EASA
European Aviation Safety Agency

ANNUAL SAFETY REVIEW 2017

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Acknowledgements

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Foreword by the Executive Director

2016 has brought continued improvements in safety across almost every operational domain. It was the lowest year in terms of fatalities in airline operations in aviation history. However, the fatal accident involving a cargo flight in Sweden that took place in January highlighted the complex nature of aviation safety and the significance of addressing human factor aspects in further reducing accidents. Additionally, the tragic accident involving an EC225 helicopter in Norway in April 2016 shows the importance of joining forces and together maintaining safety as an aviation community.

During the past year EASA has advanced and developed key strategic activities across a diverse range of new and emerging issues. The Agency has recently published the notice of proposed amendment on the regulatory framework for the operation of drones. With the emergence of new and more sophisticated cyber threats, EASA has commenced the implementation of the European Centre for Cyber Security in Aviation. The Agency continues to work with partners in Europe and at a global level to monitor the threat of conflict zones and pro-vide rapid advice to civil aviation.

Over the past year, the Agency has further refined the way in which it applies Safety Risk Management principles. In particular, the collaborative analysis groups, which bring together expertise from authorities and industry stakeholders have proved to be successful tools in further underpinning a data-driven approach to managing safety, which is now also reflected in the latest edition of the European Plan for Aviation Safety (EPAS). These various efforts will help to ensure our continued vigilance and help improve safety for today and into the future.

Patrick Ky
Executive Director

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Introduction

EASA would like to welcome you to the 2017 version of the EASA Annual Safety Review. The review has been published since 2005 and is now in its 12th year. The analysis presented in this review together with the domain-specific safety risk portfolios provide the data-driven input that supports the decision-making in formulating the European Plan for Aviation Safety (EPAS). The latest edition further extends the provision of safety risk portfolios through the addition of aerodromes/ground handling and ATM/ANS portfolios, bringing the total number of analysed aviation domains to 13. The development of the European Safety Risk Management (SRM) process, and in particular the valuable input from the Network of Analysts (NoA) and Collaborative Analysis Groups (CAGs), means that the analysis in this year's review provides not just a statistical summary of aviation safety in the EASA Member States (MS) but also identifies the most important safety challenges faced in European aviation today. This analysis will drive the development of safety actions for the next version of the EPAS and harnesses the experience of both the EASA Member States (EASA MS) and industry to connect the data with the current and future priorities of the Agency.

How is the safety review produced?

The EASA Annual Safety Review is produced by the Safety Intelligence and Performance Department (SM1) of EASA.

The analysis in the review comes from two specific data sources:

EASA's Occurrence Database. The main source of data is the Agency's own database, being accidents and serious incidents reported to the Agency by Safety Investigation Authorities (SIAs) world-wide, which is augmented by other information collected by the Agency from other sources. For commercial air transport aeroplanes, the basic categorisation of accidents and serious incidents has been agreed upon at a global level in February each year at the ICAO Safety Indicator Study Group (SISG). In all domains, the data and its quality is also checked with the EASA MS through the NoA. EASA is grateful for the support of the safety analysis teams in each EASA MS in developing the Review.

European Central Repository. The European Central Repository (ECR) is the central database of all occurrences reported to the competent authorities of the EASA MS, the reporting of which is governed by Reg. (EU) 376/2014 on the reporting, analysis and follow-up of occurrences in civil aviation. This is the primary source of information that is used to cross-check the accidents and serious incidents in EASA's own database.

In addition, the analysis and the safety risk portfolios are developed following discussion with both the NoA and CAGs. This ensures that the Agency's work is enhanced by the invaluable experience and intelligence that the members of these collaborative groups bring to the SRM process.

What is the European Plan for Aviation Safety and why do we need it?

The EPAS seeks to continuously improve aviation safety throughout Europe. The Plan looks at aviation safety in a systemic manner and is based on available evidence of causal factors to accidents and incidents. Moreover, the Plan addresses emerging safety issues in order to ensure our high level of safety is maintained in the future.

The EPAS is a key component of our integrated Safety Management System (SMS) at the European level, and is constantly being reviewed and improved. As an integral part of the EASA Work Programme, the Plan is developed by the Agency in consultation with the Member States and industry through the SRM process. The Member States are committed to the implementation of the Plan through their State programmes and plans. The current EPAS edition covers the 5-year period from 2017 to 2021.

The 3 key-issue categories addressed in the EPAS are:

Systemic Issues: Such problems affect aviation as a whole and play a role in accidents and incidents. As they may affect operational issues, improvements can have an implicit effect on operational causes. An example of a systemic issue is the potential danger that can occur if tasks and responsibilities are not properly distributed among operational staff.

Operational Issues: These issues are closely related to events reported during operations and are brought to light through data analysis. The operational issues are split into 2 parts, which form the basis of the safety risk portfolios that are provided in this review:

- **Key Risk Areas**: The key risk areas are the accident outcomes that the EPAS seeks to stop from happening. Examples of these are aircraft upset (loss of control), runway excursions or runway collisions.
- **Safety Issues**: These are the causal and contributory factors that lead to the key risk areas (accident outcomes). Examples of safety issues are icing in flight, or pilot awareness and decision making.
- **Emerging Issues**: These are suspected problems that are to be expected or anticipated in the future. Examples of emerging issues include new cybersecurity threats or risks associated with flying over conflict zones.

How the EPAS is developed through the European safety risk management process

The EPAS is developed through the European SRM process, which is defined in 5 clear and specific steps as described below.

Figure 1. The European Safety Risk Management Process

Identification of Safety Issues: While the identification of safety issues is the first step in the SRM process, because it is a closed loop process the main input comes from the safety performance measurement step at the end of the process. Candidate safety issues are taken from the results of EASA's safety analysis activities as well from the members of the collaborative groups (NoA and the CAGs). The members of these groups are encouraged to raise safety issues that are not currently captured in safety risk portfolios. These candidate safety issues are formally captured by the Agency and are then subject to a preliminary safety assessment. This assessment then informs the decision on whether a candidate safety issue should be included formally within the relevant safety risk portfolio or be subject to other actions. Advice is taken from the NoA and CAGs. The output of this

step in the process are the domain safety risk portfolios. Within the portfolios, both the key risk areas and safety issues are prioritised.

Assessment of Safety Issues: Once a safety issue is identified and captured within the safety risk portfolio, it is subject to a formal safety assessment. These assessments are prioritised within the portfolio. The assessment process is led by EASA and is supported by the NoA and CAGs. These collaborative groups are always involved in the review of each assessment's terms of reference and the results of the assessment. In addition, group members are encouraged to participate in the assessment itself; this external support is vital to achieving the best possible results. The result of the assessment is the production of scenario based bow tie models that help to identify weak controls for which potential actions can be identified. Together this forms the Safety Issue Assessment (SIA), which provides potential actions for the EPAS. This is followed by the Preliminary Impact Assessment (PIA), which assesses the wider implications and benefits of the proposed actions and makes recommendations on the actions to be implemented in the EPAS.

Definition and Programming of Safety Actions: Using the combined SIA/ PIA, formal EPAS actions proposals are then made to the advisory bodies. Once discussed and agreed upon, the actions are then included in the next version of the EPAS. Prior to publication, the EPAS is approved by the EASA Management Board.

Implementation and Follow Up: The next step in the process involves the implementation and follow-up of the actions that have been included within the EPAS. There are a number of different types of action within the EPAS. These include focussed oversight, research, rulemaking and safety promotion.

Safety Performance Measurement: The final stage in the process is then the measurement of safety performance. This serves two purposes, firstly to monitor the changes that have resulted from the implementation of safety actions. Secondly, it also serves to monitor the aviation system so that new safety issues can be identified. To ensure that there is a systematic approach to the work in this step of the SRM process, a Safety Performance Framework has been developed that identifies different tiers of Safety Performance Indicators (SPIs). Tier 1 transversally monitors all the domains and the overview of the performance in each domain. Tier 2 then covers the key risk areas at domain level, whilst Tier 2+ monitors the safety issues. This Annual Safety Review is the annual review of the Safety Performance Framework. It identifies safety trends, highlights priority domains, key risk areas and safety issues. From this step the SRM process begins again.

Chapter Overview

This document is split into a number of chapters, each of which covers the different operational domains in the European Aviation System. The different domains in each chapter cover the areas for which a specific safety risk portfolio has been developed. Except for the chapter on Commercial Air Transport – Aeroplanes, the scope of each domain chapter (and corresponding safety risk portfolio) is limited to the EASA MS, either as state of operator or state of registry. For the Aerodrome and ATM chapters, this scope is limited to the EASA MS as state of occurrence. The chapters of this review cover the following areas:

Chapter 1 – Cross-Domain Safety Overview: This provides an overview of the most important statistics across all the different domains. It helps to identify which domains are likely to need the greatest focus in the EPAS.

Chapter 2 – Commercial Air Transport.

> **Chapter 2a – Commercial Air Transport – Aeroplanes**: This covers all commercial air transport airline (passenger and cargo operators) operations involving aeroplanes. **Commercial Air Transport – Other CAT Aeroplanes:** This covers the remaining parts of commercial air transport - aeroplanes that does not involve airline operators. This includes air taxi and other such operations.
>
> **Chapter 2b – Part Special Operations (SPO)/ Aerial Work – Aeroplanes**: This covers all aerial work/ Part SPO operations involving aeroplanes and involves a wide range of different operational activities including aerial advertising, aerial patrol, agricultural, air shows, parachuting and towing (with glider operations).

Chapter 3 – Commercial Operations with Helicopters.

> **Chapter 3a - Offshore Helicopters**: This covers operations in the offshore helicopter domain and includes some initial input on offshore renewable operations in addition to the oil and gas industry.
>
> **Chapter 3b – Other CAT Helicopters**: This covers all other commercial air transport operations involving helicopters such as passenger flights, air taxi and HEMS.
>
> **Chapter 3c – Part Special Operations (SPO)/ Aerial Work – Helicopters**: This covers all aerial work/ Part SPO operations involving helicopters and includes an even wider range of different operational activities than the equivalent aeroplanes chapter, adding Construction/ Sling Load operations and Logging to the categories already mentioned.

Chapter 4 – Non-Commercial Operations.

> **Chapter 4a - Non-Commercial Operations – Aeroplanes**: The chapter covers all non-commercial operations involving aeroplanes and includes analysis of what would be understood within the traditional definition of general aviation. The chapter also includes flight training and other non-commercial activities.
>
> **Chapter 4b - Non-Commercial Operations – Helicopter**: Similarly, the next chapter covers all non-commercial operations involving helicopters.

Chapter 5 - Balloons: This chapter covers all operations involving hot air balloons.

Chapter 6 – Gliders/ Sailplanes: This chapter covers all operations involving gliders and sailplanes.

Chapter 7 – RPAS/UAS/Drones: This chapter covers operations involving Remotely-Piloted Air Systems (RPAS)/ Unmanned Aircraft Systems (UAS)/ drones.

Chapter 8 – Aerodrome/ Ground Handling: As previously described above, this chapter covers aerodrome operations that occur within the EASA MS. Therefore the scope for this chapter is EASA MS as state of occurrence. For the first time a safety risk portfolio is provided for this domain.

Chapter 9 – ATM/ANS: As previously described, the scope for this chapter is EASA MS as state of occurrence and covers ATM/ANS operations. An initial safety risk portfolio has also been provided for this domain for the first time.

Typical structure of each chapter

Each of the domain chapters in this Annual Safety Review contains specific information which is useful in understanding the analysis of that domain. Such information includes:

Key Statistics: Every chapter starts with a set of key statistics. This provides information on the Tier 1 SPIs for that domain, which includes details of the number of fatal accidents, non-fatal accidents and serious incidents. It also outlines the number of fatalities and serious injuries in the domain. In all cases, the figures for 2016 are provided followed by comparison with the annual averages over the past 10 years. This helps to provide a reference on how this year's performance relates to historical trends. This information is also provided in a graphical format.

Domain Specific Analysis: As every domain has different facets to it, a further analysis of useful domain specific information is included. For example, within the areas of special operations it is useful to provide information on the type of operation involved in safety events, while some chapters include an analysis of the type of propulsion.

Safety Risk Portfolio: The next part of the analysis, and the most important in each chapter, is the domain safety risk portfolio. The portfolio has 2 axes. Along the top, information is provided on the key risk areas, which are the most frequent accident outcomes or potential accident outcomes in that domain. In the context of the safety performance framework, the key risk areas are the Tier 2 SPIs for the domain. The key risk areas are, in most cases, ordered on the basis of their percentage involvement in fatal followed by non-fatal accidents. When viewing these percentages, it should be understood that because multiple categories can be applied to one accident the percentages may not necessarily add up to 100%. On the left hand axis of the portfolio are the safety issues, which relate to the causal and contributory factors to the key risk areas (accident outcomes). In terms of safety performance, these are the Tier 2+ SPIs. These are prioritised on the basis of their involvement in fatal accidents, then non-fatal accidents, serious incidents and incidents. The occurrences related to the individual safety issues and are identified by mapping event types in the ECCAIRS taxonomy to each safety issue.

Priority Key Risk Areas: The next part of the analysis provides more detail on the priority key risk areas (accident outcomes) in each operational domain. These are intended to help the reader to understand the main types of accident that should be prevented in order to improve the level of safety in each domain.

Top Safety Issues and Associated Actions: Finally, the last part of each chapter list the top safety issues that give rise to the accident outcomes. More information is provided about each safety issue along with details of EASA risk assessment work that might have taken place for this area. There is also a short overview of any related safety actions in the EPAS that relate to each safety issue.

Cross-Domain Safety Overview

1

This chapter provides a general overview of aviation safety in the EASA Member States (MS). It compares the number of fatal accidents and fatalities in each operational domain for 2016 with the annual average for the past 10 years. For the purposes of this overview, Aerodromes/ Ground Handling and ATM/ANS are not included. With reference to the Safety Risk Management (SRM) process, as outlined in the introduction, and the safety performance framework, this overview serves as the Tier 1 Safety Performance Indicators (SPIs).

Key Cross- Domain Statistical Overview

The only domain with an increase in fatalities in 2016 was Offshore Helicopters, where there was one accident with 13 fatalities. This is the first year that a fatal accident has been recorded in this domain since 2013. For the other domains, there has been a reduction in both the number of fatal accidents and fatalities. Because of the low number of fatal accidents in CAT Aeroplanes, the median average is introduced to highlight that while the mean average number of fatalities is high, this is largely due to a small number of large accidents.

Table 1 Overview of fatal accidents and fatalities 2016 Vs 10-year average (2006-2015)

Domain	Fatal Accidents 2016	Fatal Accidents Annual 10 Year Mean	Fatalities 2016	Fatalities Annual 10 Year Mean	Fatalities Annual 10 Year Median
CAT Aeroplanes					
Airline (Passenger/ Cargo	1	0.8	2	66.0	5.0
Other	0	1.4	0	6.4	2.0
SPO Aeroplanes	6	10.7	12	18.6	16.5
CAT Helicopters					
Offshore	1	0.4	13	3.0	0.0
Other	2	0.9	8	2.8	3.5
SPO Helicopters	0	4.1	0	7.4	6.0
Non-Commercial and Other					
NCO Aeroplanes	46	51.4	78	94.4	95.5
NCO Helicopters	9	10.0	11	17.5	17.0
Balloons*	1	2.2	1	4.0	3.0
Gliders	19	26.5	20	31.1	31.0
RPAS	0	0.0	0	0.0	0.0

*Balloon data compares 2016 with the average for the five year period 2011-2015.

The top 5 operational domains in terms of the annual average of the number of fatalities for the past 10 years (2007-2016) number of fatalities are:

Non-Commercial Aeroplanes: In terms of the average number of fatalities over the past 10 years, this domain has the highest with 173.5. In 2016, it was also the domain with the highest number of fatalities and fatal accidents, being 78 fatalities and 46 fatal accidents. In both cases, the figures for 2016 are lower than the 10 year average.

CAT Aeroplanes Airline (Passenger/Cargo): The second highest average number of fatalities over the past 10 years is in CAT Aeroplanes Airline (Passenger/ Cargo) with 66.0 per year. In 2016, there was one fatal accident, which led to 2 fatalities. This accident involved West Air Sweden Flight 294, a cargo flight using a Bombardier

CRJ200 that crashed in Sweden on 8 January 2016. The final report for this accident was published by the Swedish Accident Investigation Board in December 2016 [1].

Gliders/ Sailplanes: In terms of the average number of fatalities, the gliding/sailplanes domain has the 3rd highest total with 31.1. It was also the domain that had the 2nd highest number of both fatalities and fatal accidents in 2016, with 20 fatalities and 19 fatal accidents. Again, in both cases this represents a reduction of the previous year and is lower that than the 10 year average.

SPO Aeroplanes: In 2016, part-SPO aeroplane operations recorded 6 fatal accidents. These accidents led to a total of 11 fatalities. In both cases, this is lower than the 10 year average and is also lower than the previous year.

NCO Helicopters: Non-commercial helicopter operations had the 5th highest average number of fatalities over the past 10 years. In 2016, there were a total of 11 fatalities, which came from 9 fatal accidents. Again in both cases both are below the 10 year average.

1 http://www.havkom.se/en/investigations/civil-luftfart/olycka-i-lappland-med-flygplanet-se-dux-av-typen-canadair-crj-200?cookie=ok

Commercial Air Transport

2

Chapter 2a Commercial Air Transport Aeroplanes – Airline and Other Operations

This chapter covers Commercial Air Transport (CAT) aeroplane operations. Following the high level key statistics, the chapter is divided in two main sections, the airline passenger/cargo with aeroplanes having a maximum take-off weight above 5700 kg. This is followed by other CAT aeroplane operations, which includes all other operation types under CAT (such as air ambulance, air taxi, etc.) and the airline passenger/cargo operations including aeroplanes with a maximum take-off weight below 5700 kg. For each sub-domain, the key statistics and an occurrence based safety risk portfolio are presented. Except for the worldwide overview, the scope of this is EASA Member State (MS) operators.

Key Statistics

The key domain statistics are in the tables below and include the accidents and serious incidents involving EASA MS CAT airline operators and other CAT operations. This split provides a better focus for the analysis and a fairer grouping for the assessment of actions.

The only fatal accident in CAT aeroplane airline operations in 2016 that involved an EASA MS operator was the accident of a Bombardier CRJ-200 performing a cargo flight on 8 January 2016. From the analysis, it can be observed that there was a lower number of non-fatal accidents involving EASA MS operators in 2016 than the 10-year average, with 16 accidents compared to the average of 23.1 over the previous 10 years. At the same time, there was a 36% increase in the number of serious incidents over the same period resulting in a total of 106 serious incidents compared with the average of 78.2. In terms of fatalities, the single fatal accident resulted in 2 fatalities (the flight crew, the only occupants of the aeroplane), which is much lower than the 10 year average. There was also a slight decrease in serious injuries with 9 serious injuries compared with 10 over the previous 10 years.

Table 2 Key statistics CAT Aeroplane

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	0.8	23.1	78.2
2016	1	16	106
% of change	25% ↑	-31% ↓	35% ↑

	Fatalities	Serious Injuries
2006-2015 average	66	10
2016	2	9
% of change	-97% ↓	-10% ↓

In the domain of other CAT aeroplane operations involving an EASA MS operator, there were 3 non-fatal accidents and 5 serious incidents.

Table 3 Key statistics CAT Aeroplane - Other

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	1.4	4.1	2.7
2016	0	3	5
% of change	↓	-27% ↓	85% ↑

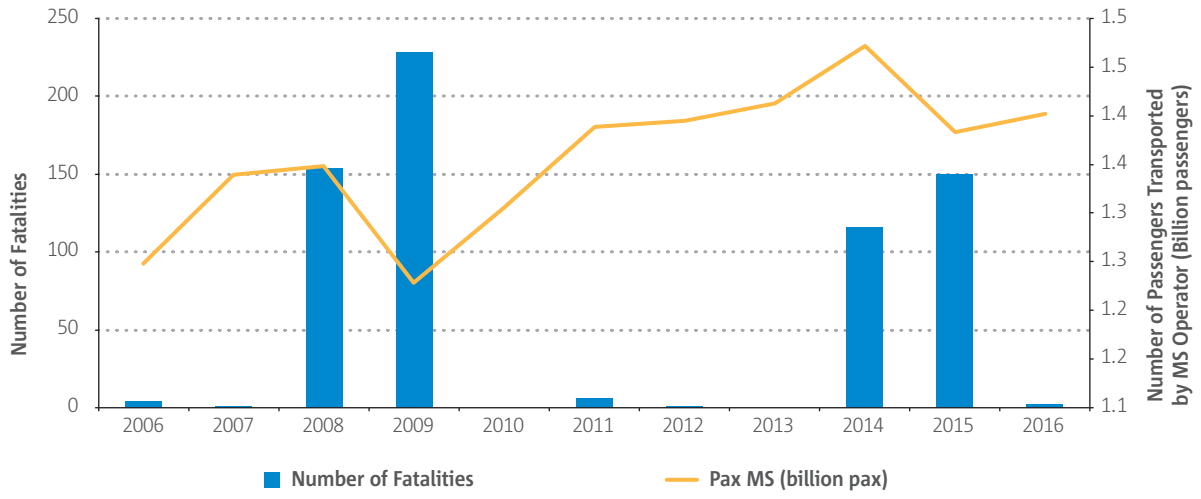
	Fatalities	Serious Injuries
2006-2015 average	6.4	1.1
2016	0	0

Commercial Air Transport Aeroplane – Airlines

The analysis focuses on the CAT aeroplane airline operations, which encompasses passenger and cargo. This domain covers the bulk of the commercial air transport activity.

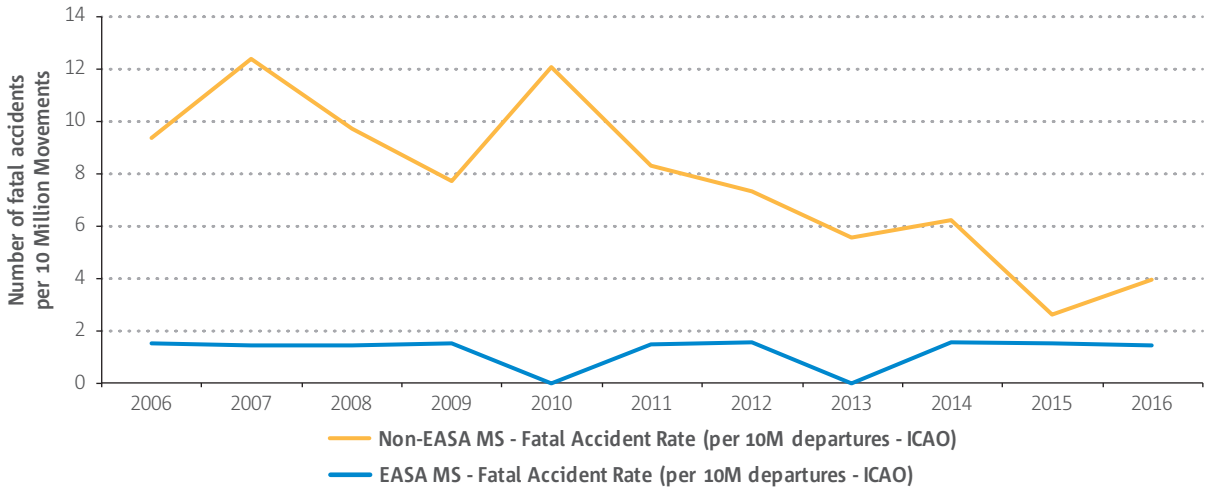
Figure 1 shows that in 2016 there was only one fatal accident resulting in 2 fatalities, who were both flight crew members on-board a cargo flight.

