%
Continued Landing after Unstable Approach	8%
Unnecessary Weather Penetration	4%
Controlled Flight Towards Terrain	4%
Ramp movements	4%
Operation Outside Aircraft Limitations	4%
Weight & Balance	4%
Loss of aircraft control while on the ground	4%

COUNTERMEASURES

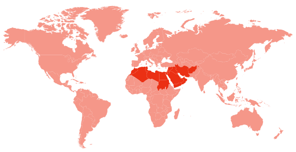
	Percentage Contribution
Overall Crew Performance	17%
Contingency Management	8%
Monitor / Cross-check	8%
Evaluation of Plans	4%
Plans Stated	4%
Taxiway / Runway Management	4%
Inquiry	4%
Captain should show leadership	4%
FO is assertive when necessary	4%
Communication Environment	4%
Leadership	4%
Workload Management	4%

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 B

Top Contributing Factors – Section 5

Middle East & North Africa Aircraft Accidents



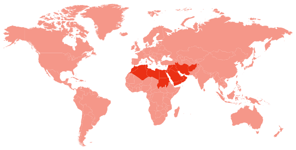
LATENT CONDITIONS

	Percentage Contribution
Safety Management	36%
Regulatory Oversight	27%
Flight Operations	23%
Flight Ops: SOPs & Checking	18%
Maintenance Operations	14%
Selection Systems	14%
Design	14%
Flight Ops: Training Systems	14%
Maintenance Ops: SOPs & Checking	14%
Technology & Equipment	9%
Maintenance Ops: Training Systems	5%
Ops Planning & Scheduling	5%
Management Decisions	5%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	32%
SOP Adherence / SOP Cross-verification	27%
Callouts	18%
Abnormal Checklist	9%
Normal Checklist	9%
Automation	9%
Pilot-to-Pilot Communication	9%
Systems / Radios / Instruments	5%
Failure to GOA after Destabilized Approach	5%
Ground Crew	5%
Crew to External Communication	5%

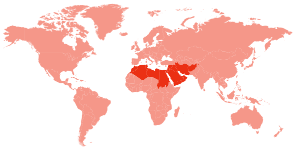
Middle East & North Africa Aircraft Accidents



THREATS

	Percentage Contribution
Aircraft Malfunction	36%
Meteorology	27%
Maintenance Events	27%
Gear / Tire	18%
Wind/Windshear/Gusty wind	14%
Poor visibility / IMC	14%
Lack of Visual Reference	14%
Air Traffic Services	14%
Fire / Smoke (Cockpit/Cabin/Cargo)	9%
Operational Pressure	9%
Airport Facilities	9%
Contaminated runway/taxiway - poor braking action	5%
Avionics / Flight Instruments	5%
Ground-based nav aid malfunction or not available	5%
Contained Engine Failure/Powerplant Malfunction	5%
Traffic	5%
Brakes	5%
Fatigue	5%
Nav Aids	5%
Spatial Disorientation / somatogravic illusion	5%
Icing Conditions	5%
Wildlife/Birds/Foreign Object	5%
Poor/faint marking/signs or runway/taxiway closure	5%

Middle East & North Africa Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Loss of aircraft control while on the ground	18%
Brakes / Thrust Reversers / Ground Spoilers	14%
Long/floated/bounced/firm/off-center/crabbed land	14%
Operation Outside Aircraft Limitations	14%
Engine	14%
Unnecessary Weather Penetration	9%
Vertical / Lateral / Speed Deviation	9%
Abrupt Aircraft Control	5%
Controlled Flight Towards Terrain	5%
Flight Controls / Automation	5%
Rejected Take-off after V1	5%
Continued Landing after Unstable Approach	5%
Unstable Approach	5%

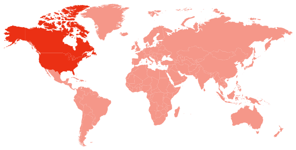
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	27%
Monitor / Cross-check	27%
FO is assertive when necessary	14%
Taxiway / Runway Management	14%
Leadership	14%
Captain should show leadership	9%
Workload Management	9%
Communication Environment	5%
Automation Management	5%
Evaluation of Plans	5%
Contingency Management	5%
SOP Briefing/Planning	5%

Note: 4 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 5

North America Aircraft Accidents



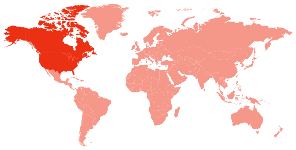
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	15%
Flight Operations	13%
Management Decisions	9%
Design	9%
Technology & Equipment	7%
Maintenance Operations	7%
Maintenance Ops: SOPs & Checking	7%
Flight Ops: SOPs & Checking	7%
Safety Management	5%
Flight Ops: Training Systems	4%
Maintenance Ops: Training Systems	4%
Change Management	4%
Selection Systems	2%
Ops Planning & Scheduling	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	20%
SOP Adherence / SOP Cross-verification	11%
Callouts	4%
Failure to GOA after Destabilized Approach	4%
Automation	4%
Ground Crew	2%
Briefings	2%
Normal Checklist	2%
Crew to External Communication	2%
Ground Navigation	2%

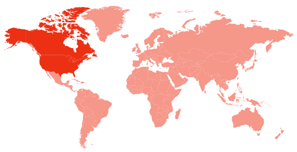
North America Aircraft Accidents



THREATS

	Percentage Contribution
Aircraft Malfunction	31%
Meteorology	29%
Gear / Tire	20%
Wind/Windshear/Gusty wind	18%
Poor visibility / IMC	15%
Lack of Visual Reference	13%
Nav Aids	11%
Ground-based nav aid malfunction or not available	11%
Airport Facilities	11%
Contaminated runway/taxiway - poor braking action	9%
Wildlife/Birds/Foreign Object	9%
Optical Illusion / visual mis-perception	7%
Maintenance Events	7%
Terrain / Obstacles	7%
Air Traffic Services	7%
Ground Events	7%
Fatigue	5%
Fire / Smoke (Cockpit/Cabin/Cargo)	4%
Icing Conditions	4%
Thunderstorms	4%
Extensive / Uncontained Engine Failure	4%
Dispatch / Paperwork	2%
Operational Pressure	2%
Structural Failure	2%
Spatial Disorientation / somatogravic illusion	2%
Inad overrun area/trench/ditch/prox of structures	2%