Figure 1 CAT Aeroplane Airlines, evolution of fatal and non-fatal accidents, period 2006-2016



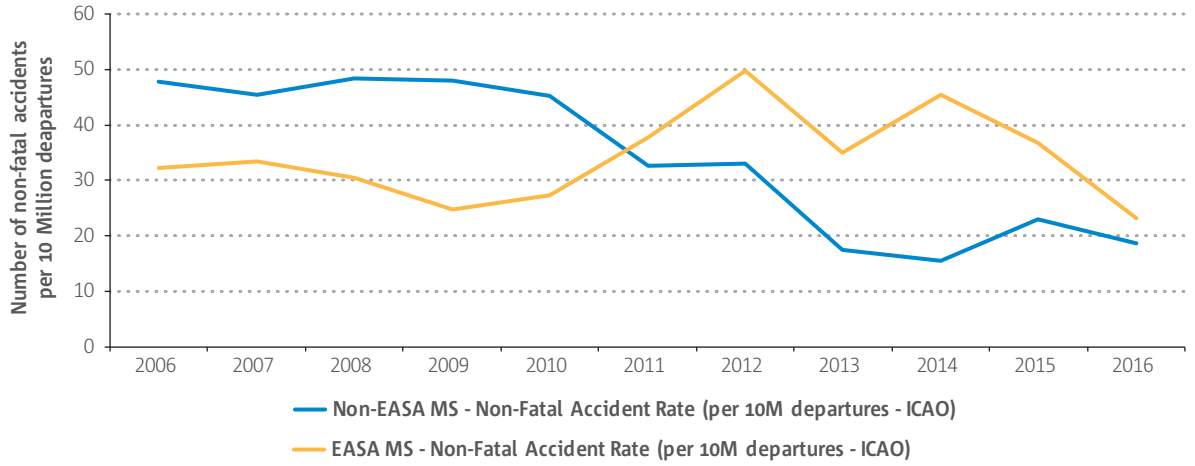
As can be seen in Figure 2 EASA MS Aircraft Operators Certificate (AOC) holders were involved in a lower rate of fatal accidents per ten million departures than the rest of the world. This rate has remained below 2 fatal accident per ten million departures since 2006.

Figure 2 CAT Aeroplane Airline fatal accident rate for EASA MS AOC and non-EASA Ms, period 2006-2016



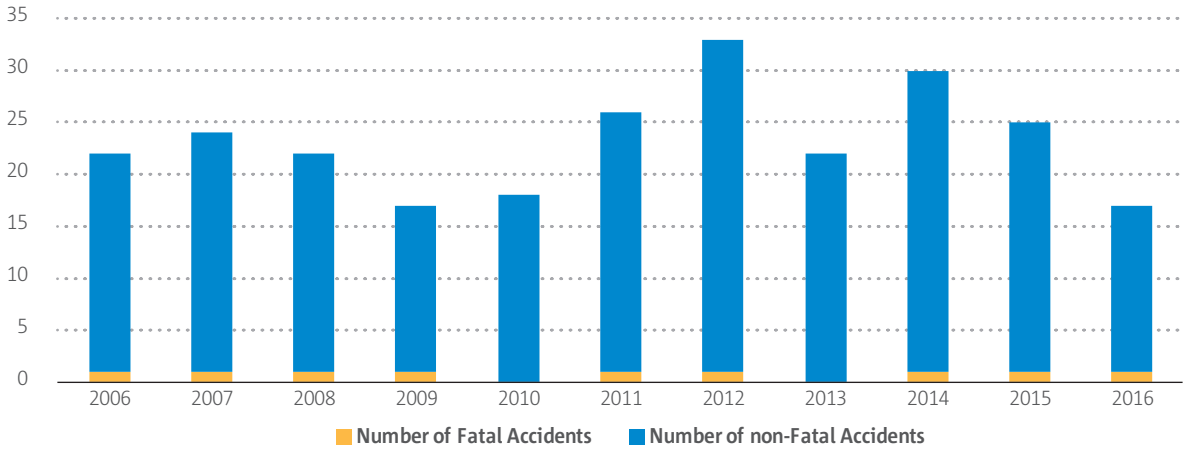
With respect to non-fatal accident rates, as can be seen in Figure 3, the rate for EASA MS AOC holders has decreased for the last two years, although it is above the rate for non-EASA AOC. This higher rate is likely to be due to the better reporting channels and data capture from the EASA MS AOC holders rather than being a reflection on the safety performance of both groups.

Figure 3 CAT Aeroplane Airline non-fatal accident rate for EASA MS AOC and non-EASA Ms, period 2006-2016



Regarding EASA MS AOC holders, the 2016 recorded figure of 16 of non-fatal accidents is equal to the lowest figure recorded during the last decade, which has not occurred since 2009. However, one fatal accident was recorded as a result of fatal injuries to the two flight crew on board.

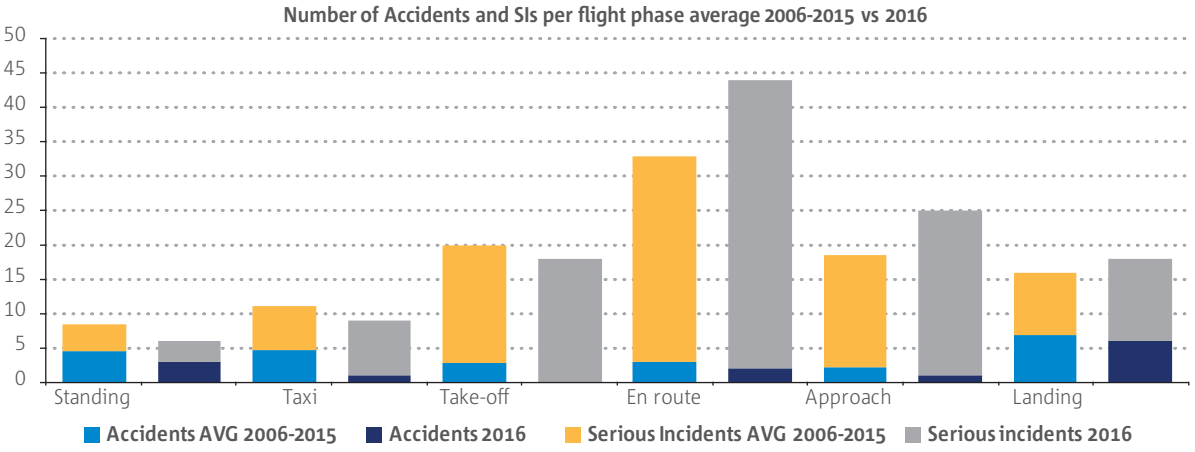
Figure 4 CAT Aeroplane Airline, evolution of fatal and non-fatal accidents, period 2006-2016



Phase of Flight

The numbers for 2016 show an overall decrease of accidents in all flight phases when compared to the 10 year average. In same period however, there was an increase in the number of serious incidents, especially those occurring during en-route, approach and landing flight phases.

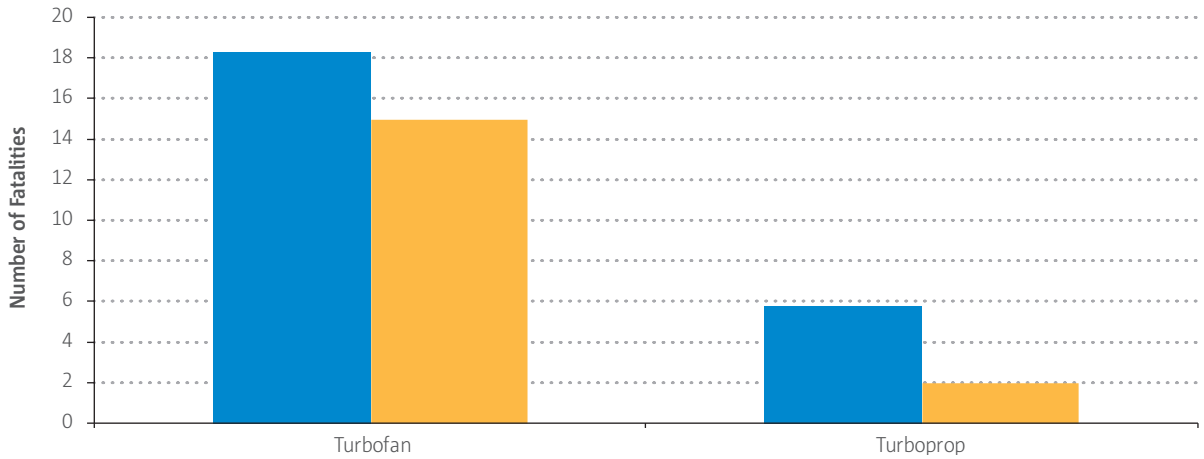
Figure 5 CAT aeroplane accidents and serious incidents per phase of flight 2006-2016



Propulsion type

The split by propulsion type shows a decrease for 2016 in both turbofan and turboprop accidents in reference to the 10 year average. This decrease is in line with the overall reduction of accidents. More accidents involve turbofan powered aircraft than turboprop aircraft and this is in line with the split in the aircraft fleet sizes.

Figure 6 CAT aeroplane accidents and serious incidents by propulsion



Safety Risk Portfolio

The safety risk portfolio for the CAT aeroplane airline domain provides a summary of the past performance of this part of the aviation system. With reference to the safety performance framework, it covers the Tier 2 (Key Risk Areas) and Tier 2+ (Safety Issues). Within the portfolio, the top risk areas and priority safety issues are identified, interlinked and prioritised. The portfolio is used to prioritise the assessment of safety issues, to target analysis activities over key risk areas and to establish the interdependencies of safety actions.

In the upper part of the safety risk portfolio, the total number of fatal and non-fatal accidents for the past 10 years has been spread across the different key risk areas shown in columns. A key risk area includes both the undesired outcome (accident) and immediate precursors to those outcomes. In rows, the SRP shows the main safety issues and its negative contribution to the safety performance of the system in the last 5 years (fatal accidents, non-fatal accidents, serious incidents and incidents, displayed in columns before the risk areas). The dotted grid establishes the relation between safety issues and key risk areas – it identifies which safety issues may lead to which accident outcomes. Dots come from occurrence data and expert judgement.

The initial prioritisation is done by the contribution to fatal accidents, non-fatal accidents, serious incidents and then incidents.

COMMERCIAL AIR TRANSPORT - AEROPLANES, AIRLINES

Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Aircraft Upset	Runway Excursion	Non-Safety Security/non-Safety	Ground Damage	Terrain Collision	Obstacle Collision in Flight	Runway Collision	Airborne Collision	Taxiway/ Apron Excursion	Unsurvivable Aircraft Environment
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents										
Outcome Percentage of Fatal Accidents (2007-2016)	8				75%	13%	13%	0%	0%	0%	0%	0%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	226				19%	30%	0%	26%	2%	1%	1%	1%	0%	4%
Operational														
Handling of Technical Failures	288	14	5	2	●	●					●	●	●	●
Icing in Flight	277	6	0	1	●									
Turbulence	2 936	5	20	0	●	●			●					
Approach Path Management	2 658	13	5	0	●	●			●	●				
Flight Planning and Preparation	3 687	11	5	0	●	●			●		●		●	
Windshear	3 919	2	5	0	●	●			●	●				
Crosswind	224	5	2	0	●	●			●	●				
Hail	17	1	2	0	●	●		●						
Icing on Ground	116	0	2	0	●	●		●					●	●
Airborne Separation	2 667	42	0	0								●		
False or Disrupted ILS Signal Capture	314	8	0	0	●	●			●	●				
Handling and Execution of Go-Arounds	219	8	0	0	●	●			●			●		
Deconfliction with Aircraft Not Using Transponders	192	4	0	0			●					●		
Entry of Aircraft Performance Data	50	3	0	0	●	●			●		●			
Bird/ Wildlife Strikes	13 003	2	0	0	●			●						

COMMERCIAL AIR TRANSPORT - AEROPLANES, AIRLINES

Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Aircraft Upset	Runway Excursion	Non-Safety Security/non-Safety	Ground Damage	Terrain Collision	Obstacle Collision in Flight	Runway Collision	Airborne Collision	Taxiway/ Apron Excursion	Unsurvivable Aircraft Environment
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents										
Outcome Percentage of Fatal Accidents (2007-2016)	8				75%	13%	13%	0%	0%	0%	0%	0%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	226				19%	30%	0%	26%	2%	1%	1%	1%	0%	4%
Taxi Speed and Directional Control	12	1	0	0	●	●		●		●	●		●	
Dangerous Goods Handling and Lithium Batteries	719	0	0	0	●			●						●
Wake Vortex	1 092	0	0	0	●			●						
Security														
Laser Illumination Effects (Not all Illuminations)	35	1	0	0			●							
Disruptive Passengers	2 505	0	0	0			●							
Technical														
Aircraft Maintenance	1 866	9	5	0	●	●		●					●	●
UAS Strikes	0	0	0	0	●							●		
Human														
Perception and Situational Awareness	1 393	27	12	2	●	●		●	●	●	●	●	●	
CRM and Operational Communication	4 822	26	8	1	●	●		●	●	●	●	●	●	
Mental Health	0	0	0	1	●	●	●	●	●	●	●	●	●	
Decision Making and Planning	450	10	4	0	●	●		●	●	●	●	●	●	

COMMERCIAL AIR TRANSPORT - AEROPLANES, AIRLINES

Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Aircraft Upset	Runway Excursion	Non-Safety Security/non-Safety	Ground Damage	Terrain Collision	Obstacle Collision in Flight	Runway Collision	Airborne Collision	Taxiway/ Apron Excursion	Unsurvivable Aircraft Environment
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents										
Outcome Percentage of Fatal Accidents (2007-2016)	8				75%	13%	13%	0%	0%	0%	0%	0%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	226				19%	30%	0%	26%	2%	1%	1%	1%	0%	4%
Experience, Training and Competence of Individuals	246	10	3	0	●	●		●	●	●	●	●	●	
Monitoring of Flight Parameters and Automation Modes	147	8	2	0	●	●		●	●	●	●	●	●	
Fatigue	335	3	2	0	●	●		●	●	●	●	●	●	
Personal Pressure and Alertness	97	9	1	0	●	●		●	●	●	●	●	●	
Gastrointestinal Illness	2 439	34	0	0	●	●	●	●	●	●	●	●	●	
Knowledge of Aircraft Systems and Procedures	94	5	0	0	●	●		●	●	●	●	●	●	
Fumes Effects	130	0	0	0	●	●	●	●	●	●	●	●	●	●
Organisational														
Effectiveness of Safety Management					●	●	●	●	●	●	●	●	●	●
Development and Application of Regulations and Procedures	21	0	0	0	●	●	●	●	●	●	●	●	●	●

Use of ERCS for risk comparison

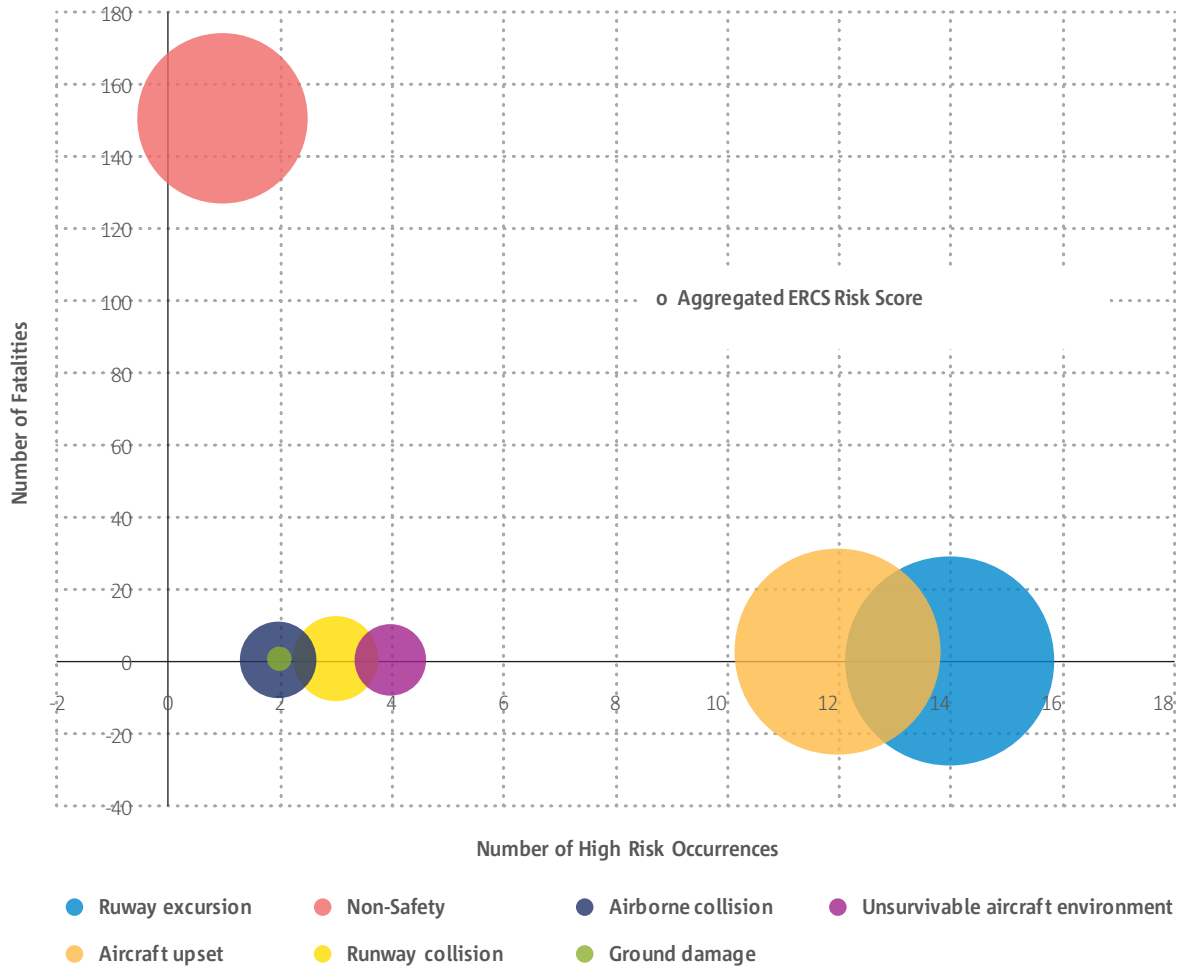
The European Risk Classification Scheme or ERCS is the methodology being developed by a group of experts who have been nominated by the European Commission in order to meet the requirement of the Regulation (EU) 376/2014 to risk score all occurrences. The obligation is on organisations and authorities, though, while organisations can decide on any methodology to risk score occurrences, the authorities shall use a common risk classification at European level, that being ERCS.

The objective of ERCS is to facilitate the identification of high risk occurrences and the identification of areas of concern in the aviation system. For this second purpose, one of the possible strategies is to aggregate the risk score of the individual occurrences. The indicator obtained by this addition is not a risk estimation per se, but a parameter that reflects how far those occurrences were from the worst possible outcome, thus allowing a common reference point for comparison.

The aggregation of individual ERCS risk scores helps to perform a comparison between key risk areas. The comparison is a relative indicator measuring the past performance of the system, showing the risk areas where barriers were penetrated either more often and/or to a greater extent, therefore resulting in a higher aggregated risk score. However, this indicator cannot be translated in terms of risk (severity X probability).

Figure 7 shows the key risk areas plotted by the number of high risk occurrences (x-axis), the number of fatalities (y-axis) and the aggregated risk score of the individual high risk occurrences (diameter of the bubble) associated to each risk area. As can be seen, depending on the parameter used (fatalities, frequency of occurrence or aggregated risk score) the prioritisation of Key Risk Areas may be significantly different.

Figure 7 Aggregated Risk Score for Accidents and Serious Incidents Involving EASA MS operators 2015-2016 by Key Risk Areas



Priority Key Risk Areas

Taking into consideration the last 10 years of fatal and non-fatal accidents, and the representation of the aggregated ERCS score, the priority key risk areas are:

 Aircraft Upset	Number 2 ERCS Score 6 Fatal Accidents	Aircraft upset or loss of control is the most common accident outcome for fatal accidents in CAT aeroplanes operations, accounting for 75% of them. It includes uncontrolled collisions with terrain, but also occurrences where the aircraft deviated from the intended flight path or aircraft flight parameters, regardless of whether the flight crew realised the deviation and whether it was possible to recover or not.
 Runway Excursion	Number 1 ERCS Score 1 Fatal Accident	Materialised runway excursions, both high and low speed and occurrences where the flight crew had difficulties maintaining the directional control of the aircraft or of the braking action during landing, where the landing occurred long, fast, off-centred or hard, or where the aircraft had technical problems with the landing gear (not locked, not extended or collapsed) during landing. This accounts for 13% of the fatal accidents in CAT aeroplane operations involving airline/cargo operations in the past decade.
 Non-Safety	Number 3 ERCS Score 1 Fatal Accident	Non-Safety accident outcomes includes intended actions. Included, is the intention to cause harm or damage, or to disrupt the normal operation of the aircraft. It also includes all terrorist or conflict related actions, as well as any other situation where there was a clear intention to cause harm, damage or disruption to the flight, regardless of the motivation to do so. It includes cases of hijacking, bomb-threat, shoot-downs, intended laser interference, disruptive passengers, etc.
 Runway Collision	Number 4 ERCS Score 3 Non-Fatal Accidents	Runway collisions have been the outcome in 1% of fatal accidents in the past decade. Despite the low percentage, the ERCS evaluation demonstrates that the risk was very real.
 Airborne Collision	Number 5 ERCS Score 3 Non-Fatal Accidents	Airborne collisions are collisions between aircraft where both (all) aircraft were airborne. Although this outcome has not occurred in the past 10 years, the risk scoring of accident and serious incidents highlights the continued risk of this type of accident.
 Ground Damage	Number 6 ERCS Score 59 Non-Fatal Accidents	Ground collisions and ground damage occur on the ramp and this key risk area does not include collisions on the runway. While it was not the accident outcome for any fatal accidents, the risk score warrants its inclusion in the priority key risk areas list.

Top Safety Issues

As for the key risk areas, it is possible to establish a ranking of safety issues based on the past performance of the system by counting high risk occurrences, or the number of fatalities or through the aggregated risk score.

- Perception and situational awareness
- Icing in flight
- Handling of technical failures
- Turbulence
- Airborne conflict
- Flight planning
- Decision making and planning
- Experience, training and the competence of individuals
- Wind-shear
- Flight- path management
- Mental health

Performed Safety Issue Assessments and identified actions

Continuing with the SRM, the Collaborative Analysis Group for CAT aeroplanes composed of the industry stakeholders, Member States and the Agency is currently working on several safety assessments on identified safety issues during 2016.

Crew Resource Management: The assessment concluded that the performed regulatory actions (revision of AMC and GM on Crew Resource Management (CRM) training) was sufficient, but that there was a need to support its implementation with additional safety promotion material so as to provide operators and training organisations with the best practices available. In November 2016, the Agency organised a dedicated workshop on CRM where different stakeholders presented their approach to CRM implementation. The Agency will collect and publish a list of best practices for CRM implementation (SPT.079).

Entry of Erroneous Take-Off Parameters: The assessment of the safety issue and the later review of the data obtained via a targeted survey showed that the issue was more common than initially estimated. Therefore, the Agency, together with the main stakeholders, decided to publish a Safety Information Bulletin[2] to raise the awareness of the operators and flight crews and to encourage the monitoring of the issue through FDM programmes. The Agency will launch a second survey to gauge the efficiency of the actions launched and the need of further initiatives.

Ice On-Ground and In-Flight: As part of the former safety issue on “flying in adverse weather conditions”, the CAT Aeroplane CAG launched a detailed assessment of two icing-related scenarios, on-ground and in-flight. The ice-on-ground assessment put forward a number of recommendations for safety actions ranging from the

2 https://ad.easa.europa.eu/ad/2016-02

improvements to the regulatory framework for de-icing providers, research on the means to estimate precipitation intensity, to the assessment of technical solutions that estimate the degradation of aircraft performance during the take-off run. All the proposed safety actions are being assessed under the Preliminary Impact Assessment (PIA) process so as to determine the most efficient actions be implemented. The assessment of in-flight icing is in its final stage. In the same manner, the assessment will identify the areas of improvement and draft possible safety actions, which will be fed into the PIA process.