North America Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	16%
Long/floated/bounced/firm/off-center/crabbed land	13%
Unnecessary Weather Penetration	5%
Flight Controls / Automation	4%
Controlled Flight Towards Terrain	4%
Rejected Take-off after V1	4%
Unstable Approach	4%
Continued Landing after Unstable Approach	4%
Abrupt Aircraft Control	4%
Engine	2%
Operation Outside Aircraft Limitations	2%
Wrong taxiway / ramp / gate / hold spot	2%
Loss of aircraft control while on the ground	2%
Brakes / Thrust Reversers / Ground Spoilers	2%

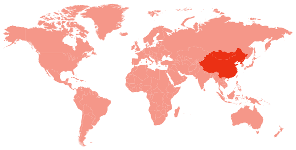
COUNTERMEASURES

	Percentage Contribution
Monitor / Cross-check	9%
Contingency Management	7%
Overall Crew Performance	7%
Automation Management	4%
Captain should show leadership	4%
Leadership	4%
Workload Management	4%
Communication Environment	2%
FO is assertive when necessary	2%
Evaluation of Plans	2%

Note: 14 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
Top Contributing Factors – Section 5

North Asia Aircraft Accidents



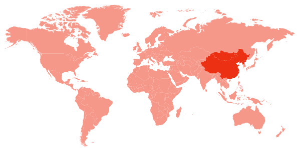
LATENT CONDITIONS

	Percentage Contribution
Flight Ops: Training Systems	33%
Safety Management	33%
Flight Operations	33%
Flight Ops: SOPs & Checking	25%
Regulatory Oversight	25%
Selection Systems	17%
Maintenance Ops: SOPs & Checking	8%
Change Management	8%
Ops Planning & Scheduling	8%
Maintenance Operations	8%
Management Decisions	8%

THREATS

	Percentage Contribution
Meteorology	58%
Wind/Windshear/Gusty wind	50%
Aircraft Malfunction	25%
Thunderstorms	25%
Contaminated runway/taxiway - poor braking action	17%
Airport Facilities	17%
Flight Controls	8%
Ground-based nav aid malfunction or not available	8%
Gear / Tire	8%
Poor visibility / IMC	8%
Maintenance Events	8%
Nav Aids	8%
Secondary Flight Controls	8%

North Asia Aircraft Accidents



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	67%
SOP Adherence / SOP Cross-verification	25%
Pilot-to-Pilot Communication	17%
Automation	8%
Abnormal Checklist	8%
Briefings	8%
Failure to GOA after Destabilized Approach	8%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Abrupt Aircraft Control	33%
Operation Outside Aircraft Limitations	33%
Long/floated/bounced/firm/off-center/crabbed land	33%
Vertical / Lateral / Speed Deviation	25%
Unstable Approach	25%
Loss of aircraft control while on the ground	17%
Brakes / Thrust Reversers / Ground Spoilers	8%
Unnecessary Weather Penetration	8%
Continued Landing after Unstable Approach	8%
Controlled Flight Towards Terrain	8%
Flight Controls / Automation	8%
Engine	8%

COUNTERMEASURES

	Percentage Contribution
Monitor / Cross-check	67%
Overall Crew Performance	50%
Leadership	17%
Workload Management	17%
Evaluation of Plans	8%
Automation Management	8%
FO is assertive when necessary	8%
Contingency Management	8%
Captain should show leadership	8%
Communication Environment	8%
Plans Stated	8%

Note: 1 accident was not classified due to insufficient data; this accident was subtracted from the total accident count in the calculation of contributing factor frequency.

Top Contributing Factors – Section 6

Cargo Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	33%
Safety Management	29%
Flight Operations	12%
Flight Ops: SOPs & Checking	10%
Maintenance Ops: SOPs & Checking	10%
Maintenance Operations	10%
Technology & Equipment	6%
Design	4%
Management Decisions	4%
Dispatch Ops: SOPs & Checking	2%
Flight Ops: Training Systems	2%
Selection Systems	2%
Maintenance Ops: Training Systems	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	31%
SOP Adherence / SOP Cross-verification	16%
Failure to GOA after Destabilized Approach	10%
Callouts	4%
Systems / Radios / Instruments	2%
Pilot-to-Pilot Communication	2%
Automation	2%
Abnormal Checklist	2%
Normal Checklist	2%

Cargo Aircraft Accidents

THREATS

	Percentage Contribution
Aircraft Malfunction	41%
Meteorology	31%
Gear / Tire	22%
Wind/Windshear/Gusty wind	20%
Airport Facilities	16%
Lack of Visual Reference	14%
Poor/faint marking/signs or runway/taxiway closure	8%
Contaminated runway/taxiway - poor braking action	8%
Poor visibility / IMC	8%
Thunderstorms	8%
Fatigue	8%
Maintenance Events	8%
Contained Engine Failure/Powerplant Malfunction	6%
Nav Aids	6%
Ground-based nav aid malfunction or not available	6%
Optical Illusion / visual mis-perception	6%
Inad overrun area/trench/ditch/prox of structures	4%
Extensive / Uncontained Engine Failure	4%
Terrain / Obstacles	4%
Dispatch / Paperwork	4%
Wildlife/Birds/Foreign Object	2%
Structural Failure	2%
Operational Pressure	2%
Fire / Smoke (Cockpit/Cabin/Cargo)	2%
Flight Controls	2%
Spatial Disorientation / somatogravic illusion	2%
Air Traffic Services	2%
Avionics / Flight Instruments	2%
Secondary Flight Controls	2%
Airport perimeter control/fencing/wildlife control	2%

Cargo Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	22%
Long/floated/bounced/firm/off-center/crabbed land	22%
Continued Landing after Unstable Approach	16%
Unstable Approach	10%
Operation Outside Aircraft Limitations	6%
Abrupt Aircraft Control	6%
Flight Controls / Automation	4%
Controlled Flight Towards Terrain	4%
Unnecessary Weather Penetration	4%
Rejected Take-off after V1	2%
Brakes / Thrust Reversers / Ground Spoilers	2%
Loss of aircraft control while on the ground	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	16%
Monitor / Cross-check	14%
Contingency Management	6%
Workload Management	4%
Captain should show leadership	4%
FO is assertive when necessary	2%
Evaluation of Plans	2%
Automation Management	2%
Leadership	2%

Note: 29 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 D

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 crew 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 the 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 chart illustrates two examples:

Case 1: There were a total of four accidents:

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 onboard killed, and two in which half onboard 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 despite the fact that 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 take into account the size of the airplane, how many people were onboard, or the length of the flight. Rather, what is key is the percentage of people, from the total carried, who perished. It does not matter 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 dramatically declining over the years. The convergence of fatality risk and fatal accident rate may indicate, although it is not possible to confirm, that these accident mitigation efforts have done the job of removing the 'low-hanging fruits' that were causing most of the accidents. Even as accident rates reach historic lows, the work of the safety professionals across the commercial aviation industry continues to be as important as it was in the past.

“Techniques to improve aviation safety have moved beyond the analysis of isolated accidents to data-driven analyses of trends throughout the air transport value chain”

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 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, maintenance/test flights are all excluded.
- The aircraft is turbine powered and has a certificated Maximum Take-Off Weight (MTOW) of at least 5,700KG (12,540 lbs.).
- The aircraft has sustained major structural damage which 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: the process by which actions, omissions, events, conditions, or a combination thereof, which led to the accident are identified and categorized.

Aircraft: the involved aircraft, used interchangeably with airplane(s).

Air Traffic Service unit: as defined in applicable ATS, Search and Rescue and overflight regulations.

Cabin Safety-related Event: accident involving cabin operational issues, such as a passenger evacuation, an onboard fire, a decompression or a ditching, which requires actions by the operating cabin crew.

Captain: the involved pilot responsible for operation and safety of the aircraft during flight time.

Commander: the involved pilot, in an augmented crew, responsible for 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 aircraft via escape slides/slide rafts, doors, emergency exits, or gaps in fuselage, usually initiated in life-threatening and/or catastrophic events.

Evacuation (Water): Passengers and/or crew evacuate aircraft via escape slides/slide rafts, doors, emergency exits, or gaps in fuselage and into or on water.

Fatal accident: An accident where at least one passenger or crewmember is killed or later dies of their injuries as a result of an operational accident

Events such as slips and falls, food poisoning, turbulence or accidents involving on board equipment, which may involve fatalities, but where the aircraft sustains minor or no damage, are excluded.

Fatality: a 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 the accident are excluded.

Fatality Risk: the sum of full-loss equivalents per 1 million sectors.

Full-Loss Equivalent: a 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 onboard 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 personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function.

Hull loss: an 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: Aircraft impact resulted in complete hull loss and 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: an occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

In-flight Security Personnel: an 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: a process conducted for the purpose of 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: a person charged, on the basis of 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 which, if improperly done, might appreciably affect mass, balance, structural strength, performance, powerplant operation, flight characteristics, or other qualities affecting airworthiness.

Non-operational accident: this definition includes acts of deliberate violence (sabotage, war, etc.), and accidents that occur during crew training, demonstration and test flights. Sabotage is believed to be a matter of security rather than flight safety, and crew training, demonstration and test flying are considered to involve special risks inherent to 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 has been 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: an accident which is believed to represent the risks of normal commercial operation, generally accidents which occur during normal revenue operations or positioning flights.

Operator: a 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 ATS personnel.

Phase of flight: the phase of flight definitions developed and applied by IATA are presented in the following table:

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 an airplane; it ends when the crew arrives at the aircraft for the purpose of the planned flight or the crew initiates a "Flight Close" phase.

Pre-flight (PRF) This phase begins with the arrival of the flight crew at an aircraft for the purpose of 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 Pre-flight 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 in 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 for the purpose of positioning 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 the purpose of Takeoff or the crew initiates a "Taxi-in" phase.

Note: This phase includes taxi from the point of moving under its 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 the purpose of 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 for the purpose of stopping the aircraft prior to 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 the purpose of cruise. It may also end by the crew initiating an "Approach" phase.

Note: Maneuvering altitude is based upon such an altitude 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 the purpose of cruising; it ends with the aircraft established at a predetermined constant initial cruise altitude at a defined speed or by the crew initiating a "Descent" phase.

Cruise (CRZ) The cruise 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 Descent for the purpose of 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 the purpose of an approach at a particular destination; it ends when the crew initiates changes in aircraft configuration and/or speeds to facilitate a landing on a particular 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 for the purpose of landing on a particular 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 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 the purpose of arriving 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 the purpose of 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 shutdown the engine(s); it ends with a decision to shut down ancillary systems for the purpose of securing 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/refueling with engine(s) running).

Post-flight (PSF) This phase begins when the crew commences the shutdown of ancillary systems of the aircraft for the purpose of leaving the flight deck; it ends when the flight and cabin crew leaves the aircraft. It may also end by the crew initiating a "Pre-flight" 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, etc.); 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.

Rapid Deplaning: passengers and/or crew rapidly exit aircraft via boarding doors and jet bridge or stairs, as precautionary measures.

Risk: the assessment, expressed in terms of predicted probability and severity, of the consequence(s) of a hazard, taking as reference the worst foreseeable situation.

Safety: the state in which the risk of harm to persons or property is reduced to, and maintained at or be-low, an acceptable level through a continuing process of hazard identification and risk management.

Sector: the operation of an aircraft between takeoff at one location and landing at another (other than a diversion).

Serious Injury: an injury sustained by a person in an accident and which:

- Requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or
- Results in a fracture of any bone (except simple fractures of fingers, toes or nose); or
- Involves lacerations which cause severe hemorrhage, or nerve, muscle or tendon damage;
- Involves injury to any internal organ; or
- Involves second or third-degree burns, or any burns affecting more than 5% of the surface of the body; or
- Involves verified exposure to infectious substances or injurious radiation.

Serious Incident: an 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:

1. 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.

2. The ICAO Annex 13 definition is unrelated to cost and includes many incidents in which the financial consequences are minimal.

Unstable Approach: approach where the ACTF 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.