Flight Crew Awareness: The assessment team reviewed recent accident investigations with a view to modelling those situations where flight crew awareness was a factor. The assessment established two main scenarios: The flight crew failed to properly react to an automation disconnection or un-commanded mode transition and to properly manage the aircraft attitude, energy or flight path and; the flight crew being surprised by an event that they normally should have anticipated as part of managing the flight or should have detected through active monitoring. The assessment team is finalising the evaluation of both scenarios and their impact on the performance of the flight crew. The assessment will offer conclusions addressing the need for further actions beyond those ones already launched.

Inadequate Handling of Go-Around: The assessment team is finalising the analysis, which will be based on a data review of accidents and serious incidents that were investigated over the past 10 years and involved an inadequate handling of the go-around manoeuvre. Per the SRM process, safety actions proposed in the assessment report will feed the PIA process.

Main Action Areas in the EPAS

There is a wide range of different EPAS actions that already cover many of the key risk areas that have been outlined in this chapter. Owing to the number of those actions, it is difficult to summarise them here. However, the action areas at the operational level are split into the strategic key risk areas of aircraft upset and runway safety, covering excursions and collisions.

Aircraft Upset: The main EPAS actions include RMT.0397 on unintended or inappropriate rudder usage (rudder reversals), RMT.0581 concerning loss of control - prevention and recovery training and RMT.0647 on loss of control or loss of flight path during go-around or climb. There are also a number of safety promotion tasks covering this key risk area.

Runway Safety: For the key risk areas of runway collisions and runway excursions, EPAS actions include RMT.0296 on the review of aeroplane performance requirements for CAT operations, RMT.0369 concerning the prediction of wind shear for aeroplane CAT operations (IRs), and RMT.0570 on the reduction of runway excursions.

Commercial Air Transport Aeroplane – Other

The analysis now shifts its focus to other commercial aeroplane operations that are within the analysis scope of passenger/cargo. This sub-domain covers CAT aeroplane operations performed with aeroplanes with a MTOW below 5700kg or of a very specific type (air ambulance, air taxi) not yet being considered as Specialised Operations (SPO).

As was the case in 2015, Figure 8 shows that in 2016 there were no fatalities. This consolidates the decreasing trend of the last 10 years. There is no reliable traffic information that splits out the other CAT aeroplane operations so as to determine an accident rate.

Figure 8 Other CAT Aeroplane, number of fatalities, 2006-2016

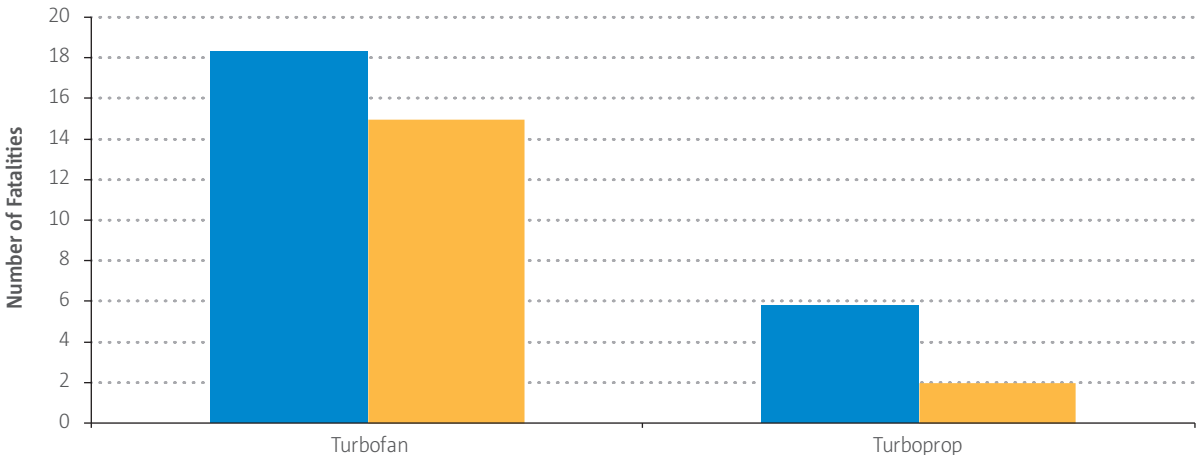
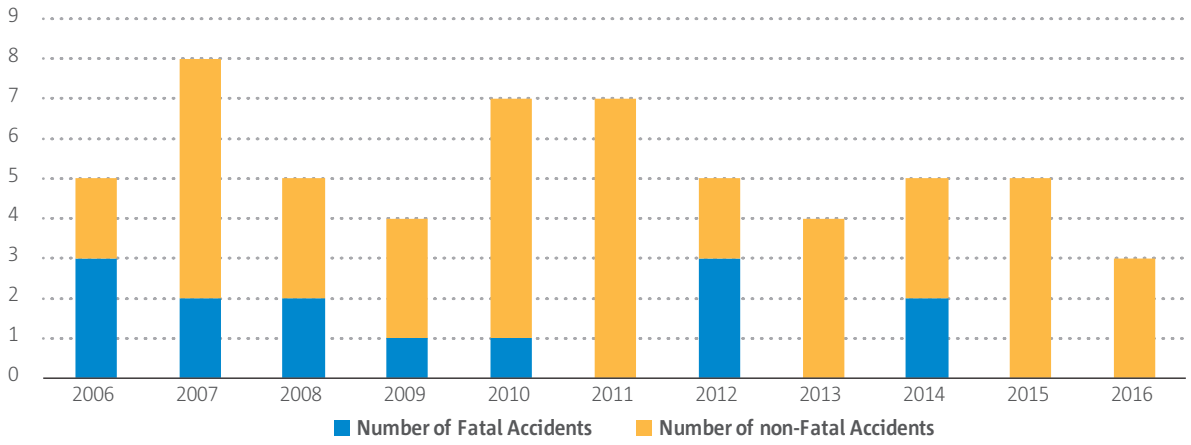


Figure 9 shows the evolution of the fatal and non-fatal accidents in the period 2006-2016. While fatal accidents show a decreasing trend recording no fatal accidents in the last 2 years, the number of non-fatal accidents remains quite stable with between 3 and 6 events per year.

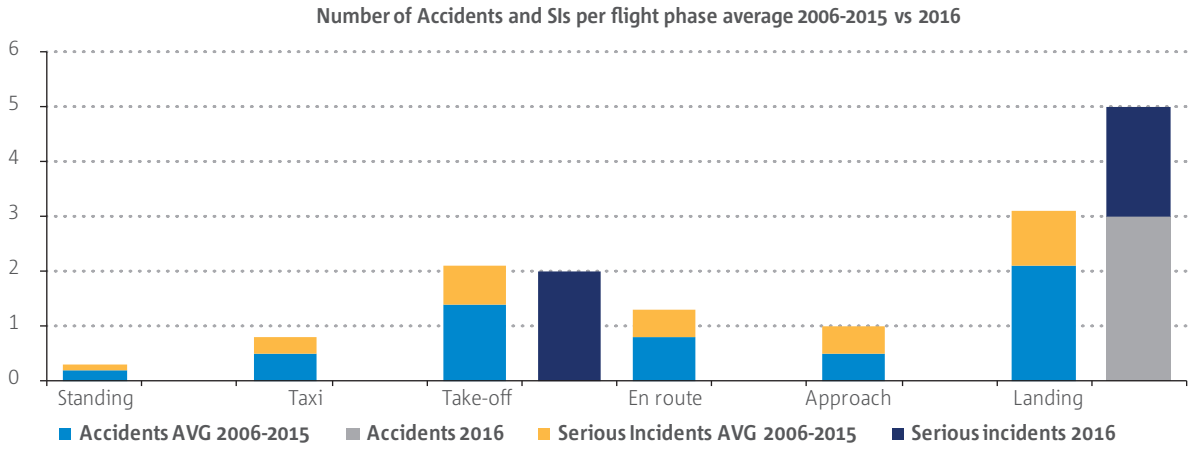
Figure 9 Other CAT Aeroplane, evolution of fatal and non-fatal accidents (2006-2016)



Flight Phases

The comparison of accidents and serious incidents by flight phase shows that almost all occurrences in 2016 happened during the landing flight phase, all those connected to the risk of runway excursion.

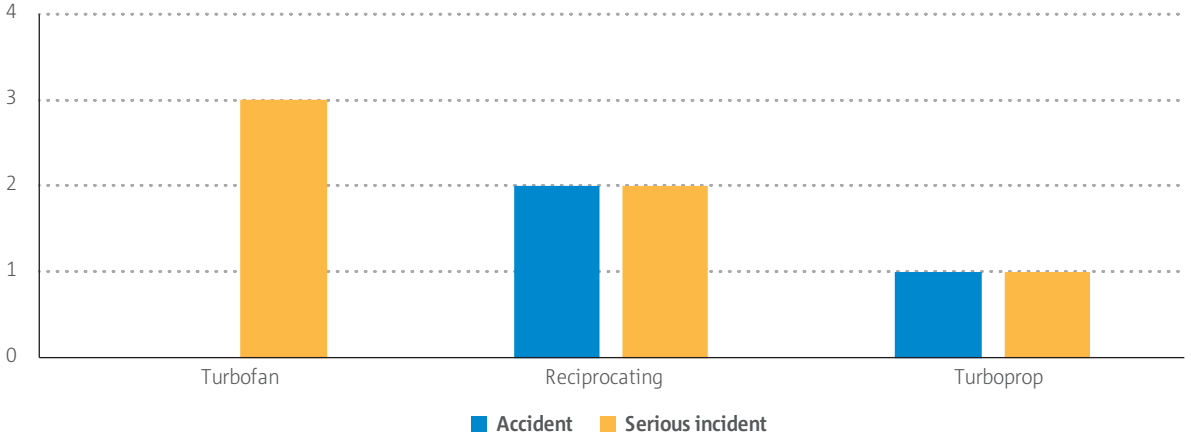
Figure 10 Other CAT Aeroplane, comparison of accidents and serious incidents by flight phase between the average of 2006-2015 and the figures in 2016



Propulsion type

Overall, the highest number of occurrences (Both accidents and serious incidents combined) involved aircraft with reciprocating engines. There were 3 serious incidents involving turbofan powered aircraft and one accident and one serious incident involving turboprop aircraft. Due to the low figures, the comparison with the previous 10 years was omitted.

Figure 11 Other CAT Aeroplane, split of accidents and serious incidents in 2016 by propulsion type



Safety Risk Portfolio

The safety risk portfolio for Other CAT Aeroplanes is provided below. At this stage the portfolio has been developed only with EASA's own data. The initial prioritisation of key risk areas and safety issues are done by the contribution to fatal accidents, non-fatal accidents for the former and then adds serious incidents and then incidents for the safety issues.

COMMERCIAL AIR TRANSPORT - AEROPLANES - OTHER

Outcome Percentage of Fatal Accidents (2007-2016)	10				50%	20%	10%	10%	10%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	42				21%	10%	5%	2%	0%	50%	7%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)						
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Airborne Collision	Obstacle Collision in Flight	Runway Collision	Runway Excursion	Ground Damage
Operational											
Flight Planning and Preparation	176	0	1	2	●	●			●	●	
Icing in Flight	9	0	0	1	●						
Handling of Technical Failures	9	2	1	0	●		●		●	●	
Crosswind	6	2	1	0	●	●		●		●	
Airborne Separation	91	2	0	0			●				
Wake Vortex	14	1	0	0	●						●
Bird/ Wildlife Strikes	169	0	0	0	●						●
Turbulence	30	0	0	0	●	●				●	
Approach Path Management	17	0	0	0	●	●		●		●	
Windshear	13	0	0	0	●	●		●		●	
Deconfliction with Aircraft Not Using Transponders	7	0	0	0			●				
False or Disrupted ILS Signal Capture	5	0	0	0	●	●		●		●	

COMMERCIAL AIR TRANSPORT - AEROPLANES - OTHER

Outcome Percentage of Fatal Accidents (2007-2016)	10				50%	20%	10%	10%	10%	0%	0%	
Outcome Percentage of Non-Fatal Accidents (2007-2016)	42				21%	10%	5%	2%	0%	50%	7%	
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)							
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Airborne Collision	Obstacle Collision in Flight	Runway Collision	Runway Excursion	Ground Damage	
Handling and Execution of Go-Arounds	3	0	0	0	●	●	●			●		
Hail	2	0	0	0	●					●	●	
Icing on Ground	2	0	0	0	●					●	●	
Dangerous Goods Handling and Lithium Batteries	1	0	0	0	●						●	
Entry of Aircraft Performance Data	0	0	0	0	●	●			●	●		
Taxi Speed and Directional Control	0	0	0	0	●			●	●	●	●	
Security												
Disruptive Passengers	2	0	0	0								
Laser Illumination Effects (Not all Illuminations)	1	0	0	0								
Technical												
Aircraft Maintenance	36	1	1	0	●					●	●	
UAS Strikes	0	0	0	0	●		●					
Human												
Perception and Situational Awareness	27	2	0	3	●	●	●	●	●	●	●	
Decision Making and Planning	7	2	1	2	●	●	●	●	●	●	●	

COMMERCIAL AIR TRANSPORT - AEROPLANES - OTHER

Outcome Percentage of Fatal Accidents (2007-2016)	10				50%	20%	10%	10%	10%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	42				21%	10%	5%	2%	0%	50%	7%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)						
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Airborne Collision	Obstacle Collision in Flight	Runway Collision	Runway Excursion	Ground Damage
Experience, Training and Competence of Individuals	10	0	0	2	●	●	●	●	●	●	●
Mental Health	0	0	0	2	●	●	●	●	●	●	●
CRM and Operational Communication	182	3	0	1	●	●	●	●	●	●	●
Monitoring of Flight Parameters and Automation Modes	4	0	0	1	●	●	●	●	●	●	●
Fatigue	1	0	0	1	●	●	●	●	●	●	●
Personal Pressure and Alertness	0	1	0	0	●	●	●	●	●	●	●
Gastrointestinal Illness	90	0	0	0	●	●	●	●	●	●	●
Knowledge of Aircraft Systems and Procedures	0	0	0	0	●	●	●	●	●	●	●
Fumes Effects	0	0	0	0	●	●	●	●	●	●	●
Organisational											
Development and Application of Regulations and Procedures	1	0	0	0	●	●	●	●	●	●	●
Effectiveness of Safety Management					●	●	●	●	●	●	●

Priority Key Risk Areas

Taking into consideration the last 10 years of fatal and non-fatal accidents, the main key risk areas are below. For the remaining chapters of the annual safety review, these are shown in a prioritised order based on the percentage involved in fatal followed by non-fatal accidents.

 Aircraft Upset	5 Fatal Accidents 9 Non-Fatal Accidents	Aircraft upset or loss of control is the most common accident outcome for fatal accidents in CAT aeroplanes operations with 50% incidence. Aircraft upset had the second highest ERCS risk score.
 Terrain Collision	2 Fatal Accidents 4 Non-Fatal Accidents	Terrain collision occurred in 20% of fatal accidents and is still a common accident outcome for other CAT aeroplanes.
 Airborne Collision	1 Fatal Accident 2 Non-Fatal Accidents	Airborne collisions are those between aircraft where both (all) aircraft were airborne. This has occurred in 10% of fatal accidents in the past 10 years.
 Obstacle Collision	1 Fatal Accident 1 Non-Fatal Accidents	Obstacle Collisions have featured in 10% of fatal accidents in the past 10 years. This key risk area involves collisions between aircraft and obstacles during the approach and landing phase of flight.
 Runway Collision	1 Fatal Accident 0 Non-Fatal Accidents	Runway collisions featured in 10% of fatal accidents in the past decade.
 Runway Excursion	0 Fatal Accidents 21 Non-Fatal Accidents	Runway excursions, side excursions as well as overruns were the outcome for 50% (21 total) of the non-fatal accidents in other CAT aeroplane operations in the past decade.

Top Safety Issues and Associated Actions

In the same way as for the key risk areas, it is also possible to establish a ranking of safety issues based on the past performance of the system. This time the safety issues are ordered by their involvement in fatal accidents, accidents, serious incidents and incidents, in that order. The top safety issues are shown below and the actions are the same as those outlined for CAT aeroplanes airline/ cargo previously.

- Perception and situational awareness.
- Flight planning and preparation.
- Decision making and planning.
- Experience, training and competence of individuals.

Chapter 2b Part Special Operations (SPO) – Aerial Work - Aeroplanes

This chapter covers aerial work and special operations (AW/SPO) involving aeroplanes of all mass groups with an EASA MS State of Registry. Key statistics and a safety risk portfolio based on occurrence data are presented. The portfolios will continue to be revised and updated using the knowledge and expertise of operators, manufacturers and National Aviation Authorities (NAAs).

Key Statistics

The key domain statistics are in the tables below. The number of fatal accidents in 2016 was lower than the average of the preceding decade. In 2016, the number of non-fatal accidents was less than half of the average of the preceding 10-year-period. The number of serious incidents in 2016 was in line with the average of 2006-2015. The number of fatalities in 2016 was slightly lower whilst the number of serious injuries was in line with the average of the previous decade.

Table 2 Key statistics Part Special Operations (SPO) Aerial Work Aeroplanes

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	10.7	37.0	4.8
2016	6	17	5
% difference	-44% ↓	-54% ↓	4% ↑

	Fatalities	Serious Injuries
2006-2015 average	18.6	7.9
2016	12	8
% difference	-35% ↓	+1% ↑

There was quite a considerable reduction in the number of accidents. In particular, the number of fatal accidents reduced to 6, compared with the 10 year average of 9.3.

Figure 12 Part Special Operations (SPO) Aerial Work Aeroplanes fatal and non-fatal accidents 2007-2016

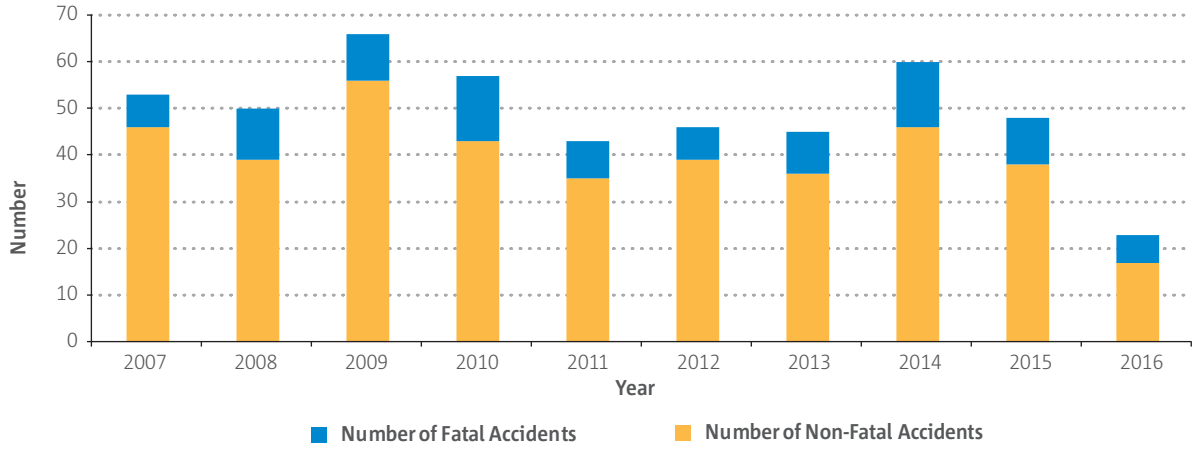


Figure 13 Part Special Operations (SPO) Aerial Work Aeroplanes fatalities and serious injuries 2007-2016

Phase of Flight

With reference to of the phase of flight, the numbers for 2016 were lower across all flight phases in comparison with the 2006-2015 average. Most accidents and serious incidents took place during the take-off phase of flight, which is unusual. Historically, the landing and manoeuvring phases have resulted in more occurrences.

Table 3 Part Special Operations (SPO) Aerial Work Aeroplanes accidents and serious incidents per phase of flight 2006-2015 vs 2016

Phase of Flight	Accidents and Serious Incidents	
	2006-2015 average	2016
Standing	0,7	0
Taxi	2,4	1
Take-off	11,4	8
En route	11,4	6
Manoeuvring	12,3	5
Approach	5,7	3
Landing	13,4	6
Post-impact	0	0
Unknown	0,6	0

Operation Type

In some operation types, namely aerial advertising, aerial observation, aerial patrol, construction/sling load, logging and other, there were no accidents or serious incidents in 2016. For aerial survey, there was one accident and an accident in this domain only occurs on average once every five years. For photography, there was one accident as well, which is just below the average. For the other operation types, the 2016 numbers were lower than the preceding decade average. Both towing and parachute dropping each recorded 7 accidents and serious incidents. For the parachute drop operations, EASA has recently completed an initial analysis that considers the need for future EPAS actions. These actions will shortly be reviewed in a Preliminary Impact Assessment (PIA) for inclusion in the next version of the EPAS.

Table 4 Part Special Operations (SPO) Aerial Work Aeroplanes accidents and serious incidents by operation 2006-2015 vs 2016

Operation Type	Accidents and Serious Incidents	
	2006-2015 average	2016
Aerial Advertising	1,2	0
Aerial Observation	0,3	0
Aerial Patrol	0,2	0
Aerial Survey	0,2	1
Agricultural	4,7	3
Air-show/Race	24,2	8
Parachute drop	8,9	7
Photography	1,2	1
Towing	11,2	7
Construction/Sling load	0	0
Logging	0	0
Other	2,2	0

Safety Risk Portfolio

The safety risk portfolio for Part SPO/aerial work with aeroplanes is shown below.

SPECIALISED OPERATIONS - AEROPLANES

Outcome Percentage of Fatal Accidents (2007-2016)	98				46%	23%	15%	5%	2%	2%	1%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	396				31%	8%	8%	16%	27%	1%	1%

Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)						
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Airborne Collision	Terrain Collision	Obstacle Collision in Flight	Runway Excursion	Unsurvivable Aircraft Environment	Runway Collision
Operational											
Airborne Separation	44	3	9	9		●	●	●			
Intentional Low Flying	5	1	12	6		●	●	●			
Handling of Technical Failures	9	2	8	1	●				●		
Flight Planning and Preparation	54	0	7	1	●	●	●	●	●	●	●
Control of Manual Flight Path	2	0	2	1	●	●	●	●	●		
Crosswind	0	0	2	0	●				●		
Icing in Flight	3	1	1	0	●						
Approach Path Management	1	0	1	0	●		●	●	●		
Bird/ Wildlife Strikes	37	0	0	0	●		●		●	●	
Icing on Ground	0	0	0	0	●						
Indadvertent Parachute Operation	-	-	-	-	●						

SPECIALISED OPERATIONS - AEROPLANES

Outcome Percentage of Fatal Accidents (2007-2016)	98				46%	23%	15%	5%	2%	2%	1%	
Outcome Percentage of Non-Fatal Accidents (2007-2016)	396				31%	8%	8%	16%	27%	1%	1%	
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)							
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Airborne Collision	Terrain Collision	Obstacle Collision in Flight	Runway Excursion	Unsurvivable Aircraft Environment	Runway Collision	
Technical												
System Reliability	366	19	69	18	●	●	●		●	●		
Aircraft Maintenance	20	2	3	1	●	●	●		●	●		
UAS Strikes	0	0	0	0	●	●						
Human												
Decision Making and Planning	4	0	3	4	●	●	●	●	●		●	
Perception and Situational Awareness	13	1	7	3	●	●	●	●	●	●	●	
Experience, Training and Competence of Individuals	3	1	4	3	●	●	●	●	●		●	
CRM and Operational Communication	69	0	0	1	●	●	●	●	●		●	
Knowledge of Aircraft Systems and Procedures	1	0	1	0	●	●	●	●	●		●	
Personal Pressure and Alertness	1	0	0	0	●	●	●	●	●		●	
Organisational												
Development and Application of Regulations and Procedures	0	0	0	0	●	●	●	●	●	●	●	
Effectiveness of Safety Management	-	-	-	-	●	●	●	●	●	●	●	

Priority Key Risk Areas

The safety risk portfolio enables the identification of the priority key risk areas for this domain. These are currently prioritised by considering the percentage involvement in the number of fatal and non-fatal accidents in that order.

 Aircraft Upset	21 Fatal Accidents 123 Non-Fatal Accidents	Aircraft upset or loss of control is the most common accident outcome for fatal accidents in SPO Aeroplane operations. 46% of fatal accidents in the 2007-2016 period can be attributed to aircraft upset.
 Airborne Collision	22 Fatal Accidents 32 Non-Fatal Accidents	Airborne collisions are collisions between aircraft where both (all) aircraft were airborne. In SPO Aeroplane operations, this accounts for 23% of the fatal accidents in the previous 10 years.
 Terrain Collision	15 Fatal Accidents 32 Non-Fatal Accidents	Terrain collision includes collisions with trees, elevated terrain and level terrain/water. 15% of fatal accidents in the past decade are attributed to terrain collision.
 Obstacle Collision	5 Fatal Accidents 63 Non-Fatal Accidents	Obstacle collision in-flight poses a high risk of resulting in a serious accident. Powerline strikes, and collisions with buildings and masts are the most common accidents in this risk area. 5% of fatal SPO Aeroplane accidents during the last 10 years were caused by obstacle collisions during the flight.
 Runway Excursion	2 Fatal Accidents 107 Non-Fatal Accidents	Runway excursions, side excursions as well as overruns, account for 2% of the fatal accidents in SPO Aeroplanes operations in the past decade.
 Fire	2 Fatal Accidents 4 Non-Fatal Accidents	An unsurvivable aircraft environment occurs when in the case of on-board fire or the rupture of a pressurised cabin causing rapid decompression. 2% of the fatal accidents last 10 years can be attributed to this key risk area.
 Runway Collision	1 Fatal Accident 4 Non-Fatal Accidents	Runway collisions encompass all collisions between aircraft and other aircraft, vehicles, persons or other objects whilst the aircraft is on the runway. 1% of the fatal accidents in the past decade in SPO aeroplane operations can be attributed to this key risk area.

Top Safety Issues and Associated Actions

Currently, there is no Aerial Work/Specialised Operations Collaborative Analysis Group. Therefore, the list of safety issues identified in the safety risk portfolio has been established using EASA analysis.

The top safety issues in Part SPO/aerial work operations with aeroplanes are:

Technical Safety Issues:

System Reliability: This safety issue addresses the goal of continually improving system reliability. Key actions here include RMT.0049 on specific risk and standardised criteria for conducting aeroplane-level safety assessments of critical systems, RMT.0217 covering CAMOs' and Part-145 organisations' responsibilities and RMT.0521 aimed at improving the airworthiness review process.

Operational Safety Issues:

Airborne Separation: The safety issue on airborne separation covers the range of issues from airspace design, flight planning, and in-flight situational awareness through to collision warning systems. There are EPAS actions covering this area, which include RMT.0445 on the technical requirements and operating procedures for airspace design, including flight procedure design, RMT.0593 on the technical requirements and operational procedures for the provision of data for airspace users for the purpose of air navigation, and MST.024 on the loss of separation between civil and military aircraft.

Intentional Low Flying: There are operational situations where low flying is required and is performed within the regulatory framework. However, the analysis has shown that further work is needed in this area. Actions include RMT.0371 on TAWS operations in IFR and VFR and TAWS for turbine-powered aeroplanes under 5 700 kg MTOM able to carry six to nine passengers (regularly used in this domain), while RMT.0599 on evidence-based training will also tackle this safety issue.

Handling of Technical Failures: Analysis in the portfolio has identified the safety issue related to the handling of technical failures by flight crew. A key action that supports this area is RMT.0599 on evidence-based training that will enable flight crew to be better prepared to deal with the most common technical failures.

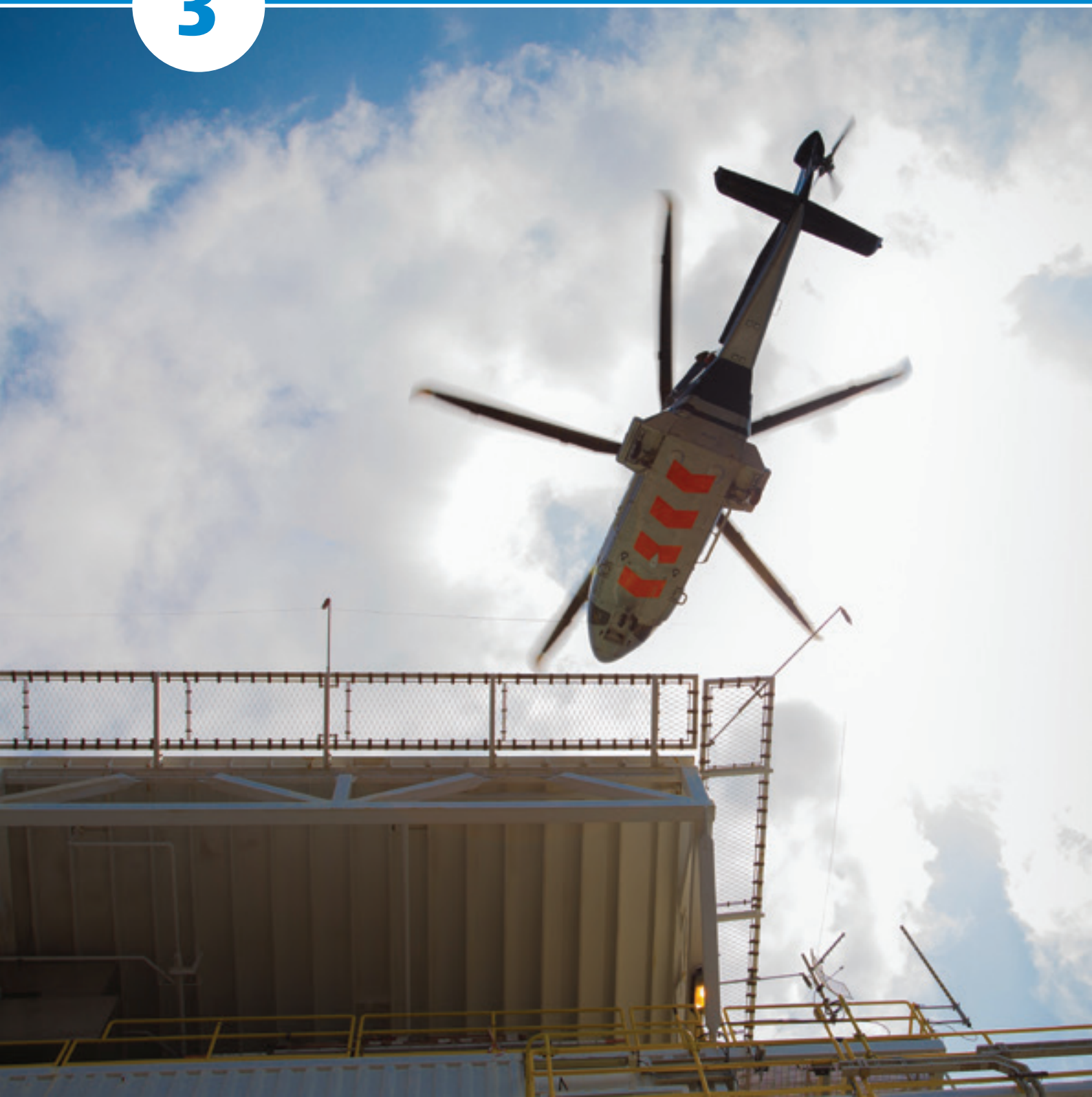
Human Factors Safety Issues:

- Decision making and planning.
- Perception and situational awareness.
- Experience, training and competence of individuals.

As mentioned previously, EASA has also undertaken further analysis of parachuting operations that identified the need for improved processes and procedures by operators as a key safety action. Following the analysis a PIA is underway to assess the impact of proposed actions. This will be completed over the summer for inclusion in the next version of the EPAS.

CAT HELICOPTER OPERATIONS

3



This chapter covers commercial air transport operations involving helicopters and it is split into three different parts in this review. The first of these covers offshore helicopters, in which are provided key statistics, the safety risk portfolio and the key strategic safety priorities at the European level that have been developed with the Offshore Helicopter CAG. The other part of the chapter covers all other CAT helicopter operations. In the next phase of the analysis for the EPAS, a specific safety risk portfolio for helicopter emergency medical services (HEMS) operations will be developed. In these two parts of the chapter the scope is helicopter operations by an EASA MS AOC holder. The third part of the chapter covers part special operations (Part SPO)/aerial work operations involving helicopters of all mass groups with an EASA MS state of registry.

Chapter 3a Offshore Helicopter Operations

Key Statistics

In the offshore helicopter domain, there was one fatal accident, which involved the loss of an Airbus Helicopters EC225 Super Puma in Norway on 29 April 2016. There were also 2 non-fatal accidents and no serious incidents in 2016. Previous to 2016, there have been no fatal or non-fatal accidents since 2013. With this single accident, the numbers of both fatal accidents and non-fatal accidents are higher for 2016 than the 10 year annual average.

Table 5 Key statistics offshore helicopters

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	0.4	0.9	1.4
2016	1	2	0
% difference	150% ↑	120% ↑	↓

	Fatalities	Serious Injuries
2006-2015 average	3	0.6
2016	13	0
% difference	+333% ↑	↓

Figure 14 Offshore fatal and non-fatal accidents 2007-2016

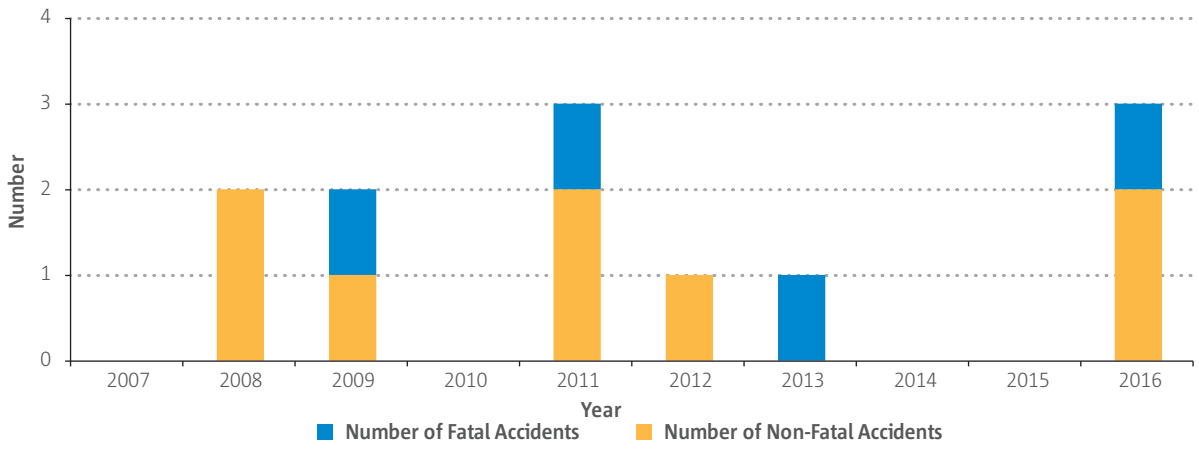
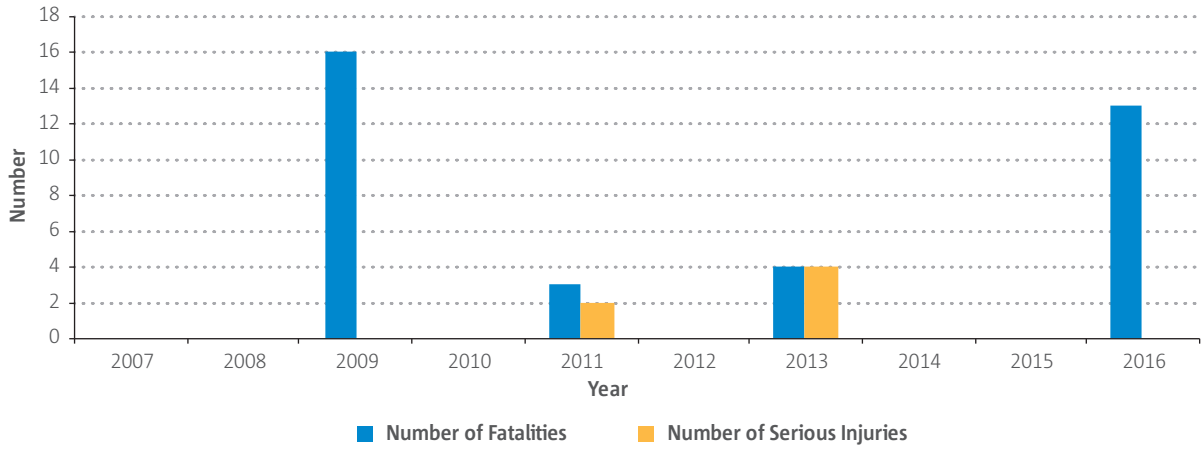


Figure 15 Offshore fatalities and serious injuries 2007-2016



The number of fatalities were higher in 2016 due to the fatal accident in Norway.

Phase of Flight

With reference to the phase of flight, there are no major differences for 2016 compared with previous years. The fatal accident in Norway occurred during the en-route flight phase, while one accident took place while taxiing.

Table 6 Offshore accidents and serious incidents per phase of flight 2006-2015 vs 2016

Phase of Flight	Accidents and Serious Incidents	
	2006-2015 average	2016
Standing	0.1	0
Taxi	0.2	1
Take-off	0.1	0
En route	1	1
Manoeuvring	0	0
Approach	0.3	0
Landing	0.4	0
Post-impact	0	0
Unknown	0.4	0

Safety Risk Portfolio

The safety risk portfolio for offshore helicopter is provided below. The SRP has been developed with the support of the Offshore Helicopter CAG. This group takes its membership from the 3 main NAAs with offshore operations involved (Germany, Norway and the UK), manufacturers (Airbus Helicopters and Leonardo), operators (Heli Offshore, Babcock Mission Critical Services, Bristow, CHC and NHV) and representatives from the oil and gas companies. The offshore helicopter SRP has been used to align the strategic safety priorities of both Heli Offshore and also the Oil and Gas Producers Association (IOGP). Furthermore, with an increase in offshore operations

supporting the renewable energy industry and their operations to offshore windfarms, an additional activity has begun within the CAG to enable the risks of this developing area be considered as early as possible.

OFFSHORE

Outcome Percentage of Fatal Accidents (2007-2016)	4				75%	25%	0%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	8				63%	13%	13%	13%	0%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)				
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Ground Damage	Obstacle Collision in Flight	Unsurvivable Aircraft Environment
Operational									
Flight Planning and Preparation	72	0	0	1	●	●	●	●	●
Control of the Helicopter Flight Path and Use of Automation	2	0	0	1	●	●		●	
Handling of Technical Failures	12	2	1	0	●	●		●	●
Airborne Separation	54	0	0	0		●		●	
Bird/ Wildlife Strikes	44	0	0	0	●				
Icing in Flight	7	0	0	0	●				
Approach Path Management	5	0	0	0	●	●		●	
Helicopter Obstacle See and Avoid	4	0	0	0		●		●	
Degraded Visual Environment	1	0	0	0	●	●	●	●	
Icing on Ground	1	0	0	0	●				
Intentional Low Flying	0	0	0	0	●	●		●	
Management of the Dynamic Landing Environment	0	0	0	0				●	
Management of the Static Landing Environment	0	0	0	0				●	
Use of Operationally Ready Safety Systems for Helicopters	0	0	0	0	●			●	●

OFFSHORE

Outcome Percentage of Fatal Accidents (2007-2016)	4				75%	25%	0%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	8				63%	13%	13%	13%	0%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)				
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Ground Damage	Obstacle Collision in Flight	Unsurvivable Aircraft Environment
Technical									
Diagnosis and Tolerance of System Failures	1 659	5	2	1	●	●	●	●	●
System Reliability	1 659	5	2	1	●	●	●	●	●
Aircraft Maintenance	34	0	0	0	●	●	●	●	●
Airworthiness Management	2	0	0	0	●	●	●	●	●
UAS Strikes	0	0	0	0	●				
Human									
Perception and Situational Awareness	25	1	0	1	●	●	●	●	●
Experience, Training and Competence of Individuals	3	1	0	0	●	●	●	●	●
CRM and Operational Communication	59	0	0	0	●	●	●	●	●
Navigation and Airspace Knowledge	27	0	0	0	●	●	●	●	●
Decision Making and Planning	12	0	0	0	●	●	●	●	●
Personal Pressure and Alertness	1	0	0	0	●	●	●	●	●
Knowledge of Aircraft Systems and Procedures	0	0	0	0	●	●	●	●	●
Organisational									
Effectiveness of Safety Management	0	0	0	0	●	●	●	●	●
Development and Application of Regulations and Procedures	0	0	0	0	●	●	●	●	●

Priority Key Risk Areas

The safety risk portfolio enables the identification of the priority key risk areas for this domain. These are currently prioritised by considering the percentage involvement in the number of fatal and then non-fatal accidents.

 Helicopter Upset	3 Fatal Accidents 5 Non-Fatal Accidents	The key risk area with the highest priority in offshore helicopter operations is aircraft upset or loss of control. Loss of control for offshore helicopters generally falls into two scenarios, technical failure that renders the aircraft uncontrollable or human factors.
 Terrain Collision	1 Fatal Accident 1 Non-Fatal Accident	The other fatal accident involved the key risk area of terrain collision. This makes this the second priority key risk area, although equipment is now fitted to helicopters in this domain that will significantly mitigate the risk of this outcome.
 Ground Damage	0 Fatal Accidents 1 Non-Fatal Accident	The third priority key risk area is ground collisions and other ground damage. Whilst, this was not the outcome in any fatal accidents, other non-fatal accidents fall into this category and these accidents are costly to operators, both financially and in terms of in-service effects.
 Obstacle Collision	0 Fatal Accidents 1 Non-Fatal Accident	Although there were no further key risk areas involved in offshore helicopters accidents, the CAG agreed that the risk of obstacle collision in and around helidecks meant that it should be placed in the priority list. This also includes wrong deck landings.

Top Safety Issues and Associated Actions

The offshore helicopter safety issues have been prioritised on the basis of their involvement in fatal accidents, non-fatal accidents, serious incidents and incidents in that order. The top safety issues for this domain are:

Technical Safety Issues:

Diagnosis and Tolerance of System Failures/ System Reliability: Recent accidents have shown the need for continued efforts related to improving system reliability for offshore helicopters. In addition, the goal is to continually improve the ability to diagnose system failures early. A key action here is RMT.0608, which aims to strengthen the existing CS-29 requirements pertaining to rotor drive system lubrication. Also relevant is RMT.0711, which covers vibration health monitoring and SPT.080 on the implementation of HUMS best practice through the work of Heli Offshore.

Operational Safety Issues:

Flight Planning and Preparation: This safety issue was identified in the safety risk portfolio and there are actions in this regard related to work on evidence-based training to improve the preparation of flight crew for the most relevant operational scenarios.

Control of the Helicopter Flight Path and Use of Automation. Both accidents and serious incidents have resulted from this important safety issue that covers the control by the flight crew of the helicopter flight path and the use of automation. This is partially covered in the longer term by RMT.0713 on the reduction in human-factors-caused rotorcraft accidents that are attributed to the rotorcraft design. There is also work that extends RMT.0599 on evidence-based training to offshore helicopter operations, which will help address this safety issue.

Handling of Technical Failures. This important safety issue was also identified in the safety risk portfolio. The handling of the most common technical failures will also be covered within RMT.0599 mentioned above.

Human Factors Safety Issues:

Perception and Situational Awareness: The most important human factors safety issue is related to perception and situational awareness of flight crew. Actions related training (such as RMT.0599 on EBT) will have a positive effect on this safety issue but further assessment will be carried out within the HF CAG. In addition, the introduction of the Flight Crew Operating Manual (FCOM) being implemented by the manufacturers as part of a Heli Offshore initiative linked to EPAS action SPT.082 will further enable flight crew to improve their situation awareness.

Chapter 3b Other Commercial Air Transport Helicopters

Key Statistics

The key domain statistics for operations involving other commercial air transport - helicopter with an EASA MS AOC holder or an EASA MS State of Registry are in the tables below. This domain mainly covers business aviation and helicopter emergency medical services (HEMS). There was an increase in fatal accidents in 2016 – 1 fatal accident occurred in Slovakia, and 1 in Moldova, which involved an EU operator. Both accidents involved HEMS flights and both had 4 fatalities each. There were also 3 non-fatal accidents, which is lower than the 10-year average. The number of serious incidents was similar to the 10-year average, while fatalities were significantly higher due to the two fatal accidents.

Table 7 Key statistics Other Helicopter Commercial Operations

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	0.9	4.1	0.9
2016	2	3	1
% difference	222% ↑	-27% ↓	11% ↑

	Fatalities	Serious Injuries
2006-2015 average	2.8	2.3
2016	8	0
% difference	285% ↑	↓

Figure 16 Other Helicopter Commercial Operations fatal and non-fatal accidents 2007-2016

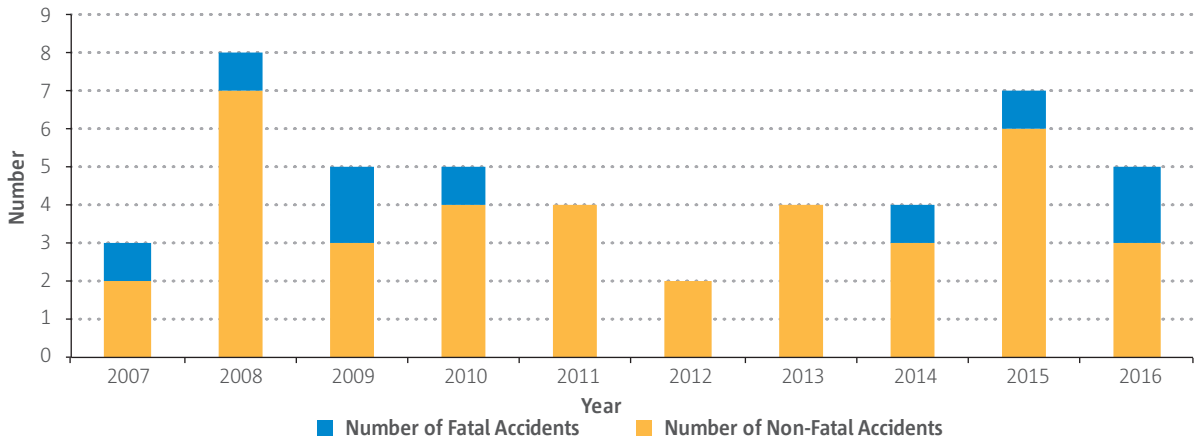
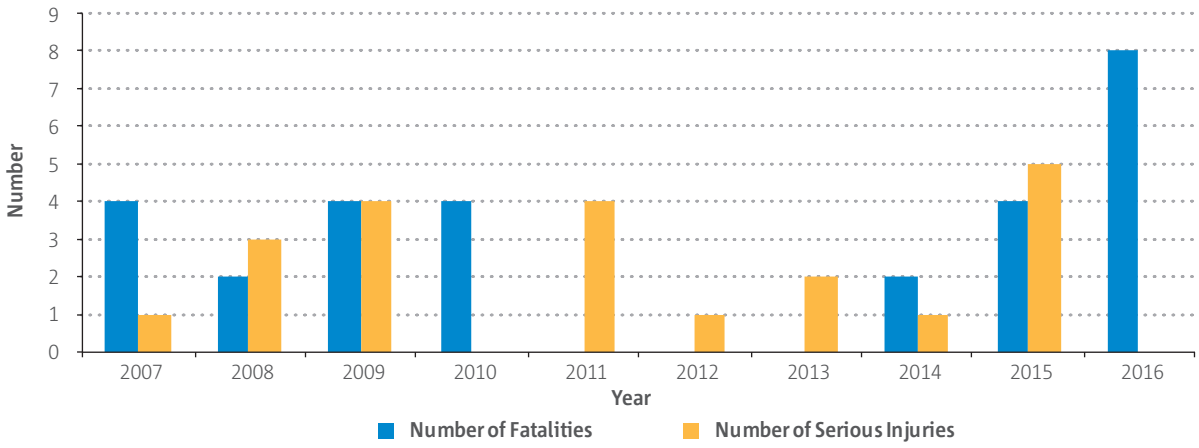


Figure 17 Other Helicopter Commercial Operations fatalities and serious injuries 2007-2016



Phase of flight

En-route and approach were the flight phases with the most accidents and serious incidents in 2016. However, the low numbers in all categories make it difficult to draw conclusions from this part of the data.