STEADES ATM Definitions and Severity Scores

Ranking	Descriptors	Definitions	Severity Scores
1	Airprox	Minimum separation between the aircraft and another aircraft or airborne object (e.g. weather balloon) has been infringed	125
2	Take Off Clearance with Runway in Use	Clearance received from Air Traffic Control to take off while the runway is occupied	
3	Landing Clearance with Runway In Use	Landing clearance received from Air Traffic Control with the runway still occupied by the preceding	
4	Barometric Information Error	Incorrect or inaccurate barometric pressure information received from ATC. STEADES Comment: Reports in this category also contain misinterpretation and mis-selection of barometric settings	
5	Inadequate Separation	Separation between two aircraft during any stage of flight is considered inadequate. STEADES Comment: - perceived by flight crew as inadequate	
6	Landing Clearance Not Received	Landing clearance that has not been received which may or may not have resulted in a go around	25
7	Wake Turbulence - Encountered	Wake turbulence generated by a preceding or passing aircraft	
8	Take Off Clearance Cancelled	Take off clearance cancelled after take-off roll commenced	
9	Comms with ATC Lost	Communications with Air Traffic Control lost but not due to an aircraft technical defect	
10	Jet Blast - Encountered	Jet blast received from an aircraft maneuvering close to the terminal area	
11	ATC Violation Filed	When it is deemed by Air Traffic Control that the aircraft has failed to follow an instruction or published procedure	
12	Callsign Confusion	Two or more aircraft on frequency with similar call-signs creating confusion	
13	Groundprox	A near collision between two aircraft during taxi or on ground maneuvering	
14	ATC Congestion	ATC congestion resulting in an unsafe condition. STEADES Comment: both airspace congestion and radio frequency congestion	5
15	Met Info/Briefing	Inaccuracies in the meteorological briefing or information received	
16	ATC English	An ATC unit controlling aircraft in a language other than English. STEADES Comment: considered by flight crew as inadequate, which could be influenced by accent, quality of communication, etc. Reports also contain controllers speaking in their own language.	
17	Wake Turbulence - Generated	Wake turbulence reported by a following aircraft	
18	Jet Blast - Generated	While maneuvering close to the terminal area a jet blast report was recorded by another aircraft	
19	LAHSO/SIRO	Land and Hold Short Operations or Simultaneous Intercepting Runway Operations enforced by ATC	
20	Military Influence	Where the military, either ground or airborne, had a significant influence	
21	Excessive Hold Delays	Un-forecasted holding delays that could cause an unsafe situation	1
22	ATC Service Standard	Poor co-ordination between two controlling Air Traffic Control units. STEADES Comment: Reports contain more than specific issues, such as inadequate level of service perceived by flight crew	
23	ATM - Other	Other ATM issues not covered by previous descriptors.	

A2

Annex 2
Accident Classification Taxonomy Flight Crew

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. Standard Operating Procedures (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. Standard Operating Procedures (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. Standard Operating Procedures (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. Standard Operating Procedures (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
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/IMC
	↗ Wind/wind shear/gusty wind
	↗ Icing conditions
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	↗ Self-explanatory
Other	↗ Not clearly falling within the other environmental threats
Airline Threats	Examples
Aircraft Malfunction	↗ Technical anomalies/failures 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 after Destabilisation during Approach	↗ Flight crew does not execute a go-around after stabilization requirements are not met
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-centerline 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 (CFIT)	↗ 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 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)
Tailstrike	↗ Tailstrike 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	↗ 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 kept 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

"Risks to civil aviation arising from conflict zones remains a challenge for the industry"

A3

Annex 3 – Accidents Summary

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
01-08-16	Bombardier	CRJ200	SE-DUX	West Atlantic Sweden	Near Ritsem, Sweden	CRZ	Cargo	Jet	Hull Loss	The aircraft was destroyed after a flight instrument system failure and the abrupt reaction of the crew induced a loss of control of the aircraft
01-09-16	ATR	ATR72-500	PR-PDD	Passaredo Transportes Aereos	Rondonopolis, Brazil	APR	Passenger	Turboprop	Substantial Damage	The aircraft undershot the runway on final approach
01-28-16	Boeing	MD-80	EP-ZAB	Zagros Airlines	Mashad, Iran	LND	Passenger	Jet	Hull Loss	Directional control was lost while landing
02-14-16	Boeing	B737-800	PR-GXA	GOL Linhas Aereas	Brasilia, Brazil	ESD	Passenger	Jet	Substantial Damage	A fire broke out on the aircraft's No.2 engine prior to pushback
03-05-16	Boeing	B767-300	N305UP	UPS Airlines	Albuquerque, United States	TOF	Cargo	Jet	Substantial Damage	The aircraft suffered a tailstrike
03-09-16	Antonov	An26	S2-AGZ	True Aviation Bangladesh	Cox's Bazar, Bangladesh	ICL	Cargo	Turboprop	Hull Loss	The aircraft allegedly suffered a right engine failure shortly after take-off. The aircraft crashed into the ground and was destroyed
03-18-16	Beechcraft	B1900	AP-BII	Aircraft Sales & Services	Karachi, Pakistan	ICL	Cargo	Turboprop	Substantial Damage	The right engine reportedly failed shortly after the aircraft got airborne and the pilot elected to carry out a belly landing on the remaining runway length
03-18-16	Airbus	A321	PT-XPI	TAM	Iguassu Falls, Brazil	TOF	Passenger	Jet	Substantial Damage	Substantial damage was found on the tail plane, resulted from loose asphalt hitting the aircraft
03-19-16	Boeing	B737-800	A6-FDN	Flydubai	Rostov-on-Don, Russian Federation	GOA	Passenger	Jet	Hull Loss	The aircraft was destroyed after control was lost during a go around
03-23-16	Avro	RJ-85	EI-RJG	Cityjet	Florence, Italy	ICL	Passenger	Jet	Substantial Damage	The aircraft suffered a tailstrike on landing
03-25-16	Embraer	E190	N273JB	JetBlue Airways	Nassau, Bahamas	LND	Passenger	Jet	Substantial Damage	The aircraft landed with the nose undercarriage retracted
03-27-16	Fokker	F100	UP-F1012	Halyk Air	Astana, Kazakhstan	LND	Passenger	Jet	Substantial Damage	The aircraft's nose undercarriage failed to extend when it was selected down on approach
04-04-16	Boeing	B737-800	PK-LBS	Batik Air	Jakarta, Indonesia	RTO	Passenger	Jet	Substantial Damage	The aircraft collided with another aircraft during take-off roll/ rejected take-off
04-20-16	Beechcraft	B1900	C-FEVA	EVAS Air Charters	Gander, Canada	LND	Passenger	Turboprop	Substantial Damage	The aircraft's nose undercarriage failed and collapsed after a hard, bounced landing
04-28-16	Embraer	E190	HC-COX	TAME	Cuenca, Ecuador	LND	Passenger	Jet	Substantial Damage	The aircraft overran the runway on landing
04-30-16	Fokker	F50	SE-LEZ	Air Vallee	Catania, Italy	LND	Passenger	Turboprop	Substantial Damage	The aircraft landed with its nose undercarriage retracted
05-02-16	Boeing	B737-800	TC-JFY	Turkish Airlines	Pristina, Kosovo	LND	Passenger	Jet	Substantial Damage	The aircraft overran the runway on landing
05-03-16	Boeing	B737-800	EI-CXV	MIAT - Mongolian Airlines	Khovd Airport, Mongolia	TOF	Passenger	Jet	Substantial Damage	Directional control was lost as the aircraft accelerated through about 60kt on take-off, resulting in a runway excursion

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
05-10-16	Airbus	A321	N189UW	American Airlines	En Route	ECL	Passenger	Jet	Substantial Damage	The aircraft suffered a bird strike
05-11-16	Airbus	A320	F-GKXJ	Air France	Paris, France	TXO	Passenger	Jet	Substantial Damage	The aircraft's rudder was struck by another aircraft's wingtip
05-18-16	Antonov	An-12	4K-AZ25	Silk Way Airlines	Camp Dwyer, Afghanistan	ICL	Cargo	Turboprop	Hull Loss	The aircraft reportedly suffered an engine failure on take-off, lost height and crashed
05-19-16	Airbus	A320	SU-GCC	EgyptAir	Mediterranean Sea, 150nm N of Alexandria, Egypt	CRZ	Passenger	Jet	Hull Loss	Contact with the aircraft was lost during cruise. Awaiting for more details
05-21-16	Airbus	A320	HZ-AS38	Saudia	Taif, Saudi Arabia	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
05-27-16	Boeing	B777-300	HL7534	Korean Air	Tokyo - Haneda International, Japan	TOF	Passenger	Jet	Substantial Damage	The aircraft suffered an engine fire during take-off
05-28-16	Airbus	A320-210	EC-JGM	Vueling Airlines	Manchester, United Kingdom	ESD	Passenger	Jet	Substantial Damage	The aircraft overran the tug while it was being towed from its stand
06-04-16	Antonov	An-30	TN-AHP	South Supreme Airlines	Yambio, South Sudan	LND	Passenger	Turboprop	Substantial Damage	The aircraft overran the runway on landing
06-06-16	Boeing	MD-11	N277UP	UPS Airlines	Seoul - Incheon International, South Korea	RTO	Cargo	Jet	Hull Loss	The aircraft overran the runway during an aborted take-off
06-14-16	Antonov	An-32	EK32120	Ayk Avia	Bor, South Sudan	LND	Cargo	Turboprop	Hull Loss	The aircraft veered-off the side of the runway during landing
06-14-16	ATR	ATR 72-200	PK-WGL	Wings Air	Unknown	UNK	Passenger	Turboprop	Substantial Damage	A crack was found on the horizontal stabilizer fitting
06-19-16	BAE Systems	BAE146	EP-MOF	Mahan Air	Khark Airport, Iran	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a runway excursion
06-21-16	Dornier	Do-228	9Q-CSL	Busy Bee Congo	Goma - International, DR Congo	LND	Passenger	Turboprop	Substantial Damage	The aircraft suffered a gear-up landing followed by a runway excursion
06-27-16	Boeing	B777-300	9V-SWB	Singapore Airlines	Singapore, Singapore	LND	Passenger	Jet	Hull Loss	The aircraft was damaged by a wing and engine fire
07-07-16	Bombardier	Dash 8-400	HS-DQC	Nok Air	Loei, Thailand	LND	Passenger	Turboprop	Substantial Damage	The aircraft sustained substantial damage in a hard landing
07-16-16	Airbus	A321-200	D-ASTP	Germania	Fuerteventura, Spain	GOA	Passenger	Jet	Substantial Damage	The aircraft initiated a go around but touched down hard
07-27-16	ATR	ATR 72-600	CN-COH	Royal Air Maroc	Casablanca, Morocco	RTO	Ferry	Turboprop	Substantial Damage	The aircraft's main gear caught fire during a rejected take-off
08-03-16	Boeing	B777-300	A6-EMW	Emirates Airlines	Dubai, United Arab Emirates	GOA	Passenger	Jet	Hull Loss	The aicraft was destroyed after a landing accident. The aircraft landed long and the crew elected to carry out a go-around. However, the aircraft failed to climb away and settled back onto the runway with its undercarriage in transit
08-05-16	Boeing	B737-400	HA-FAX	ASL Airlines Hungary	Bergamo, Italy	LND	Cargo	Jet	Hull Loss	The aircraft overran the runway on landing
08-07-16	Boeing	B737-800	HL8253	T'way Air	Seoul, South Korea	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a tailstrike on landing
08-12-16	Yakovlev	Yak-42	RA-42340	Krasavia	Ufa, Russian Federation	LND	Passenger	Jet	Substantial Damage	The aircraft overran the runway on landing
08-24-16	Tupolev	TU-204	RA-64021	Aviastar-TU	Norilsk, Russian Federation	LND	Cargo	Jet	Substantial Damage	The aircraft suffered a hard landing
08-27-16	Boeing	B737-700	N766SW	Southwest Airlines	En Route	CRZ	Passenger	Jet	Substantial Damage	The aircraft suffered an uncontained engine failure
09-13-16	Boeing	B737-300	PK-YSY	Trigana Air Service	Wamena, Indonesia	LND	Cargo	Jet	Hull Loss	The aircraft touched down hard resulting in a gear collapse