Table 8 Offshore accidents and serious incidents per phase of flight 2006-2015 vs 2016

Phase of Flight	Accidents and Serious Incidents	
	2006-2015 average	2016
Standing	0.2	0
Taxi	0.2	0
Take-off	0.4	0
En route	1.8	2
Manoeuvring	0.9	1
Approach	0.6	2
Landing	1.7	1
Post-impact	0	0
Unknown	0.2	0

Safety Risk Portfolio

The safety risk portfolio for other commercial operations with helicopters has been developed using EASA data as no CAG has as yet been established for this domain. It is intended to establish a CAG focussed on HEMS operations in the second half of 2017. This will enable the portfolio to be further improved based on operational experience. With regards to the fatal accident percentages, it should be noted that the existence of accidents still under investigation with unknown causes is the reason why the key risk area identified in the portfolio do not appear to add up to 100%.

OTHER COMMERCIAL HELICOPTERS

Outcome Percentage of Fatal Accidents (2007-2016)	10				40%	40%	0%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	37				59%	11%	22%	11%	5%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue								
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Obstacle Collision in Flight	Runway Excursion	Terrain Collision	Ground Damage
Operational									
Helicopter Obstacle See and Avoid	6	1	4	3		●		●	●
Intentional Low Flying	7	1	5	2		●		●	
Bird/ Wildlife Strikes	98	-	1	-	●				
Approach Path Management	-	-	1	-	●	●	●	●	
Airborne Separation	25	1	-	-		●		●	
Flight Planning and Preparation	30	-	-	-	●	●	●	●	●
Degraded Visual Environment	5	-	-	-	●	●		●	●
Icing in Flight	4	-	-	-	●				
Handling of Technical Failures	2	-	-	-	●	●	●	●	●
Control of the Helicopter Flight Path and Use of Automation	-	-	-	-	●	●		●	
Icing on Ground	-	-	-	-	●				●
Use of Operationally Ready Safety Systems for Helicopters	-	-	-	-					
Management of the Dynamic Landing Environment	-	-	-	-		●			●
Management of the Static Landing Environment	-	-	-	-		●			●

OTHER COMMERCIAL HELICOPTERS

Outcome Percentage of Fatal Accidents (2007-2016)	10				40%	40%	0%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	37				59%	11%	22%	11%	5%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue								
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Obstacle Collision in Flight	Runway Excursion	Terrain Collision	Ground Damage
Technical									
Diagnosis and Tolerance of System Failures	546	2	5	-	●	●	●	●	
System Reliability	546	2	5	-	●	●	●	●	
Aircraft Maintenance	14	-	-	-	●	●	●	●	●
Airworthiness Management	2	-	-	-	●	●	●	●	●
UAS Strikes	-	-	-	-	●				
Human									
Perception and Situational Awareness	9	-	1	1	●	●	●	●	●
CRM and Operational Communication	32	1	1	-	●	●	●	●	●
Experience, Training and Competence of Individuals	2	1	1	-	●	●	●	●	●
Knowledge of Aircraft Systems and Procedures	1	-	1	-	●	●	●	●	●
Navigation and Airspace Knowledge	8	-	-	-		●		●	
Decision Making and Planning	3	-	-	-	●	●	●	●	●
Personal Pressure and Alertness	1	-	-	-	●	●	●	●	●
Organisational									
Development and Application of Regulations and Procedures	-	-	-	-	●	●	●	●	●
Effectiveness of Safety Management	-	-	-	-	●	●	●	●	●

Priority Key Risk Areas

The safety risk portfolio enables the identification of the priority key risk areas for this domain. These risks are currently prioritised by considering the percentage involvement in the number of fatal and then non-fatal accidents in that order.

 Helicopter Upset	4 Fatal Accidents 22 Non-Fatal Accidents	Aircraft upset is the top key risk area: 50% of fatal accidents resulted in this accident outcome.
 Obstacle Collision	4 Fatal Accidents 4 Non-Fatal Accidents	Obstacle collisions is the second most common accident outcome in this domain accounting for 40% of the fatal accidents. This highlights the challenges of HEMS operations and their limited selection and planning for landing sites.
 Landing Area Excursion	0 Fatal Accidents 8 Non-Fatal Accidents	Helicopter landing area excursions was the outcome in 11% of non-fatal accidents. No such occurrences involved fatalities.
 Terrain Collision	1 Fatal Accident 4 Non-Fatal Accidents	Terrain collision includes collisions with trees, elevated terrain and level terrain/water. A total of 10% of fatal accidents in the past decade are attributed to this key risk area.

Top Safety Issues and Associated Actions

For other CAT helicopters, the safety issues have been prioritised on the basis of their involvement in fatal accidents, non-fatal accidents, serious incidents and incidents in that order. The top safety issues for this domain are:

Technical Safety Issues:

Diagnosis and Tolerance of System Failures/ System Reliability: Similar types of helicopter are used in offshore and other CAT helicopters operations so it is no surprise that system failure is also an issue in this domain. The goal is to both improve system reliability and provide support in the earliest possible diagnosis of a system failure. A key action here is RMT.0608, which aims to strengthen the existing CS-29 requirements pertaining to rotor drive system lubrication. Also of relevance is RMT.0711, which covers vibration health monitoring.

Operational Safety Issues:

Helicopter Obstacle See and Avoid: Obstacle collisions are the second most common accident outcome in this domain, making obstacle see and avoid one of the key safety issues. This involves the provision of the best equipment and strategies to help flight crew maintain safe clearance from obstacles during take-off and landing. There are presently no specific actions in this area.

Intentional Low Flying: The safety issue of intentional low flying, is very closely related to the see and avoid safety issue above. In the domain of other CAT helicopter operations, there is routinely a requirement to fly at low altitude (within the regulatory framework) and the analysis identified that a disproportionately high number of occurrences take place in the activity. Further work will be carried out to investigate this in more detail.

Human Factors Safety Issues:

Perception and Situational Awareness: The most important human factors safety issue is related to perception and situational awareness of flight crew. Actions related training will have a positive effect on this safety issue but further assessment will be carried out within the HF CAG.

Chapter 3c Part Special Operations (SPO) – Aerial Work - Helicopters

This chapter covers aerial work and special operations (SPO) involving helicopters of all mass groups having an EASA MS State of Registry. The key statistics and an occurrence data based safety risk portfolio are presented.

Key Statistics

The key domain statistics are in the tables below. There were no fatal accidents in this domain in 2016. The number of non-fatal accidents was lower in 2016 compared with the average of the previous decade. The number of serious incidents in 2016 was slightly higher in 2016 compared with the 2006-2015 average. The number of serious injuries was somewhat lower in 2016 vis-a-vis the average of the preceding 10-year period. When looking at the trend over time in the first graph, it is pleasing to see that the lower numbers of accidents has been sustained for 4 years in a row.

Table 9 Key statistics Part Special Operations (SPO) Aerial Work Helicopters

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	4.1	17.2	1.3
2016	0	13	2
% difference	↓	-24% ↓	53% ↑

	Fatalities	Serious Injuries
2006-2015 average	7.4	6.5
2016	0	5
% difference	↓	-23% ↓

Figure 18 Part Special Operations (SPO) Aerial Work Helicopter accidents and serious incidents by operation 2007-2016

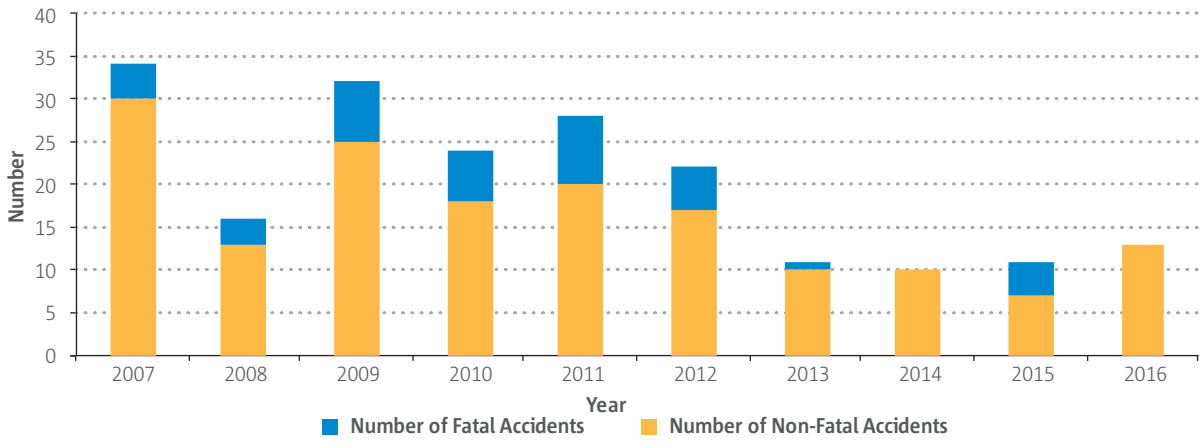
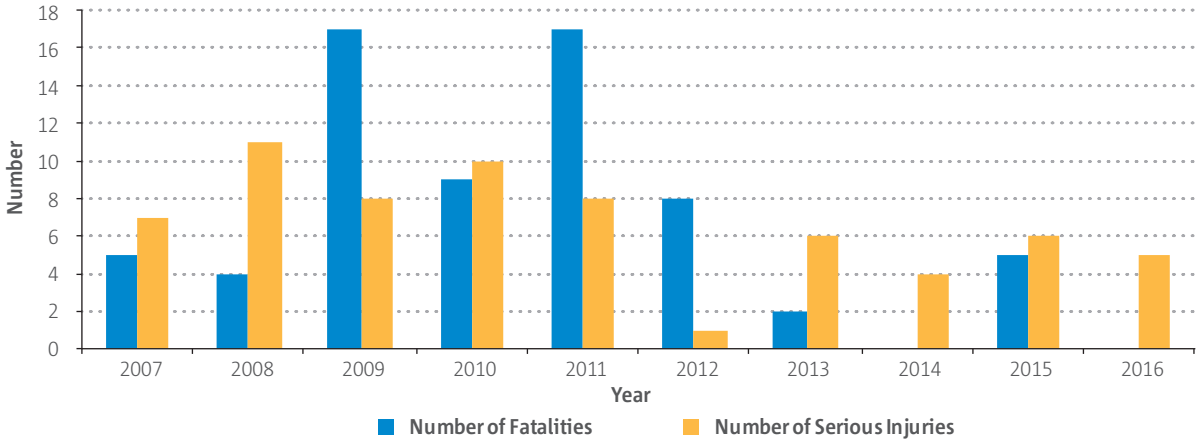


Figure 19 Part Special Operations (SPO) Aerial Work Helicopter fatalities and serious injuries 2007-2016



Phase of Flight

In terms of flight phase, the numbers for 2016 were similar to those for the average of the previous decade. The number of occurrences during take-off was slightly higher than the 10 year average, while for manoeuvring there was a reduction.

Table 10 Part Special Operations (SPO) Aerial Work Helicopters accidents and serious incidents per phase of flight 2006-2015 vs 2016

Phase of Flight	Accidents and Serious Incidents	
	2006-2015 average	2016
Standing	0,5	0
Taxi	0	0
Take-off	3,3	4
En route	3,6	2
Manoeuvring	10	6
Approach	1,2	0
Landing	3,3	3
Post-impact	0	0
Unknown	0,8	0

Operation Type

In some operation types, namely aerial observation, aerial patrol, aerial survey and photography, there were no accidents or serious incidents in 2016. In parachute drop and towing there were more accidents and serious incidents in 2016 compared to the previous decade average. For the remaining operation types the numbers were similar.

Table 11 Part Special Operations (SPO) Aerial Work Helicopters accidents and serious incidents by operation 2006-2015 vs 2016

Operation Type	Accidents and Serious Incidents	
	2006-2015 average	2016
Aerial Advertising	0	0
Aerial Observation	1,2	0
Aerial Patrol	1	0
Aerial Survey	0,7	1
Agricultural	5	3
Airshow/Race	0,4	0
Parachute drop	0	0
Photography	1,7	0
Towing	0,1	0
Construction/Sling load	4,5	4
Logging	1,3	0
Other	3,1	3

Safety Risk Portfolio

The domain safety risk portfolio for Part SPO/aerial work operations with helicopters is provided below.

SPECIALISED OPERATIONS ROTORCRAFT

Outcome Percentage of Fatal Accidents (2007-2016)	38				29%	24%	18%	5%	3%	0%	
Outcome Percentage of Non-Fatal Accidents (2007-2016)	161				25%	35%	7%	3%	12%	1%	
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)						
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Obstacle Collision in Flight	Aircraft Upset	Terrain Collision	Airborne Collision	Runway Excursion	Unsurvivable Aircraft Environment	
Operational											
Intentional Low Flying	131	4	16	6	●		●	●			
Helicopter Obstacle See and Avoid	30	4	11	4	●		●	●			
Flight Planning and Preparation	26	0	3	0	●	●	●	●	●	●	
Handling of Technical Failures	2	0	1	0		●			●		
Bird/ Wildlife Strikes	31	0	0	0		●	●		●	●	
Airborne Separation	27	0	0	0	●			●			
Degraded Visual Environment	2	0	0	0	●	●	●	●	●		
Approach Path Management	1	0	0	0	●	●	●		●		
Control of the Helicopter Flight Path and Use of Automation	0	0	0	0	●	●	●	●	●		
Technical											
System Reliability	377	1	19	2		●	●	●	●	●	
Aircraft Maintenance	36	0	0	0		●	●	●	●	●	
UAS Strikes	0	0	0	0		●		●			
Airworthiness Management	0	0	0	0		●	●	●	●	●	

SPECIALISED OPERATIONS ROTORCRAFT

Outcome Percentage of Fatal Accidents (2007-2016)	38				29%	24%	18%	5%	3%	0%	
Outcome Percentage of Non-Fatal Accidents (2007-2016)	161				25%	35%	7%	3%	12%	1%	
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)						
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Obstacle Collision in Flight	Aircraft Upset	Terrain Collision	Airborne Collision	Runway Excursion	Unsurvivable Aircraft Environment	
Human											
Perception and Situational Awareness	23	2	5	1	●	●	●	●	●	●	
CRM and Operational Communication	48	0	1	0	●	●	●	●	●		
Decision Making and Planning	6	0	1	0	●	●	●	●	●		
Personal Pressure and Alertness	3	0	1	0	●	●	●	●	●		
Experience, Training and Competence of Individuals	3	0	0	0	●	●	●	●	●		
Knowledge of Aircraft Systems and Procedures	2	0	0	0	●	●	●	●	●		
Organisational											
Development and Application of Regulations and Procedures	0	0	0	0	●	●	●	●	●	●	
Effectiveness of Safety Management	-	-	-	-	●	●	●	●	●	●	

Priority Key Risk Areas

The safety risk portfolio enables the identification of the priority key risk areas for this domain. These are currently prioritised by considering the percentage involvement in the number of fatal and non-fatal accidents in that order.

 Obstacle Collision	11 Fatal Accidents 40 Non-Fatal Accidents	Obstacle collisions is the most common accident outcome in this domain with 40% of the fatal accidents. It highlights the challenges of HEMS operations and their limited selection and planning for landing sites.
 Helicopter Upset	9 Fatal Accidents 56 Non-Fatal Accidents	Aircraft upset or loss of control is the second most common accident outcome for fatal accidents in SPO Aeroplane operations. 46% of fatal accidents in the 2007-2016 period can be attributed to aircraft upset.
 Terrain Collision	1 Fatal Accident 5 Non-Fatal Accidents	Terrain collision includes collisions with trees, elevated terrain and level terrain/water. A total of 18% of fatal accidents in the past decade have been attributed to this key risk area.
 Airborne Collision	2 Fatal Accidents 3 Non-Fatal Accidents	Airborne collisions are collisions between aircraft where both (all) aircraft were airborne. In Part SPO helicopter operations, this accounts for 18% of the fatal accidents in the previous 10 years.
 Landing Area Excursion	2 Fatal Accidents 5 Non-Fatal Accidents	Runway excursions, side excursions as well as overruns, account for 2% of the fatal accidents in SPO Aeroplanes operations in the past decade.

Top Safety Issues and Associated Actions

Currently, there is no Aerial Work/Specialised Operations CAG. Therefore, the list of safety issues identified in the safety risk portfolio has been established solely using EASA data.

Technical Safety Issues:

Diagnosis and Tolerance of System Failures/ System Reliability: There is continual work in the design, manufacturing and maintenance regulatory framework to improve system reliability and provide support in the earliest possible diagnosis of a system failure. A key action here is RMT.0608, which aims to strengthen the existing CS-29 requirements pertaining to rotor drive system lubrication. Another related action specifically in the aerial work operations is RMT.0709 related to the prevention of catastrophic accidents due rotorcraft hoists issues.

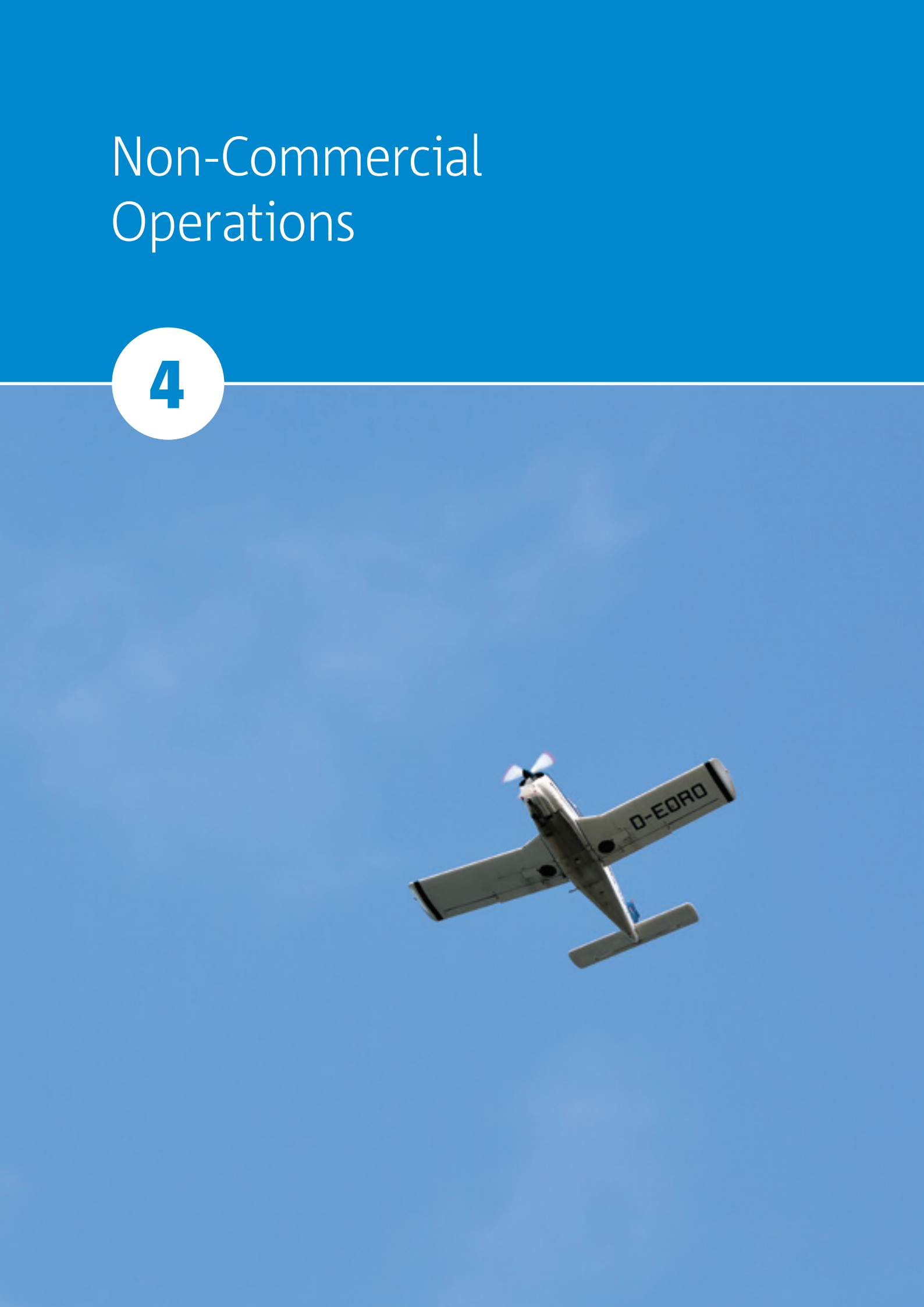
Operational Safety Issues:

Intentional Low Flying: There are many operational situations where low flying is required and is performed within the regulatory framework. However, the analysis has shown that further work is needed in this area. For helicopters, the nature of many aerial work activities make this very specific to each one and the various operating communities will be involved in further analysis and assessment work when it takes place.

Helicopter Obstacle See and Avoid: Obstacle collisions are the most common accident outcome in this domain, making obstacle see and avoid one of the key safety issues. This is very closely link to the previous safety issue on low flying. The work previously described about would likely involve the provision of the best equipment and strategies to help flight crew maintain safe clearance from obstacles during take-off and landing.

Non-Commercial Operations

4



Chapter 4a Non-Commercial Operations – Aeroplanes

This chapter covers general aviation non-commercial operations (GA NCO) involving aeroplanes in mass groups below 5700 kg and having an EASA MS State of Registry. Key statistics and an occurrence data driven safety risk portfolio are presented. The safety risk portfolio is enhanced with expertise from operators, manufacturers, flying clubs/ associations and National Aviation Authorities (NAAs) that support the GA Sectorial Committee and other related advisory bodies. A GA NCO Aeroplane Collaboration and Analysis Group (CAG) has been formally established in May 2017.

Key Statistics

The key domain statistics are in the tables below. There were fewer fatal accidents in 2016 compared to the 10-year average and there was also a significantly lower number of non-fatal accidents. The numbers of fatalities and serious injuries in 2016 were significantly lower than the averages for the preceding decade. In GA NCO aeroplanes, there were 46 fatal accidents, which continues the downward trend from the previous year and is lower than the 10-year average. The number of fatalities has also been significantly reduced (78) compared to the 10-year average.

Table 12 Key statistics Non-commercial operations aeroplanes

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	51.4	388.1	25.9
2016	46	265	36
% difference	-10% ↓	-32% ↓	39% ↑

	Fatalities	Serious Injuries
2006-2015 average	94.4	50.8
2016	78	36
% difference	-17% ↓	-29% ↓

For the first time, the Agency has been able to collect sufficient GA exposure data to create initial accident rates for this domain. The exposure data was collected via a survey of the EASA Member States (MS) and through merging data that was kindly provided by GAMA. The fatal accident rate reduced between 2014 and 2015, however, despite the lower number of accidents the rate increased in 2016. The rate of non-fatal accidents has reduced by over 40% between 2014 and 2016.