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
09-14-16	Fokker	F100	EP-CFP	Iran Air	Tehran, Iran	TXO	Passenger	Jet	Substantial Damage	The aircraft's nose undercarriage failed while it was taxiing for departure
09-24-16	BAE Systems	Jetstream 41	9N-AIB	Yeti Airlines	Bhairawa, Nepal	LND	Passenger	Turboprop	Substantial Damage	The aircraft overran the runway on landing
09-24-16	Bombardier	Dash 8-200	N366PH	Commutair	Washington, United States	LND	Passenger	Turboprop	Substantial Damage	The aircraft landed with its nose gear retracted
09-26-16	ATR	ATR72-200	RP-C7252	Cebu Pacific	Cebu, Philippines	TXI	Passenger	Turboprop	Substantial Damage	While taxiing a fire was observed from both left hand main wheels prompting the crew to stop on the taxiway and initiate an evacuation of the aircraft
09-27-16	Airbus	A310-300	EP-IBK	Iran Air	Tehran, Iran	ESD	Passenger	Jet	Substantial Damage	The aircraft's right horizontal stabiliser was substantially damaged when it struck the underside of another aircraft during push back from its stand
09-30-16	Beechcraft	B1900	N376SA	Southern Air Charter	Deadman's Cay, Bahamas	LND	Passenger	Turboprop	Substantial Damage	The aircraft landed with gears up
10-09-16	Airbus	A320	EC-MBL	Vueling Airlines	Palma de Mallorca, Spain	LND	Passenger	Jet	Substantial Damage	The aircraft was damaged in a hard landing
10-11-16	Antonov	An-26	RA-26660	Polar Airlines	Belaya Gora, Russian Federation	LND	Passenger	Turboprop	Hull Loss	The aircraft undershot the runway
10-21-16	Airbus	A300	PR-STN	Sterna Linhas Aereas	Recife, Brazil	LND	Cargo	Jet	Substantial Damage	The aircraft's nose undercarriage collapsed on landing
10-22-16	ATR	ATR 72-600	CS-DJF	White Airways	Lisbon, Portugal	LND	Passenger	Turboprop	Substantial Damage	The aircraft landed hard and bounced resulting on both nose wheels breaking away
10-24-16	Dornier	328JET	XA-ALA	FlyMex	Toluca, Mexico	LND	Passenger	Jet	Substantial Damage	The aircraft was damaged when it ran off the runway while landing
10-24-16	Bombardier	Dash 8-400	ET-ANY	Ethiopian Airlines	Dire Dawa, Ethiopia	TOF	Passenger	Turboprop	Hull Loss	Directional control was lost during the take-off roll and the aircraft ran off the side of the runway
10-28-16	Boeing	B767-300	N345AN	American Airlines	Chicago, United States	RTO	Passenger	Jet	Hull Loss	The aircraft was heavily damaged by fire following an aborted take-off
10-28-16	Boeing	DC-10	N370FE	FedEx	Fort Lauderdale, United States	LND	Cargo	Jet	Hull Loss	The aircraft's left main undercarriage failed and collapsed on landing
10-31-16	Bombardier	DHC-4T	PK-SWW	Trigana Air Service	6nm S of Ilaga, Indonesia	DST	Cargo	Turboprop	Hull Loss	The aircraft disappeared while en route and was later found to have crashed on high ground
11-19-16	Boeing	B737-800	N832NN	American Airlines	Saint Louis, United States	ICL	Passenger	Jet	Substantial Damage	The aircraft sustained substantial damage to the right hand engine and fuselage as a result of bird strikes
11-28-16	Avro	RJ-85	CP-2933	LAMIA Bolivia	15-20 nm southeast of Medellin, Colombia	DST	Passenger	Jet	Hull Loss	The aircraft impacted terrain after the crew declared electrical problems and no fuel
12-05-16	Swearingen	Metro III	N765FA	Key Lime Air	North of Pelham, Georgia, United States	DST	Cargo	Turboprop	Hull Loss	The aircraft crashed while on descent to the destination airport
12-07-16	ATR	ATR 42-500	AP-BHO	Pakistan International Airlines	Near Havelian, Pakistan	DST	Passenger	Turboprop	Hull Loss	The aircraft crashed while descending towards the destination airport after a failure of the left hand engine
12-10-16	Boeing	B737-400	JY-JAQ	Safi Airways	Kabul, Afghanistan	LND	Passenger	Jet	Substantial Damage	The aircraft touched down hard causing the right main gear to collapse
12-16-16	Bombardier	CRJ900	OY-KFF	Scandinavian Airlines	Copenhagen, Denmark	TXO	Passenger	Jet	Substantial Damage	The aircraft was damaged by a loose trailer
12-20-16	Boeing	B727-200	HK-4544	Aerosucre Colombia	16 km W of Puerto Carreño-Cumaribo Airport, Colombia	TOF	Cargo	Jet	Hull Loss	The aircraft struggled to become airborne while taking off and impacted the ground shortly after
12-25-16	ATR	ATR 72-200	PK-WGW	Wings Air	Semarang, Indonesia	LND	Passenger	Turboprop	Substantial Damage	The aircraft landed but veered right off the runway and came to a stop with the right main gear collapsed

“47% of accidents on jet aircraft ended with a normal disembarkation”

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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	2012	2013	2014	2015	2016
Aerospatiale	262	1,340	670	-	-	-
Airbus	A300	211,681	178,558	155,985	140,413	142,150
Airbus	A310	73,659	56,965	52,674	42,848	35,215
Airbus	A318	111,610	103,133	103,240	95,714	90,797
Airbus	A319	2,210,498	2,249,976	2,308,307	2,323,813	2,328,288
Airbus	A320	4,691,569	5,214,648	5,693,547	6,280,117	6,873,133
Airbus	A321	1,044,942	1,164,850	1,322,994	1,478,028	1,743,162
Airbus	A330	759,286	830,462	908,899	985,714	1,038,864
Airbus	A340	192,784	173,348	150,745	132,801	127,776
Airbus	A350	-	-	49	3,737	20,059
Airbus	A380	42,132	56,519	71,610	89,612	107,498
Aircraft Industries (LET)	410	122,321	122,502	130,002	132,805	130,477
Antonov	An-12	7,183	5,505	4,636	3,696	3,497
Antonov	An-124	6,085	6,242	5,972	5,912	6,470
Antonov	An-140	4,563	3,899	1,877	873	556
Antonov	An-148	4,939	14,086	13,142	18,880	20,441
Antonov	An-158	-	2,500	7,446	8,413	10,531
Antonov	An-22	-	-	-	-	33
Antonov	An-225	48	47	30	48	48
Antonov	An-24	49,657	41,975	37,594	36,421	36,542
Antonov	An-26	24,167	21,680	21,005	21,528	22,204

MANUFACTURER	MODEL	2012	2013	2014	2015	2016
Antonov	An-28	4,045	4,226	4,334	4,723	4,768
Antonov	An-3	448	558	550	551	561
Antonov	An-30	788	839	937	987	889
Antonov	An-32	4,802	5,191	5,590	5,277	5,098
Antonov	An-38	3,055	3,041	2,442	1,601	1,584
Antonov	An-72 / An-74	3,190	3,505	4,011	3,812	3,737
ATR	ATR 42	1,357,854	1,347,715	1,544,152	1,548,159	1,709,496
Avro	RJ100	144,493	135,645	149,409	143,775	135,107
BAE Systems	146	59,563	54,374	50,715	44,476	39,240
BAE Systems	ATP	23,747	25,593	29,577	27,262	20,160
BAE Systems	Jetstream 31	260,510	269,505	276,495	272,316	252,625
BAE Systems	Jetstream 41	99,714	95,366	94,424	78,655	78,506
BAE Systems (BAC)	One-Eleven	6	-	-	-	-
BAE Systems (Hawker Siddeley)	748	13,760	12,797	12,444	11,222	11,369
Boeing	707	205	68	-	-	-
Boeing	717	280,684	276,351	266,898	264,906	302,973
Boeing	727	101,993	61,721	44,513	39,597	37,431
Boeing	737	8,597,390	8,683,562	9,061,106	9,617,990	10,382,623
Boeing	747	401,188	372,063	341,535	328,465	314,987
Boeing	757	792,851	743,091	693,746	622,419	636,558
Boeing	767	686,075	674,622	641,678	634,490	653,070
Boeing	777	740,158	815,401	863,692	923,416	1,004,489
Boeing	787	15,771	43,574	121,968	217,083	316,755
Boeing (Douglas)	DC-10	57,543	50,584	45,728	41,253	36,177
Boeing (Douglas)	DC-3	6,898	6,919	8,020	9,215	9,794
Boeing (Douglas)	DC-8	5,560	2,185	977	454	205
Boeing (Douglas)	DC-9	84,974	75,134	35,041	33,134	31,004
Boeing (Douglas)	MD-11	111,897	104,563	95,626	80,572	75,807
Boeing (Douglas)	MD-80	733,832	699,278	610,564	584,055	588,156
Boeing (Douglas)	MD-90	95,364	106,345	108,547	109,502	103,528
Bombardier	C Series	-	-	-	-	2,572

MANUFACTURER	MODEL	2012	2013	2014	2015	2016
Canadair (Bombardier)	CL-415	2,276	2,578	2,798	2,920	2,929
Canadair (Bombardier)	CRJ	2,579,566	2,495,988	2,404,667	2,357,300	2,481,748
CASA / IAe	212	38,439	36,490	32,246	33,216	35,778
CASA / IAe	235	5,871	5,895	6,531	7,098	7,120
Comac	ARJ21	-	-	-	164	2,300
Convair	580	38,467	37,567	37,213	36,090	32,631
Convair	640	3,578	4,107	4,753	4,811	4,764
De Havilland (Bombardier)	DHC-5	574	1,277	1,543	1,084	986
De Havilland (Bombardier)	DHC-7	52,275	48,430	44,732	36,303	25,332
De Havilland (Bombardier)	DHC-8	1,730,189	1,768,522	1,746,148	1,757,290	1,761,813
Embraer	120 Brasilia	196,725	186,856	175,457	92,237	91,620
Embraer	135	192,952	189,170	191,693	215,505	233,894
Embraer	140	171,951	169,317	111,320	40,591	46,210
Embraer	145	1,179,012	1,190,365	1,088,134	858,376	790,550
Embraer	170	325,885	344,661	331,492	324,146	295,562
Embraer	175	283,604	310,480	389,463	476,597	631,657
Embraer	190	748,242	834,366	912,469	945,956	897,259
Embraer	195	208,219	248,559	269,175	290,770	309,783
Fairchild (Swearingen)	Metro	842,047	820,644	785,772	764,978	758,971
Fairchild Dornier	228	196,007	190,833	193,333	188,736	192,813
Fairchild Dornier	328	79,375	69,255	65,295	60,463	61,161
Fairchild Dornier	328JET	39,367	45,930	54,742	56,826	56,377
Fokker	100	219,203	197,420	180,278	156,347	136,303
Fokker	50	146,404	124,168	96,486	90,510	70,025
Fokker	70	81,048	70,421	56,980	55,372	48,010
Fokker	F27	8,867	8,108	5,743	4,306	3,414
Fokker	F28	7,162	2,391	456	357	357
Grumman	G73 Turbo Mallard	5,964	5,943	5,944	5,944	5,963
Gulfstream Aerospace (Grumman)	G-I	8,645	7,326	6,582	5,901	5,626
Harbin	Y12	16,764	17,177	17,085	18,146	18,282
Hawker Beechcraft	1900	1,085,678	1,073,366	1,094,252	1,077,816	1,042,735

MANUFACTURER	MODEL	2012	2013	2014	2015	2016
Ilyushin	Il-114	1,112	1,216	1,293	1,292	1,296
Ilyushin	Il-18	2,771	2,456	2,402	2,213	2,524
Ilyushin	Il-62	3,754	3,322	2,788	2,312	2,552
Ilyushin	Il-76	22,996	23,525	23,458	22,340	22,532
Ilyushin	Il-96	6,655	6,626	4,188	4,076	4,423
Lockheed Martin	L-1011 Tristar	1,446	790	-	-	-
Lockheed Martin	L-182 / L-282 / L-382 (L-100) Hercules	32,920	30,869	27,285	28,267	28,873
Lockheed Martin	L-188	1,428	338	882	1,040	1,754
NAMC	YS-11	3,727	4,958	3,717	3,719	3,449
Saab	2000	51,443	50,969	53,744	52,347	46,931
Saab	340	351,087	336,603	309,185	295,013	296,168
Shaanxi	Y-8	16	-	-	-	-
Shorts	330	16,683	13,867	12,761	10,115	6,200
Shorts	360	67,168	65,406	64,702	63,508	63,015
Sukhoi	Superjet 100	7,651	13,227	33,682	62,236	88,315
Tupolev	Tu-134	21,149	17,417	14,344	14,066	12,469
Tupolev	Tu-154	31,866	27,569	18,871	13,447	10,549
Tupolev	Tu-204 / Tu-214	14,195	12,286	11,985	11,197	10,090
Xian	MA-60	8,204	7,962	9,209	9,438	9,783
Yakovlev	Yak-40	41,572	33,550	29,537	27,171	28,216
Yakovlev	Yak-42 / Yak-142	23,998	20,194	19,956	19,326	16,836

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	Tailstrike
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
ACAS	Airborne Collision Avoidance System
ACC	Accident
ACD	Aircraft Control Domain
ACI	Airports Council International
ACRS	Aviation Confidential Reporting System
ACTF	Accident Classification Task Force
ADS-B	Automatic Dependent Surveillance-Broadcast
AES	Arrival/Engine Shutdown (IATA Phase of Flight)
AFI	Africa (IATA and ICAO Region)
AIRP	Airworthiness Panel
ALPA	Airline Pilots Association
ANSP	Air Navigation Service Provider
AOC	Air Operator Certificate
APAC	Asia Pacific (ICAO Region)

List of Acronyms (Cont'd)