Figure 20 Fatal and Non-Fatal Accident Rates for NCO Aeroplanes 2014-2016

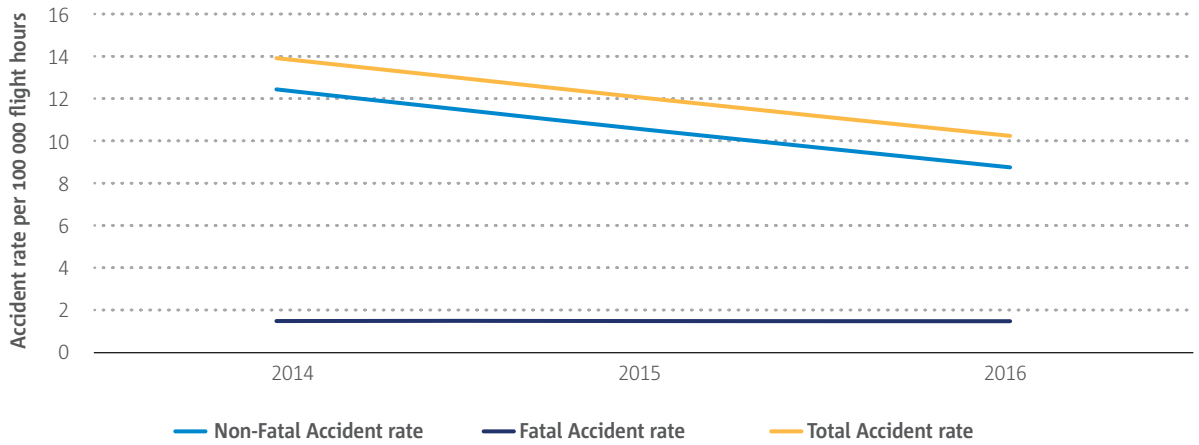


Figure 21 Non-commercial operations aeroplanes fatal and non-fatal accidents 2007-2016

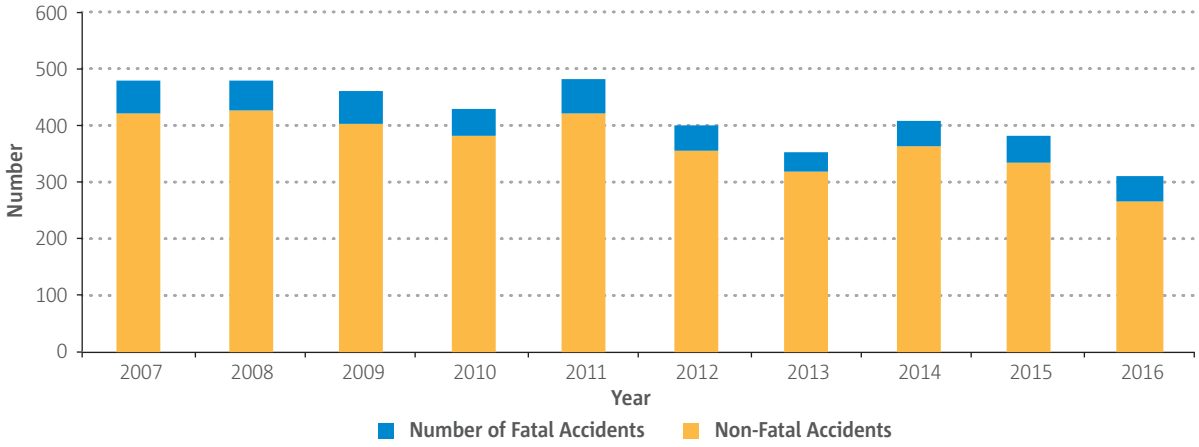
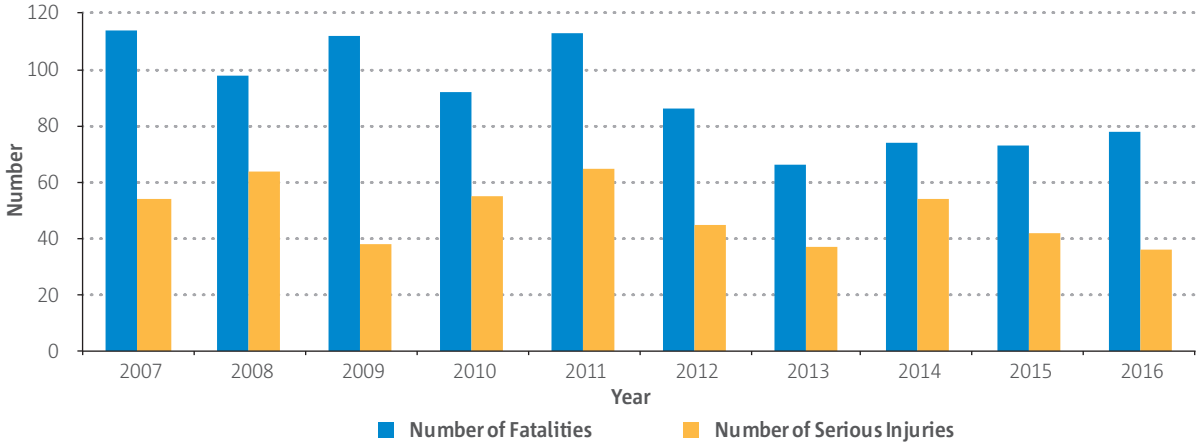


Figure 22 Non-commercial operations fatalities and serious injuries 2007-2016



Phase of Flight

In terms of flight phase, in GA NCO aeroplanes accidents most of the accidents occur during take-off, approach and landing. The largest number of accidents take place during landing, however there were fewer landing accidents in 2016 compared to the 10-year average.

Table 13 Non-commercial operations accidents and serious incidents per phase of flight 2006-2016

Phase of Flight	Accidents and SIs	
	2006-2015 average	2016
Standing	11.8	6
Taxi	27.2	20
Take-off	80.9	61
En route	74.7	55
Manoeuvring	16.1	14
Approach	43.8	27
Landing	206.2	144
Unknown	4.2	20

Operation Type

Most of the accidents in the GA NCO aeroplanes domain occurred during pleasure flights. The next most numerous operation type involves flight training/instructional flights.

Table 14 Non-commercial operations accidents and serious incidents by operation 2006-2016

Operation Type	Accidents and Serious Incidents	
	2006-2015 average	2016
Demonstration	1.1	0
Relocation	4.5	2
Flight Training/Instructional	88.9	54
Pleasure	312.9	163
Test Flight	5.1	3
Other	5.1	3
Unknown	4.4	39

Safety Risk Portfolio

The GA NCO aeroplanes safety risk portfolio is provided below and identifies the key risk areas and safety issues. This portfolio comprises safety issues that have been identified through analysing safety occurrence data. The portfolio has initially been developed by the Agency and then adjusted following discussion at a GA Safety Workshop held in October 2016. This work was further developed in the Network of Analysts. A GA NCO CAG will continue the work and meets for the first time in May 2017.

NON COMMERCIAL OPERATIONS - AEROPLANES

Outcome Percentage of Fatal Accidents (2007-2016)	496				47%	23%	9%	8%	3%	1%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	4 425				24%	5%	7%	3%	47%	2%	4%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)						
	Incidents (ECR data)	Serious Incidents	Non-fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Obstacle Collision in Flight	Airborne Collision	Runway Excursion	Unsurvivable Aircraft Environment	Ground Damage
Operational											
Flight Planning and Preparation	1 988	5	49	18	●	●	●	●	●	●	
Intentional Low Flying	13	1	12	18	●	●	●			●	

NON COMMERCIAL OPERATIONS - AEROPLANES

Outcome Percentage of Fatal Accidents (2007-2016)	496				47%	23%	9%	8%	3%	1%	0%	
Outcome Percentage of Non-Fatal Accidents (2007-2016)	4 425				24%	5%	7%	3%	47%	2%	4%	
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)							
	Incidents (ECR data)	Serious Incidents	Non-fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Obstacle Collision in Flight	Airborne Collision	Runway Excursion	Unsurvivable Aircraft Environment	Ground Damage	
Airborne Separation	347	15	56	10				●				
Handling of Technical Failures	33	4	13	8	●	●	●		●	●		
Icing in Flight	26	2	53	3	●					●		
Bird/ Wildlife Strikes	275	2	18	3			●			●		
Approach Path Management	18	3	37	2	●		●	●	●			
Control of Manual Flight Path	5	-	5	2	●	●	●	●	●	●		
Deconfliction with Aircraft Not Using Transponders	101	3	1	1				●				
Crosswind	23	2	64	-	●				●			
Turbulence	25	-	14	-	●	●	●		●			
Icing on Ground	6	-	2	-	●	●	●			●		
Baggage and Cargo Loading	1	-	-	-	●		●			●		
Technical												
System Reliability	3 497	79	770	58	●	●		●	●	●		
Aircraft Maintenance	84	7	10	2	●				●	●		
UAS Strikes	1	2	-	-	●		●	●		●		
Human												
Perception and Situational Awareness	429	10	104	12	●	●	●	●			●	
Decision Making and Planning	47	3	54	9	●	●	●	●	●		●	

NON COMMERCIAL OPERATIONS - AEROPLANES

Outcome Percentage of Fatal Accidents (2007-2016)	496				47%	23%	9%	8%	3%	1%	0%	
Outcome Percentage of Non-Fatal Accidents (2007-2016)	4 425				24%	5%	7%	3%	47%	2%	4%	
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)							
	Incidents (ECR data)	Serious Incidents	Non-fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Obstacle Collision in Flight	Airborne Collision	Runway Excursion	Unsurvivable Aircraft Environment	Ground Damage	
Experience, Training and Competence of Individuals	45	4	42	6	●		●	●	●			
Navigation and Airspace Knowledge	1 078	8	1	2	●		●	●	●			
Personal Pressure and Alertness	14	3	12	1	●	●	●	●	●	●	●	
CRM and Operational Communication	1 151	3	9	1	●	●	●	●	●	●	●	
Knowledge of Aircraft Systems and Procedures	14	1	8	-	●	●	●	●	●	●	●	
Organisational												
Development and Application of Regulations and Procedures	5	-	-	-	●	●	●	●		●		

Priority Key Risk Areas

 Aircraft Upset	232 Fatal Accidents 1061 Non-Fatal Accidents	At 47%, aircraft upset is the most common type of accident outcome in the last 10 years during non-commercial operations with aeroplanes. Aircraft upset is the area of greatest focus for future work in this domain.
 Terrain Collision	112 Fatal Accidents 202 Non-Fatal Accidents	Terrain Collision was the second most common accident outcome in the last 10 years, accounting for 23% of accidents, and continues to present a significant safety challenge.
 Obstacle Collision	46 Fatal Accidents 320 Non-Fatal Accidents	Obstacle collision in flight is the third most frequent type of accident outcome. It accounts for 9% of all the fatal accidents over the last 10 years.
 Airborne Collision	42 Fatal Accidents 115 Non-Fatal Accidents	The fourth key risk area is airborne collision, which accounts for 8% of all the fatal accident outcomes in the last 10 years.
 Runway Excursion	13 Fatal Accidents 2060 Non-Fatal Accidents	Runway excursion is the fifth most frequent type of fatal accident outcome in the last 10 years, accounting for 3% of all fatal accidents in this domain. This risk area is quite common but carries low number of fatalities.

Top Safety Issues and Associated Actions

The top identified safety issues in the non-commercial operations aeroplanes domain are:

Operational Safety Issues:

Flight Planning and Preparation: This is a safety issue that frequently results in CFIT accidents, particularly when worsening weather leads to the need for in-flight re-planning, which considerably tests a pilot's ability to concurrently fly the aircraft. EPAS action SPT.044, a safety promotion task to improve GA safety in Europe through risk awareness and safety promotion, will have a specific focus on risk awareness to enhance the planning and preparation of the pilot.

Intentional Low Flying: This issue affects the pilot's decision making process. When either through self-made or external pressures, effects such as marginal weather then lead some pilots to try to reach the planned destination instead of waiting for the current weather situation to improve. This safety issue is recurrent in loss of control accidents where stall or spin occurs while flying in low altitudes or entering IMC weather.

Airborne Separation: This safety issue is the 3rd highest when it comes to fatalities over the last 5 years. Preflight planning and knowledge of complex airspace structures are common factors related to this safety issue. In addition, situational awareness and the ability for inexperienced pilots to communicate effectively with ATC have also been identified as causal factors. The EPAS action, SPT.044 will also help to support this safety issue through specific targeting of strategies to prevent mid-air collisions. This action has specifically been chosen as the first collaborative task for the European Safety Promotion Network (SPN).

Handling of Technical Failures: After a technical failure during flight the pilot's workload increases significantly. There is evidence of accidents occurring due to the pilot being too focused on the problem rather than flying the aircraft. This in turn creates situations where the accident outcome becomes significantly worse than it could have been had the technical failure been handled appropriately. SPT.044 will provide the pilot with tools to assess better the encountered risk.

Human Factor Safety Issues

Perception and Situational Awareness: This safety issue is linked to a number of different types of accidents, especially a pilot's awareness of the aircraft's energy state that may lead to a loss of control and also awareness of both the geographical position of the aircraft and its position in relation to other aircraft. Rulemaking task RMT.0677 will enable pilots to have easier access to an IFR rating, which should significantly reduce the risk of unintended flights into clouds and enable private pilots to fly more safely in critical weather. Follow up action SPT.088 involves a safety promotion campaign that promotes instrument flying for GA pilots.

Decision Making and Planning: The decision making and planning process varies between persons. This process feeds directly into the pilot's actions, which then provides the basis for the end result. It is therefore very important that the correct information is available to the pilot when decisions are made so as to facilitate the best possible outcome of any encountered scenario. The safety promotion task SPT.012 promotes the new European provisions on pilot training, while rulemaking task RMT.0581, related to a loss of control prevention and recovery training, will further help the decision making of pilots.

Experience, Training and Competence of Individuals: The final HF priority area is related to the knowledge, training and competency of individuals. Through the analysis of airborne conflict performed by the NoA, the complexity of airspace structures was identified as one example where the complex nature of the aviation system makes things challenging, especially for private pilots. The safety risk assessment in this area will specifically consider ways to provide clear, simple information to help pilots have the right information so as to perform flights as safely as possible. Rulemaking task RMT.0678 is designed to aid pilots in their theoretical aviation knowledge and the previously mentioned task SPT.044 is also important in supporting work on this safety issue. The former task also considers a modular LAPL(A)/(S) training and a review of the mountain rating.

Chapter 4b Non-Commercial Operations – Helicopters

This chapter covers non-commercial operations involving both helicopter and gyrocopters with a maximum take-off weight under 5700 kg where the state of registry was an EASA MS. Key statistics and an occurrence data based safety risk portfolio (SRP) are presented.

Key Statistics

The key domain statistics are in the tables below. There was one less fatal accident in 2016 compared to the 10-year average, but there was a significantly lower number of non-fatal accidents. The numbers of fatalities and serious injuries in 2016 were close to the half of the average for the preceding decade.

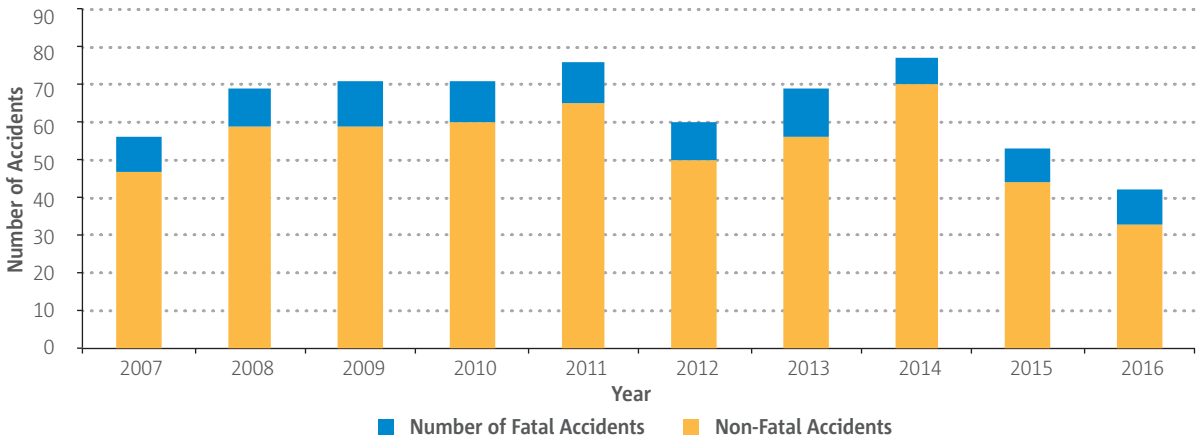
Table 15 Key statistics Non-commercial operations helicopters

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	10	57.0	2.2
2016	9	33	3
% difference	-10% ↓	-42% ↓	36% ↑

	Fatalities	Serious Injuries
2006-2015 average	17.5	9.8
2016	11	6
% difference	-37% ↓	-33% ↓

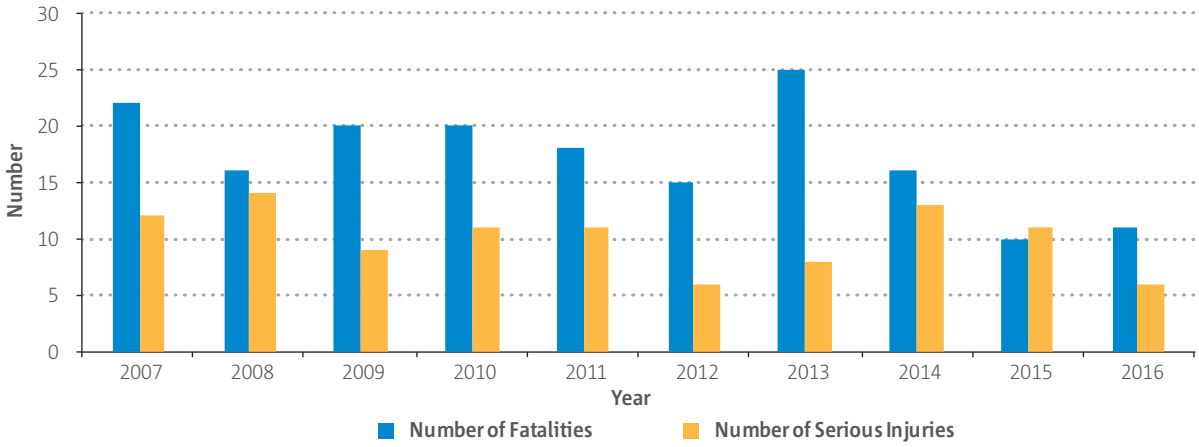
In non-commercial helicopter operations, there were 9 fatal accidents, which is 10% less than the 10-year average. There was also a significant reduction in the number of non-fatal accidents.

Figure 23 Non-commercial operations helicopters fatal and non-fatal accidents 2007-2016



There were 11 fatalities in non-commercial helicopter operations, which was 1 more than in 2015 and is 35% less than the 10-year average.

Figure 24 non-commercial operations helicopters fatalities and serious injuries 2007-2016



Phase of Flight

In terms of flight phase, the number of accidents in 2016 was a marginally lower than the 10-year average. It can be seen that most critical phases of helicopter flights are during the take-off, en-route and landing phases of the flight.

Table 16 non-commercial operations helicopters accidents and serious incidents per phase of flight 2006-2016

Phase of Flight	Accidents and Serious Incidents	
	Number of Accidents and SIs 2006-2015	2016
Standing	2.1	2
Taxi	4.6	2
Take-off	15	8
En route	14.6	11
Manoeuvring	7.9	7
Approach	6.1	3
Landing	17.2	10
Post-impact	0	0
Unknown	2.4	3

Safety Risk Portfolio

The non-commercial helicopters operations safety risk portfolio is provided on the page below, and provides the key risk areas and safety issues. This portfolio has been developed by EASA using safety occurrence data covering accidents and serious incidents that has been reported to the Agency.

NON COMMERCIAL OPERATIONS - ROTORCRAFT

Outcome Percentage of Fatal Accidents (2007-2016)	102				48%	14%	8%	7%	1%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	543				38%	7%	8%	3%	1%	28%	2%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)						
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Obstacle Collision in Flight	Airborne Collision	Unsurvivable Aircraft Environment	Runway Excursion	Ground Damage
Operational											
Helicopter Obstacle See and Avoid	7	1	28	10	●	●	●	●			●
Intentional Low Flying	13	-	14	8	●	●	●	●			●
Flight Planning and Preparation	229	-	3	3	●	●	●	●		●	●
Handling of Technical Failures	10	1	18	2	●	●			●	●	
Control of the Helicopter Flight Path and Use of Automation	-	-	8	2	●	●	●	●		●	●
Approach Path Management	22	2	2	-	●	●	●	●		●	
Bird/ Wildlife Strikes	22	1	2	-	●		●	●			
Airborne Separation	18	1	1	-	●	●		●			
Technical											
System Reliability	509	6	79	17	●	●	●	●	●		
Aircraft Maintenance	28	1	3	-	●	●	●	●	●		
UAS Strikes	-	-	-	-	●		●	●			
Airworthiness Management	-	-	-	-	●				●		

NON COMMERCIAL OPERATIONS - ROTORCRAFT

Outcome Percentage of Fatal Accidents (2007-2016)	102				48%	14%	8%	7%	1%	0%	0%	
Outcome Percentage of Non-Fatal Accidents (2007-2016)	543				38%	7%	8%	3%	1%	28%	2%	
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)							
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Obstacle Collision in Flight	Airborne Collision	Unsurvivable Aircraft Environment	Runway Excursion	Ground Damage	
Human												
Perception and Situational Awareness	55	1	7	3	●	●	●	●		●	●	
Personal Pressure and Alertness	-	-	1	3	●	●	●	●		●	●	
Experience, Training and Competence of Individuals	8	-	8	2	●	●	●	●	●		●	
Decision Making and Planning	17	-	5	1	●	●	●	●		●	●	
CRM and Operational Communication	115	-	-	1	●	●		●	●	●	●	
Knowledge of Aircraft Systems and Procedures	2	-	1	-	●	●		●	●	●	●	
Navigation and Airspace Knowledge	112	-	-	-	●	●	●	●				
Organisational												
Development and Application of Regulations and Procedures	1	-	-	-	●		●	●				

Priority Key Risk Areas

 Helicopter Upset	49 Fatal Accidents 204 Non-Fatal Accidents	At 48%, aircraft upset is the most common type of accident outcome for non-commercial operations with helicopters.
 Terrain Collision	14 Fatal Accidents 37 Non-Fatal Accidents	Terrain Collision is the second most significant type of fatal accident in the last 10 years and occurred in 14% of fatal accidents.
 Obstacle Collision	8 Fatal Accidents 46 Non-Fatal Accidents	The third key risk area addresses obstacle collisions during flight. 8% of all fatal accidents last 10 years are attributed to obstacle collisions.
 Airborne Collision	7 Fatal Accidents 16 Non-Fatal Accidents	The fourth key risk area is airborne collision. Of all fatal accidents over the last 10 years, 7% of them can be attributed to airborne collision.

Top Safety Issues and Associated Actions

Operational Safety Issues:

Helicopter Obstacle See and Avoid: This safety issue is the most common cause of helicopter accidents as it touches on all of the four key risk areas mentioned above. EPAS action SPT.044, a safety promotion task to improve GA safety in Europe, will focus on this and some of the other issues in work it covers on GA NCO helicopter operations.

Intentional Low Flying: The nature of NCO helicopter operations includes quite a lot of low flying. This relates to the safety issue above as well as the perception and situational awareness issue mentioned below. The risk of low flying does not only contains the risk of collisions but also less response time in case of technical failures.

Handling of Technical Failures: This safety issue has to do with flying the aircraft in spite of technical failures. During technical failures the pilot's workload increases and it is therefore of paramount importance that the pilot puts his focus on flying the aircraft first and then address the technical issues.

Control of the Helicopter Flight Path and Use of Automation: This safety issue addresses the pilot's control of the helicopter flight path. This infers planning issues as well as ability/inability of the pilot to properly control the aircraft due to various reasons.