Acronym	Meaning
APR	Approach (IATA Phase of Flight)
APV	Approaches with Vertical Guidance
ASBU	Aviation System Block Upgrade
ASPAC	Asia/Pacific (IATA Region)
ATC	Air Traffic Control
ATIS	Automatic Terminal Information System
ATM	Air Traffic Management
ATO	Authorized Training Organizations
ATS	Air Traffic Services
AVSEC	Aviation Security
BEA	Bureau d'Enquetes et d'Analyses por la securite de l'aviation civile
CAB	Cabin Operations
CANPA	Continuous Angle Non-Precision Approaches
CANSO	Civil Air Navigation Services Organization
CAST	Commercial Aviation Safety Team
CBT	Computer-based Training
CBTA-TF	Competency-based Training and Assessment Task Force
CCO	Continuous Climb Operations
CDM	Collaborative Decision Making
CDO	Continuous Descent Operations
CICTT	CAST/ICAO Common Taxonomy Team
CIS	Commonwealth of Independent States (IATA Region)
CNS	Communication Navigation and Surveillance
CONOPS	Concept of Operations
COSTF	Cabin Operations Safety Task Force
CRM	Crew Resource Management
CRZ	Cruise (IATA Phase of Flight)
CSSG	Cargo Safety Sub Group
DAQCP	IATA De-icing/Anti-icing Quality Control Pool
DGP	Dangerous Goods Panel
DH	Decision Height
DST	Descent (IATA Phase of Flight)
E&M	Engineering & Maintenance
EBT	Evidence-Based Training
ECL	En Route Climb (IATA Phase of Flight)
EGPWS	Enhanced Ground Proximity Warning System
EMAS	Engineered Material Arrestor System

List of Acronyms (Cont'd)

Acronym	Meaning
ESD	Engine Start/Depart (IATA Phase of Flight)
EUR	Europe (IATA and ICAO Region)
FAA	Federal Aviation Administration (of the USA)
FCF	Functional Check Flight
FDA	Flight Data Analysis
FDM	Flight Data Monitoring
FDX	Flight Data eXchange
FLC	Flight Close (IATA Phase of Flight)
FLE	Full-Loss Equivalent
FLP	Flight Planning (IATA Phase of Flight)
FLTOPSP	Flight Operations Panel
FMS	Flight Management System
FMTF	Fatigue Management Task Force
FO	First Officer
FRMS	Fatigue Risk Management System
FSF	Flight Safety Foundation
FSTD	Flight Simulation Training Device
GADM	Global Aviation Data Management
GANP	Global Air Navigation Plan
GDDB	Ground Damage Database
GDS	Ground Servicing (IATA Phase of Flight)
GNSS	Global Navigation Satellite System
GOA	Go-around (IATA Phase of Flight)
GPS	Global Positioning System
GPWS	Global Positioning System
GS	Ground Safety
GSIE	Global Safety Information Exchange
GSM	Global System for Mobile Communications
GSP	Ground Service Provider
HIP	Hazard Identification Process
HITF	Hazard Identification Task Force
HL	Hull Loss
HUD	Heads-Up Display
I-ASC	IATA Aviation Safety Culture
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICATEE	International Committee for Aviation Training in Extended Envelopes

List of Acronyms (Cont'd)

Acronym	Meaning
ICL	Initial Climb (IATA Phase of Flight)
IDQP	IATA Drinking-Water Quality Pool
IFALPA	International Federation of Air Line Pilots' Associations
IFATCA	International Federation of Air Traffic Controllers ASSNS
IFE	In Flight Entertainment System
IFQP	IATA Fuel Quality Pool
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IOSA	IATA Operational Safety Audit
IQ	Instructor Qualification
IRM	Issue Review Meeting
ISAGO	IATA Safety Audit for Ground Operations
ISARPs	IATA Standards & Recommended Practices
ISD	Inadvertent Slide Deployment
ISM	IOSA Standards Manual
ISO	International Standards Organization
ISSA	IATA Standard Safety Assessment
KSAs	Knowledge, Skills and Attitudes
LATAM/CAR	Latin America and the Caribbean (IATA Region)
LND	Landing (IATA Phase of Flight)
LOSA	Line Oriented Safety Audit
LRU's	Least Recently Used
MAC	Mid-Air Collision
MDA	Minimum Descent Altitude
MED	Injuries to and/or Incapacitation of Persons
MEL	Minimum Equipment List
MENA	Middle East and North Africa (IATA Region)
MID	Middle East (ICAO Region)
MoU	Memorandum of Understanding
MPL	Multi-Crew Pilot License
MRO	Maintenance Repair Organization
MTOW	Maximum Take-Off Weight
NAM	North America (IATA Region)
NASIA	North Asia (IATA Region)
NavAids	Navigational Aids
N/A	Not Applicable
NLR/TNO	National aerospace Laboratory/Organization for Applied Scientific Research

List of Acronyms (Cont'd)

Acronym	Meaning
NTSB	National Transportation Safety Board (of the USA)
OD	Operational Damage
OEM	Original Equipment Manufacturer
OPC	(IATA) Operations Committee
OPS	Operations
OTH	Other
PA	Pan America (ICAO Region)
PANS-TRG	Procedures for Air Navigation Services - Training
PAT	Pilot Aptitude Testing
PBN	Performance-Based Navigation
PED	Portable Electronic Device
PFD	Primary Flight Display
PRF	Pre-Flight (IATA Phase of Flight)
PSF	Post-Flight (IATA Phase of Flight)
PTTF	Pilot Training Task Force
RA	Resolution Advisory
RAeS	Royal Aeronautical Society
RE	Runway Excursion
RESA	Runway End Safety Area
RI	Runway Incursion
RFID	Radio Frequency Identification
RNAV	Area Navigation
RNP	Required Navigation Performance
RPAS	Remotely Piloted Aircraft Systems
RS	Runway Safety
RTO	Rejected Takeoff (ATA Phase of Flight)
SAE	Societe of Automotive Engineers
SAFO	Safety Alert for Operators
SARPs	Standard and Recommended Practices
SD	Substantial Damage
SeMS	Security Management Systems
SESAR	Single European Sky ATM Research
SFO	Safety and Flight Operations
SG	(IATA) Safety Group
SGI	Somatogravic Illusion
SMS	Safety Management System
SOP	Standard Operating Procedures

List of Acronyms (Cont'd)

Acronym	Meaning
SPIs	Safety Performance Indicators
SRA	Safety Risk Assessment
SRS	Schedule Reference Service
SSP	State Safety Program
STC	Suplementary Type Certificate
SRI	Safety Risk Index
STEADES	Safety Trend Evaluation, Analysis and Data Exchange System
SUPRA	Simulation of Upset Recovery in Aviation
TAWS	Terrain Awareness Warning System
TCAS TA/RA	Traffic Alert and Collision Avoidance System Resolution Advisory
TCAS	Traffic Alert and Collision Avoidance System
TEM	Threat and Error Management
TOF	Takeoff (IATA Phase of Flight)
TP	Turboprop
TXI	Taxi-in (IATA Phase of Flight)
TXO	Taxi-out (IATA Phase of Flight)
UAS	Undesired Aircraft State
UNK	Unknown
UPRT	Upset Prevention and Recovery Training
UPS	United Parcel Service
US	United States
USD	United States Dollar
Wi-Fi	Wireless Fidelity

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