Human Factors Safety Issues:

Perception and Situational Awareness: This safety issue is a common cause of helicopter accidents and it complements all of the operational safety issues mentioned above. As helicopters land in a tighter area than fixed wing aircraft, the landing process requires even higher level of awareness than in conventional landing as the pilot has to consider the area behind him and to both sides while performing his landing.

Personal Pressure and Alertness: Working under high pressure can result in missing important information related to the current situation. This safety issue also relates to the level of a pilot's alertness at the time of the occurrence.

Balloons

5

This chapter covers balloon operations where the state of registry was an EASA MS. For this chapter minimal incident data is available from the European Central Repository (ECR) so this has not been included in the safety risk portfolio. The Balloon Collaborative Analysis Group (BCAG) was one of the first CAGs to be established by the Agency. The group has reviewed all the fatal accidents and sufficiently sampled the non-fatal accidents data for the last five years. The BCAG comprises members from industry, manufacturer and NAAs providing an excellent source of expert knowledge. The identified safety issues in relation to the available data give a realistic picture of safety within the hot air balloon operations. The future work of the CAG will be to risk assess the balloon accidents and further support the EASA's SRM process.

Key Statistics

The key domain statistics are in the tables below. The balloon domain has a very small number of occurrences and this affects statistical analysis. A typically used 10-year data range was not possible as reliable balloon accident data has only been available since 2011. A 5-year average is therefore used in this section. In 2016 there was 1 fatal accident in balloon operations, leading to 1 fatality, both figures being lower than the 5-year average. There was an increase in the number of non-fatal accidents compared to 2015 and the number of serious injuries decreased significantly compared to the 5-year average.

Table 17 Key statistics Balloons

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2011-2015 average	2.2	20.2	2
2016	1	11	4
% difference	-55% ↓	-45% ↓	100% ↑

	Fatalities	Serious Injuries
2011-2015 average	4	24
2016	1	9
% difference	-75% ↓	-62% ↓

There was 1 fatal balloon accident in 2016, compared with 2 in 2015 and 2014. The number of non-fatal accidents increased in 2016 compared with 2015 but there is a significant decrease in non-fatal accidents compared with the 5 year average.

Figure 25 Balloons fatal and non-fatal accidents 2012-2016

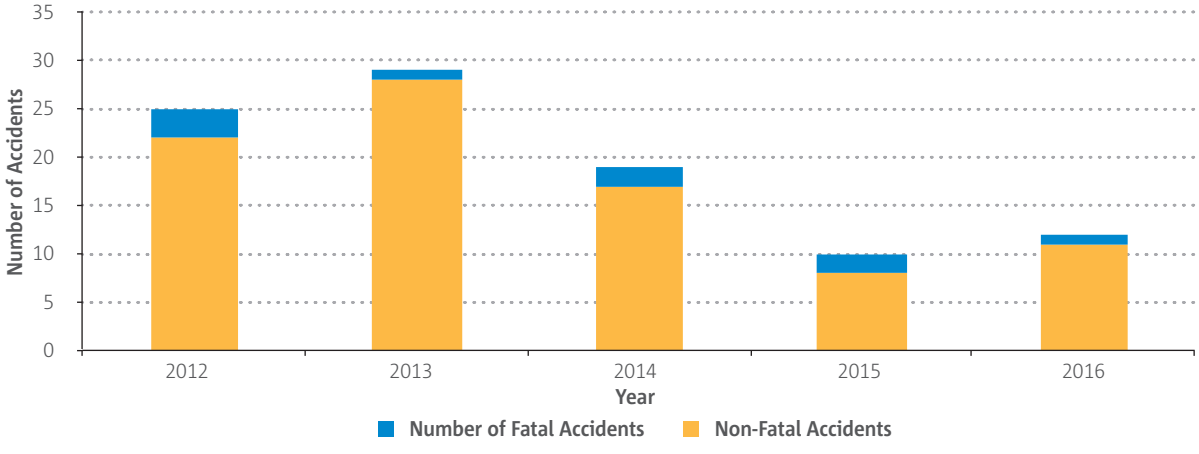
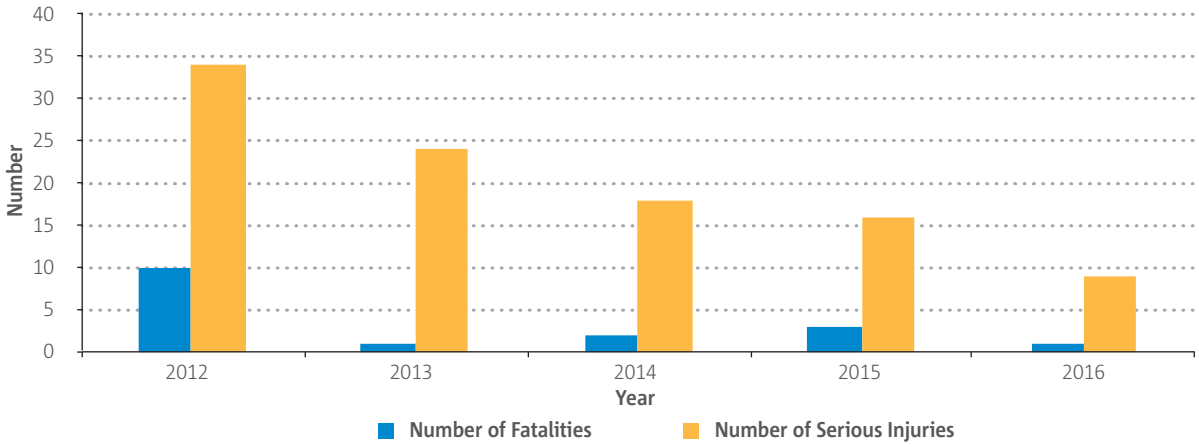


Figure 26 Balloons fatalities and serious injuries 2012-2016



Phase of Flight

In terms of flight phase, the numbers for 2016 were similar to those for the average of the previous 5 years.

Table 18 Balloons accidents and serious incidents per phase of flight 2011-2016

Phase of Flight	Accidents and SIs	
	2011-2015 average	2016
Standing	1	2
Taxi	0	0
Take-off	1.6	2
En route	2.2	1
Manoeuvring	0.4	0
Approach	2	2
Landing	17	8
Post-impact	0	0
Unknown	0	0

Safety Risk Portfolio

The balloon operations safety risk portfolio is provided on the next page, which gives the key risk areas and safety issues. This portfolio has been developed using EASA data and enhanced as a result of work by the BCAG.

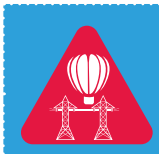
BALLOONS

Outcome Percentage of Fatal Accidents (2007-2016)	12				33%	25%	17%	8%	8%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	185				34%	22%	5%	7%	2%	3%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)					
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Hard Landing	Obstacle Collision in Flight	Terrain Collision	Balloon Control and Upset	Balloon Fire	Airborne Collision
Operational										
Presence and Use of Pilot Restraints	1	1	6	4	●	●	●	●	●	●
Control of Manual Flight Path	6	-	8	3	●	●	●	●		●
Flight Planning and Preparation	16	-	12	-	●	●	●	●	●	●
Airborne Separation	10	1	1	-		●	●	●		●
Approach Path Management	-	-	-	-	●	●	●			
Technical										
Fuel Systems	2	1	-	1				●	●	
Exterior Colour Schemes and Markings	-	-	-	-						●

BALLOONS

Outcome Percentage of Fatal Accidents (2007-2016)	12				33%	25%	17%	8%	8%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	185				34%	22%	5%	7%	2%	3%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)					
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Hard Landing	Obstacle Collision in Flight	Terrain Collision	Balloon Control and Upset	Balloon Fire	Airborne Collision
Human										
Decision Making and Planning	2	-	4	3	●	●	●		●	
Perception and Situational Awareness	9	1	5	1	●	●	●	●	●	●
Experience, Training and Competence of Individuals	-	-	1	-	●	●	●	●	●	●
Knowledge of Aircraft Systems and Procedures	-	-	1	-	●		●	●	●	
CRM and Operational Communication	17	-	-	-	●		●		●	●
Personal Pressure and Alertness	-	-	-	-	●	●	●	●	●	●
Organisational										
Passenger Safety Briefing	-	-	4	1	●	●	●	●	●	●
Development and Application of Regulations and Procedures	-	-	-	-	●	●	●	●	●	●
Effectiveness of Safety Management	-	-	-	-	●	●	●	●	●	●

Priority Key Risk Areas

 Hard Landings	4 Fatal Accidents 62 Non-Fatal Accidents	Abnormal landings or hard landings are the most common cause for balloon accidents. It rare that the balloon gets damaged during these landings but the hard landings have been causing injuries to persons on board or they are ejected from the basket. Broken or fractured feet and hands are the most common injuries. 33% of the fatal accidents for the last 10 years can be attributed to these hard landings.
 Obstacle Collision	3 Fatal Accidents 40 Non-Fatal Accidents	Obstacle collision in flight poses a high risk of a serious accident. Powerline strikes, collisions with buildings and masts are the most common accidents in this risk area. Powerline strikes can cause fire and electrical shock to persons on board the balloon. 25% of fatal balloon accidents for the last 10 years are caused by obstacle collision during the flight.
 Terrain Collision	2 Fatal Accidents 9 Non-Fatal Accidents	Terrain collision includes collisions with trees, elevated terrain and level terrain/water. 17% of fatal balloon accidents are attributed to terrain collision.
 Balloon Upset	1 Fatal Accident 13 Non-Fatal Accidents	Aircraft upset or loss of control is not very common in Ballooning but does happen. 8% of fatal accidents last 10 years can be attributed to loss of control. This involves pilots being ejected from the basket during the take-off or landing phases of flight.
 Fire	1 Fatal Accident 4 Non-Fatal Accidents	An unsurvivable Aircraft Environment happens in case of on board fire or the rupture of the envelope. 8% of the fatal accidents last 10 years can be attributed to this key risk area.

Top Safety issues and associated actions

Operational Safety Issues:

Presence and Use of Pilot Restraints: When looking at the accidents during the last 5 years it can be seen that in 6 non-fatal balloon accidents and 4 fatal accidents the pilot had been ejected during either take-off or landing. It has been proven to be beneficial to have a harness on board the balloon to protect the pilot from being ejected during the balloon operation. While there are no specific EPAS actions with regards to the use of harnesses, there has been coordinated work at national level through NAAs and balloon clubs.

Control of Manual Flight Path: The control of the manual flight path includes the pilot's understanding of the Balloon inertia and balloon physics. The inertia changes with balloon size and the pilot's actions need to reflect that to correctly control the flight path.

Human Factor Safety Issues

Decision Making and Planning: The pilot's decisions and planning are of paramount importance when it comes to the safe operation of the balloon. This includes both the decision to take-off and also to land. In the last 5 years 3 fatal and 4 non-fatal accidents have been attributed to decision making and planning as one of the causal factors.

Perception and Situational Awareness: This safety issue is very important when it comes to balloon flights. Often these flights are made just over the tree tops and the corn fields. If the sun is low it can be impossible to see powerlines. As powerline strikes are the most common of the obstacle collision accidents the pilots should engage the passengers to help him avoid such collisions and that way increase his perception and situational awareness.

Passenger Safety Briefing: It has been identified that a good passenger briefing is essential to ensure a safe flight. Such briefing helps passengers to stay within the safety lines and to engage in the flight in the safest way possible.

Gliders/Sailplanes

6

This chapter covers glider/sailplane operations where the state of registry is an EASA MS.

Key Statistics

The key domain statistics are in the tables below. For gliders, there was a reduction in the numbers of fatal accidents and fatalities in 2016 with 19 fatal accidents and 20 fatalities. The number of non-fatal accidents was lower than the 10-year average with 168. There was a slight decrease in the number of serious injuries to 33.

Table 19 Key statistics Glider/Sailplanes

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	26.5	168	4.6
2016	19	148	6
% difference	-28% ↓	-12% ↓	30% ↑

	Fatalities	Serious Injuries
2006-2015 average	31.1	35.0
2016	20	33
% difference	-36% ↓	-6% ↓

There were 20 fatalities in gliders/sailplanes operations in 2016. This the lowest result since the data collection for these operations began. The graph shows a downward trend in number of fatalities from 2007 to 2016. However, the number of serious injuries is increasing.

Figure 27 Glider/Sailplane fatal and non-fatal accidents 2007-2016

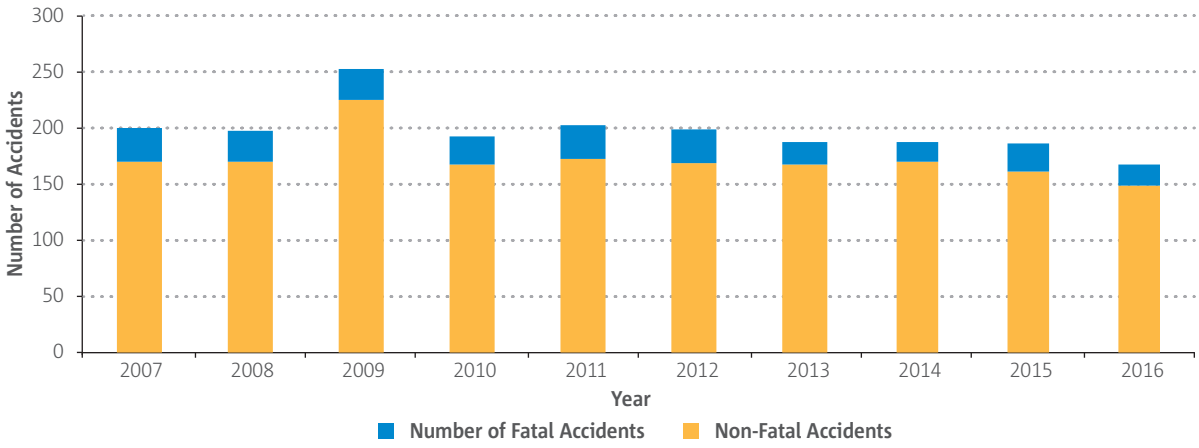
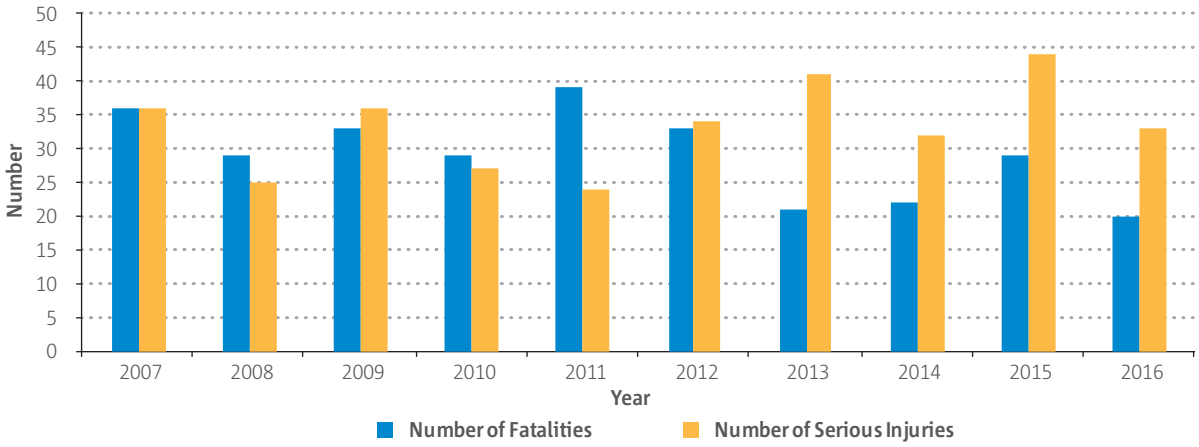


Figure 28 Glider/Sailplane fatalities and serious injuries 2007-2016



Phase of Flight

In terms of flight phase, the majority of the glider/sailplane accidents occur during take-off or landing. Accidents during take-off may be attributed to a wing touching ground during a winch launch and during landing it is mostly attributed to situational perception resulting in hard landings and/or ground loops.

Table 20 Sailplane accidents and serious incidents per phase of flight 2006-2016

Phase of Flight	Accidents and SIs	
	2006-2015 average	2016
Standing	2.5	1
Taxi	3.9	3
Take-off	44.4	36
En route	33.3	28
Manoeuvring	15.8	10
Approach	30.1	14
Landing	96.9	96
Post-impact	0.2	0
Unknown	3	4

Safety Risk Portfolio

The glider/sailplane operations safety risk portfolio provides the key risk areas and safety issues in this domain.

SAILPLANES/GLIDERS

Outcome Percentage of Fatal Accidents (2007-2016)	251				50%	12%	8%	4%	3%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	1 973				15%	14%	3%	42%	15%	2%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)					
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Airborne Collision	Runway Excursion	Obstacle Collision in Flight	Ground Damage
Operational										
Intentional Low Flying	2	1	11	6	●	●			●	
Tow Rope Disconnects and Cable Failures	5	-	22	5	●			●	●	
Airborne Separation	17	2	14	4	●		●			
Handling of Off-Field/Forced Landings	-	-	14	3	●	●		●	●	●
Handling of Technical Failures	3	2	11	3	●	●			●	
Control of Manual Flight Path	-	-	15	1	●	●	●	●	●	●
Approach Path Management	2	-	13	-	●	●		●	●	
Flight Planning and Preparation	62	-	8	-	●	●	●		●	●
Bird/Wildlife Strikes	3	-	2	-	●		●		●	
Technical										
Aircraft Maintenance	3	1	3	-	●			●		

SAILPLANES/GLIDERS

Outcome Percentage of Fatal Accidents (2007-2016)	251				50%	12%	8%	4%	3%	0%	
Outcome Percentage of Non-Fatal Accidents (2007-2016)	1 973				15%	14%	3%	42%	15%	2%	
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)						
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Terrain Collision	Airborne Collision	Runway Excursion	Obstacle Collision in Flight	Ground Damage	
Human											
Perception and Situational Awareness	40	1	27	4	●	●	●	●	●	●	
Decision Making and Planning	2	-	18	4	●	●	●	●	●	●	
Experience, Training and Competence of Individuals	2	-	16	1	●	●	●	●	●	●	
Organisational											
Development and Application of Regulations and Procedures	2	-	-	-	●	●	●	●	●	●	

Priority Key Risk Areas

 Aircraft Upset	125 Fatal Accidents 296 Non-Fatal Accidents	Aircraft Upset is the top key risk area responsible for 50% of all fatal accidents in the last 10 years. It addresses all of the operational and human factor safety issues.
 Terrain Collision	30 Fatal Accidents 276 Non-Fatal Accidents	The second key risk area of terrain collision accounts for 12% of fatal accidents over the last 10 years. These accidents include safety issues such as handling off-field landings, intentional low flying, control of manual flight path as well as approach path management and flight planning. Perception and decision making are the main human factor issues.
 Airborne Collision	20 Fatal Accidents 59 Non-Fatal Accidents	The 3rd key risk area is Airborne Collision. The collision risk is significantly higher in gliding as often there are many sailplanes searching for lift in the same area – even climbing together under the same cloud with very little space between them. There is also significant risk where powered aircraft and gliders are in the same area and efforts to communicate the position has not been successful. 8% of fatal accidents last 10 years are attributed to airborne collision.
 Runway Excursion	10 Fatal Accidents 829 Non-Fatal Accidents	In Sailplane operations an Off-field Landing is considered to be a perfectly normal way to end a flight. It bares with it higher risk which is for the most part accepted by the community. However, the outliers are when a landing occurs after failed take-off, technical failures or approach management and the aircraft needs to land in an area that is not suitable for sailplane landing causing damage or even injuries. 4% of fatal accidents last 10 years are attributed to such failed landings.
 Obstacle Collision	8 Fatal Accidents 303 Non-Fatal Accidents	The last mentioned key risk area is Obstacle Collision in Flight. 3% of fatal accidents last 10 years have been attributed to this risk area. The main issues have to do with the approach and landing phases of the flight. What differentiates gliding from other types of flying is that sailplanes do not have the same opportunity to avoid obstacles on the ground as they do not have any powerplant to abort or to adjust the flight to the landing area. Many of the accidents have to do with collisions with trees, bushes, fences, tall vegetation during the landing phase, causing substantial damage to the sailplane.

Top Safety Issues and Associated Actions

Operational Safety Issues

Intentional Low Flying: This safety issue relates to 3 of the key risk areas; aircraft upset, terrain collision and obstacle collision in flight. As with many of the safety issues SPT.044, a safety promotion task to improve GA safety in Europe will be also relevant to this safety issue. In the gliding domain, there will be close collaboration between EASA, the European Gliding Union (EGU) and national associations.

Tow Rope Disconnects and Cable Failures: Various key risk areas are related to this safety issue including aircraft upset, runway excursions and obstacle collision in flight.

Airborne Separation – In sailplane operations the separation between aircraft is not always easy to achieve. The perception and situational awareness training is therefore important to mitigate occurrences involving this safety issue.

RPAS/UAS/Drones

7

This chapter covers Unmanned Aircraft Systems (UAS) Operations, otherwise known as Remotely Piloted Aviation Systems (RPAS) and as drones, which occurred in EASA Member States. EASA continues to work in great depth on various aspects of UAS operations. The number of drones within the EU has multiplied over the last 2 years. EASA has already introduced a technical opinion to initiate the definition of the regulatory framework required at EU level. Most of the occurrences in this UAS analysis were related to either airspace infringements that occasionally lead to a near collision with an aircraft or issues with controlling the RPAS's flight path.

Key Statistics

Analysis of UAS occurrences in the European Central Repository (ECR) alone identified 606 occurrences of all severity levels for the last 5 years, of which 37 had been classified as accidents. None of the accidents involved fatalities. The collection of data on UAS occurrences is still in its infancy and there is still a lot of work to be done to ensure the correct application of taxonomy terminology related to UAS. The application of the definition of accident in relation to UAS has improved since new definitions were provided in ICAO Annex 13. However the increase in the number of non-fatal accidents and serious incidents demonstrates mainly the rapid development of drone operations.

Table 21 Key statistics UAS from ECR occurrence database

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2011-2015 average	0	2.6	0.3
2016	0	15	7
% difference	=	470% ↑	2230% ↑

	Fatalities	Serious Injuries
2011-2015 average	0	0
2016	0	0

Figure 29 below shows the development of reported UAS occurrences for the last 5 years. The dataset is combined with the ECR and data reported to EASA from several European operators flying to and from the United Kingdom. This figure therefore provides an indication of the situation. These occurrences, observations and sightings come mostly from pilots flying commercial aircraft. So far it is rare to receive a report from UAS pilots regarding occurrences they encounter.

Figure 29 UAS reported occurrences per year 2012-2016

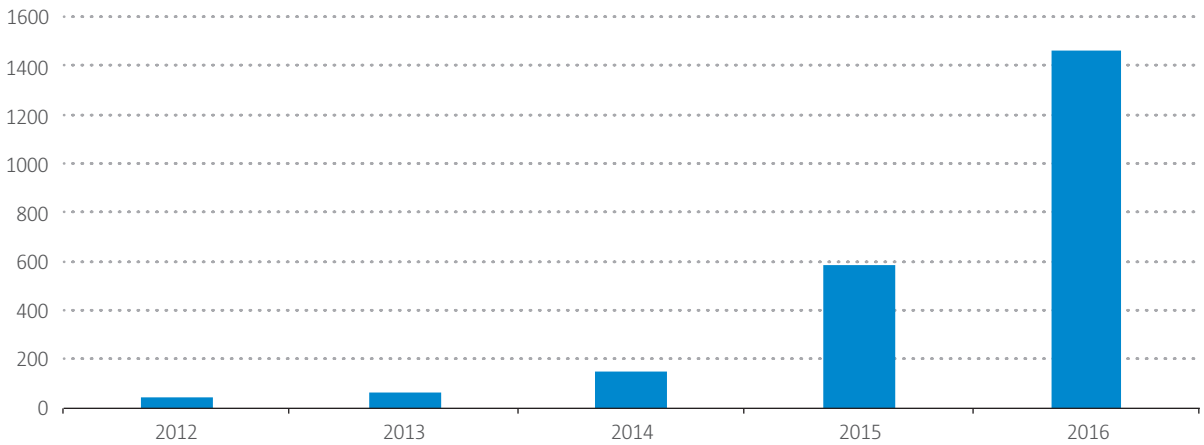
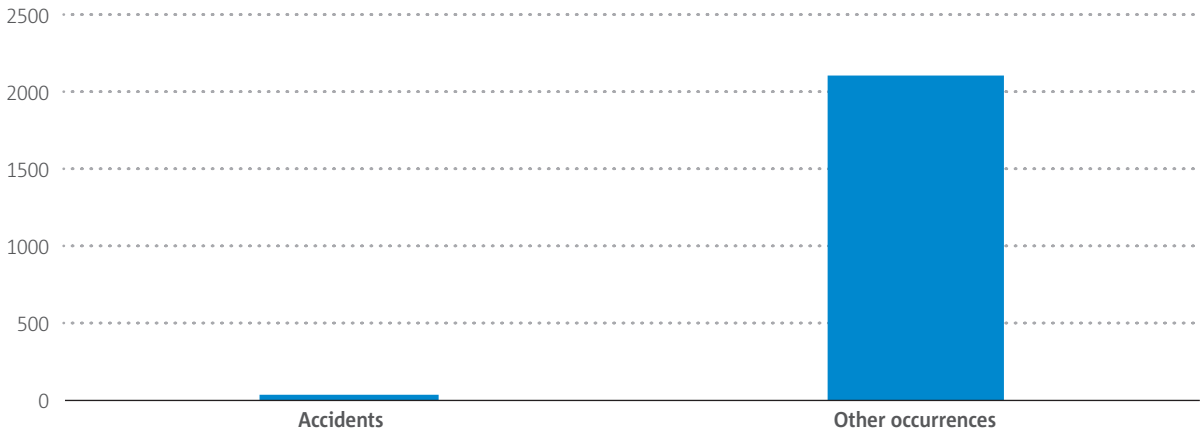
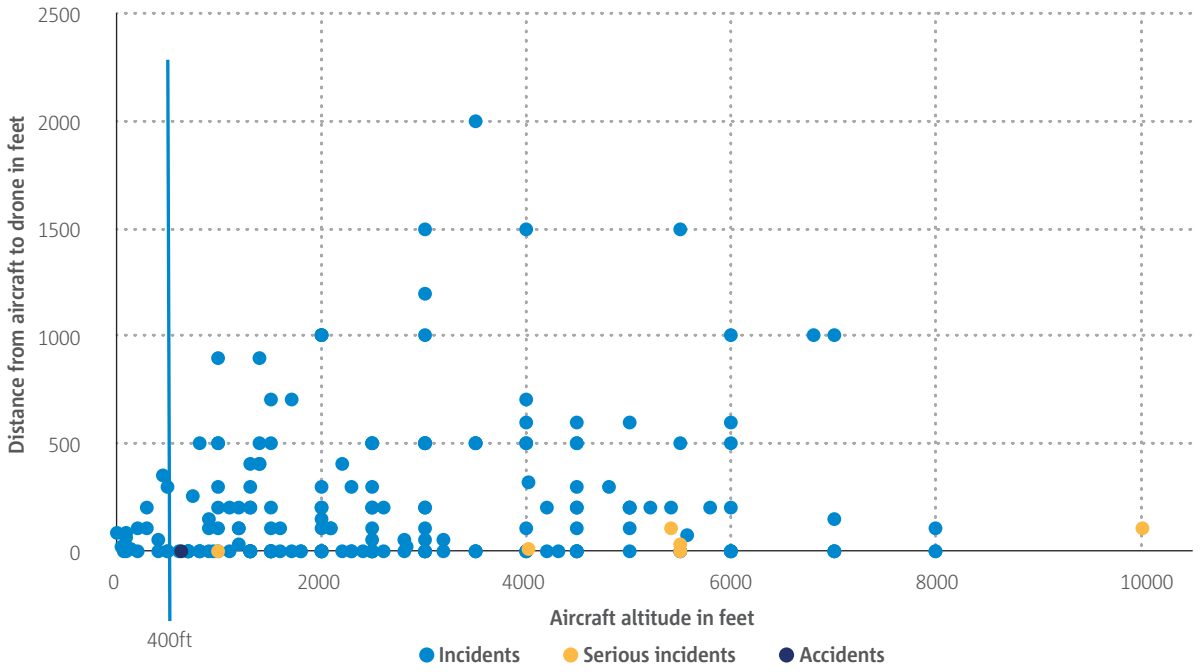


Figure 30 UAS accidents and other occurrences - Source ECR 2012-2016



Based on the available data containing altitude information (Figure 31) it can be seen that when the drones are spotted the manned aircraft is most often in the area from 0-6000 feet above the ground and the distance from the aircraft to the drone is from 0-1000 feet.

Figure 31 Aircraft altitude vs. distance from drone at the time of detection 2010-2016



Safety Risk Portfolio

This second version of the UAS Safety Risk Portfolio is shown below, which provides the full picture of the key risk areas and safety issues. Further analysis is ongoing with the NoA and the CAT Aeroplanes CAG as part of an EASA task force created to assess the risk of collision between drones and aircraft. The task force:

- Reviewed all relevant occurrences including the occurrences collected by the European Member States. Analyse the existing studies on the subject of impact between drones and aircraft.
- Studied the vulnerabilities of aircraft (windshields, engines, and airframe) taking into account the different categories of aircraft (large aeroplanes, general aviation, and helicopters) and their associated design and operational requirements.
- Considered the possibility to do further research and perform actual tests (for example on windshields). Such tests are currently ongoing.

The regulatory framework for the safe operations of drones in Europe currently being developed by EASA addresses the issue of collision between drones and aeroplanes. A combination of measures are envisaged such as operation in visual line of sight, flight under 150 m height above ground, being equipped with identification and geo-limitation functions and drone registration. Any operation of drones close to aerodromes would require a specific authorization from the national aviation authority based on a risk assessment.

RPAS/UAS

Outcome Percentage of Fatal Accidents (2012-2016)	0			0%	0%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2012-2016)	32			50%	16%	13%	3%
Safety Issues				Key Risk Areas (Outcomes and precursors)			
	Incidents	Serioius Incidents	Accidents	Aircraft Upset	Airborne Collision	Obstacle Collision in Flight	Terrain Collision
Operational							
Control of the UAS Flight Path and Use of Automation	3	1	5	●	●		●
Airspace Infringement	185	5	1	●	●		
Bird/Wildlife Strikes	1	-	1	●			
Flight Planning and Preparation	3	-	-	●	●	●	●
Landing Management	1	-	-	●		●	●
Airborne Separation	42	-	-		●	●	
Technical							
System Reliability	20	1	11	●	●	●	●

RPAS/UAS

Outcome Percentage of Fatal Accidents (2012-2016)	0			0%	0%	0%	0%
Outcome Percentage of Non-Fatal Accidents (2012-2016)	32			50%	16%	13%	3%
Safety Issues				Key Risk Areas (Outcomes and precursors)			
	Incidents	Serioius Incidents	Accidents	Aircraft Upset	Airborne Collision	Obstacle Collision in Flight	Terrain Collision
Human							
Navigation and Airspace Knowledge	102	4	-	●	●	●	●
Knowledge of Aircraft Systems and Procedures	-	-	-	●	●	●	
Experience, Training and Competence of Individuals	-	-	-	●	●	●	●
Organisational							
Development and Application of Regulations and Procedures	-	-	-		●	●	●
Management of Change and New Situations	-	-	-		●	●	

Priority Key Risk Areas

	0 Fatal Accidents 16 Non-Fatal Accidents	The first key risk area is the aircraft upset. Most of the accidents are related to drone pilots losing control of the drone resulting in a damage and most often a destruction of the aircraft. 50% of the RPAS accidents are related to such incidents.
	0 Fatal Accidents 5 Non-Fatal Accidents	Airborne Collision is the 2nd key risk area. Even though there are very few occurrences where actual collisions between a drone and a manned aircraft the risk is considered to be substantial and with a continuing exponential increase of unmanned aircraft in the air of all sizes and shape, it is considered vital to monitor this area closely and to work on solutions that prevent actual collisions.
	0 Fatal Accidents 4 Non-Fatal Accidents	Obstacle Collision in Flight is the 3rd key risk area. Drones used in aerial work operations and in space constrained areas are susceptible to higher collision risk than manned aircraft.

Top Safety Issues and Associated Actions

In the UAS domain, there is a large strategic EPAS action that will cover all the various safety issues identified in the safety risk portfolio. This is RMT.0230 which involves the development of implementing rules for UAS.

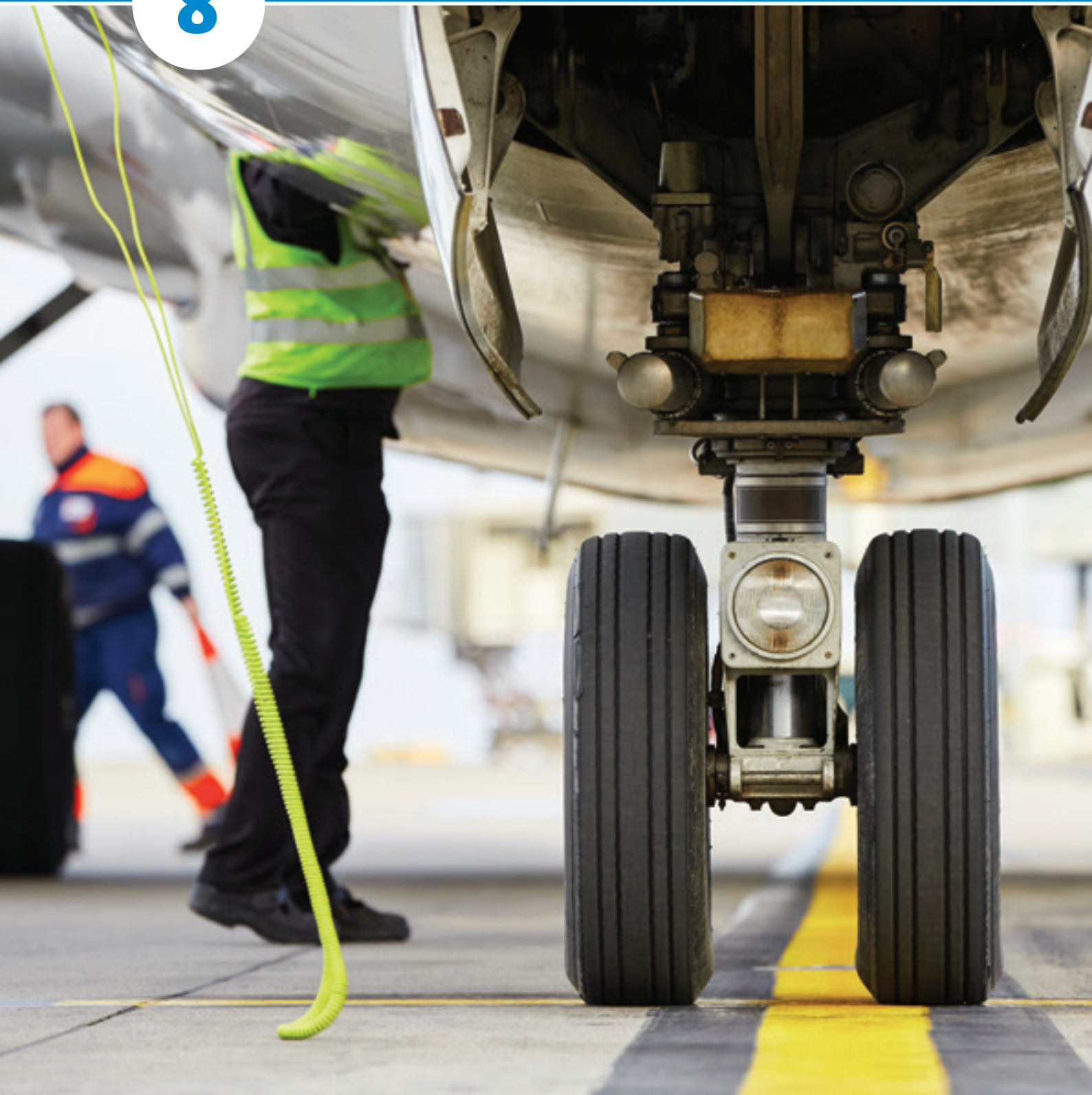
Operational Safety Issues:

Control of the UAS Flight Path and Use of Automation: This safety issue covers all control aspects of the drone, including loss of link and automation measures for control. Drone development is ongoing and so is work on rules and certification for the drone environment.

Airspace Infringement/ Airborne Separation: This safety issue addresses the potential risk of collision by drones entering controlled airspace without permission. Today it is impossible to fully identify the extent of the problem, especially due to the fact that smaller drones do not have transponders on board and sightings of birds and other objects are sometimes raised as drones due to recent publicity of the issue. Countermeasures are being currently discussed on how best to mitigate the risk and there is a great deal of work ongoing on the airspace structures to enable safe drones operations in the long term.

Aerodrome and Ground Handling

8



This chapter covers aerodrome and ground handling operations, with the scope being the EASA Member States as State of Occurrence. Data is fetched from the EASA database (accidents and serious incidents) as well as the European Central Repository. It is worth noting that the accidents and serious incidents in this Chapter are those related to aerodrome/ground handling operations in a general context, which means that the aerodrome itself may or may not have had a contribution to the given occurrence, but it may have a role in preventing similar occurrences in the future.

A Safety Risk Portfolio for Aerodrome and Ground Handling operations is also provided. This has been developed with the support of the Aerodrome and Ground Handing Collaborative Analysis Group (CAG), launched in March 2017.

Key Statistics

In Aerodrome and Ground Handling related activities there was one fatal accident in 2016 with one fatality, both numbers significantly below the average of the preceding decade. There was 73 non-fatal accidents in 2016, which is just over half of the average of the preceding decade.

Table 22 Key statistics Aerodromes and Ground Handling

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	6,5	138,9	12,7
2016	1	73	21
% difference	-85% ↓	-47% ↓	60% ↑

	Fatalities	Serious Injuries
2006-2015 average	11	18,6
2016	1	14
% difference	-91% ↓	-25% ↓

Figure 32 Aerodromes & Ground Handling, fatal and non-fatal accidents 2007-2016

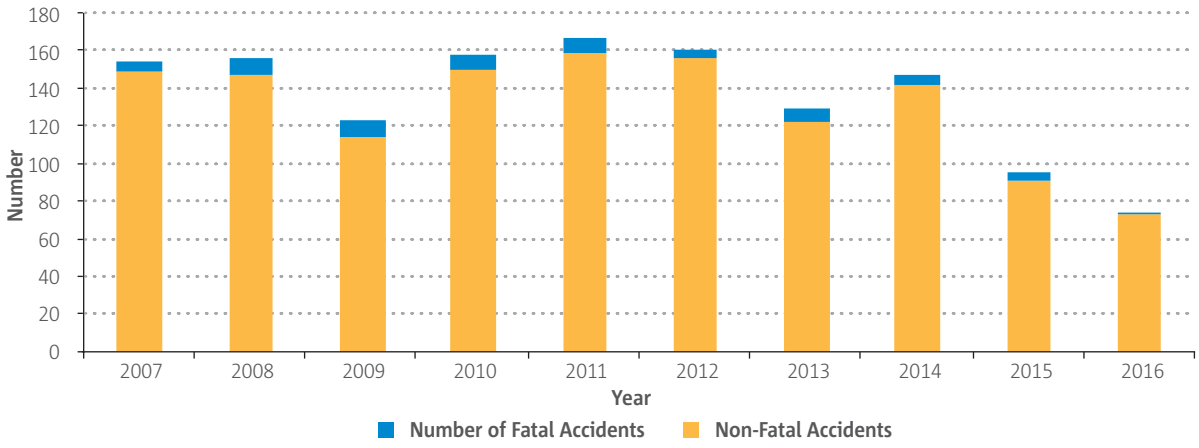
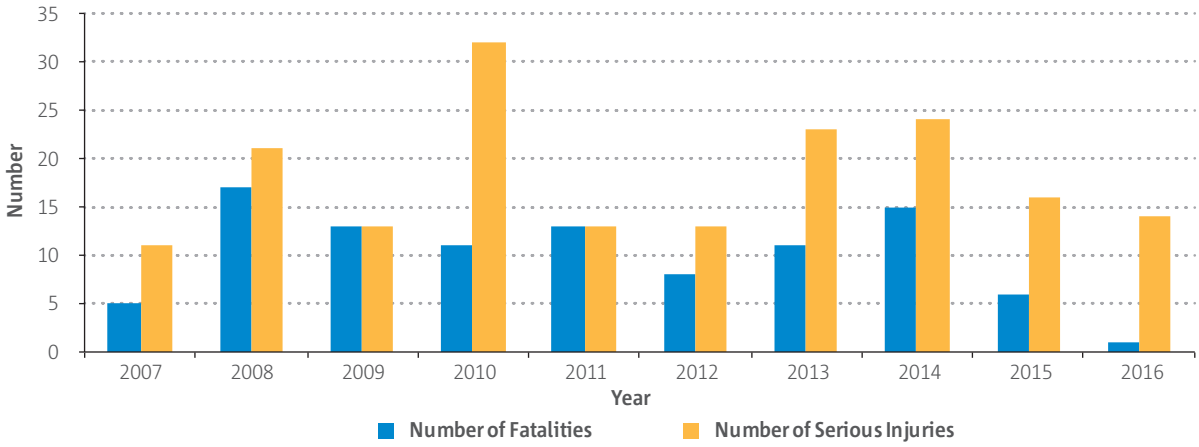


Figure 33 Aerodromes & Ground Handling, fatalities and serious injuries 2007-2016



Safety Risk Portfolio

For the first time, the Agency is pleased to publish its first safety risk portfolio for aerodromes and ground handling.

AERODROMES

Outcome Percentage of Fatal Accidents (2007-2016)	68				32%	19%	16%	4%	1%	1%	1%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	1 361				14%	38%	13%	7%	23%	1%	1%	1%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)							
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Runway Excursion	Obstacle Collision in Flight	Terrain Collision	Ground Damage and Injuries	Runway Collision	Unsurvivable Aircraft Environment	Taxiway/ Apron Excursion
Operational												
Baggage and Cargo Loading	7 775	3	2	2	●	●		●	●		●	
Aerodrome Design and Layout	1 857	4	9	1		●			●	●		●
Coodination and Control of Turnrounds	1 204	2	5	1	●	●		●	●		●	●
Ground Operations in Adverse Weather Conditions	155	1	5	1		●			●	●		●

AERODROMES

Outcome Percentage of Fatal Accidents (2007-2016)	68				32%	19%	16%	4%	1%	1%	1%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	1 361				14%	38%	13%	7%	23%	1%	1%	1%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)							
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Runway Excursion	Obstacle Collision in Flight	Terrain Collision	Ground Damage and Injuries	Runway Collision	Unsurvivable Aircraft Environment	Taxiway/ Apron Excursion
Fuelling Operations	1 583	1	4	1	●				●		●	
Positioning and Securing of Ground Equipment	412	17	253	0	●				●			
Condition and Serviceability of Airport Operating Environment	14 880	15	39	0		●			●	●		●
Operation of Ground Equipment (Non-Motorised)	19	2	26	0	●				●			
Operation of Vehicles (and Other Motorised GSE)	959	1	11	0	●				●	●		
Bird/ Wildlife Strikes	5 007	0	8	0	●	●		●			●	
Wildlife Strikes and Wildlife Control	4 736	0	8	0	●	●		●			●	
Jet Blast	79	1	6	0					●			
Pushback Operations	399	1	2	0					●			●
Design and Serviceability of Vehicles (Motorised GSE)	187	1	2	0					●			
Control of Passengers on the Apron	742	0	1	0					●			

AERODROMES

Outcome Percentage of Fatal Accidents (2007-2016)	68				32%	19%	16%	4%	1%	1%	1%	0%
Outcome Percentage of Non-Fatal Accidents (2007-2016)	1 361				14%	38%	13%	7%	23%	1%	1%	1%
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)							
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Aircraft Upset	Runway Excursion	Obstacle Collision in Flight	Terrain Collision	Ground Damage and Injuries	Runway Collision	Unsurvivable Aircraft Environment	Taxiway/ Apron Excursion
Baggage and Cargo Securing	609	0	1	0	●	●		●	●		●	
Operation of Jet Bridges	79	0	1	0	●				●			
Parking and Positioning of Aircraft	275	2	0	0					●			●
Dangerous Goods Handling and Lithium Batteries	1 328	0	0	0	●			●	●		●	
Load Sheets and Other Documentation/ Systems	313	0	0	0	●			●	●		●	
Design and Serviceability of Ground Equipment (Non-Motorised)	71	0	0	0					●			
Ground Staff Movement Around Aircraft	14	0	0	0					●			
Handling of Passengers with Reduced Mobility	0	0	0	0					●			
Unreported Damage to Composite Structure	0	0	0	0	●						●	

AERODROMES

Outcome Percentage of Fatal Accidents (2007-2016)	68				32%	19%	16%	4%	1%	1%	1%	0%
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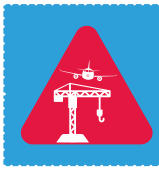
Human												
Decision Making and Planning	36	2	17	2	●	●	●	●	●	●	●	●
Perception and Situational Awareness	1 161	13	45	1	●	●	●	●	●	●	●	●
Experience, Training and Competence of Individuals	76	2	17	1	●	●	●	●	●	●	●	●
CRM and Operational Communication	613	2	10	1	●	●	●	●	●	●	●	●
Personal Pressure and Alertness	29	3	7	0	●	●	●	●	●	●	●	●
Fatigue	7	1	2	0	●	●	●	●	●	●	●	●
Weather Effects	0	0	0	0		●			●	●		●
Organisational												
Commercial Pressures	28	1	4	0	●	●	●	●	●	●	●	●
Effectiveness of Safety Management	0	0	0	0	●	●	●	●	●	●	●	●

Priority Key Risk Areas

	22 Fatal Accidents 190 Non-Fatal Accidents	Aircraft upset or loss of control is the most common accident outcome for fatal accidents where there was a relation to aerodromes and ground handling operations. 32% of fatal accidents in the 2007-2016 period can be attributed to aircraft upset.
	13 Fatal Accidents 517 Non-Fatal Accidents	Runway excursions, side excursions as well as overruns, account for 19% of the fatal accidents where there was a relation to aerodromes and ground handling operations in the past decade.
	11 Fatal Accidents 177 Non-Fatal Accidents	Obstacle collision in flight poses a high risk of a serious accident. Powerline strikes, collisions with buildings and masts are the most common accidents in this risk area. In 16% of fatal accidents during the last 10 years where there was a relation to aerodrome and ground handling operations this key risk area was identified.
	3 Fatal Accidents 95 Non-Fatal Accidents	Terrain collision includes collisions with trees, elevated terrain and level terrain/water. In 4% of fatal accidents in the past decade where there was a relation to aerodromes and ground handling operations terrain collisions were identified as a key risk area.
	1 Fatal Accident 313 Non-Fatal Accidents	The key risk area ground damage and injuries comprise damage to aircraft sustained whilst on the ground, and injuries sustained to persons when the aircraft is on the ground. In 1% of fatal accidents in the 2007-2016 period where there was a relation to aerodrome and ground handling this key risk area was identified.
	1 Fatal Accident 14 Non-Fatal Accidents	Runway collisions encompasses all collisions between aircraft and other aircraft, vehicles, persons or other objects whilst the aircraft is on the runway. In 1% of fatal accidents in the past decade where there was a relation to aerodrome and ground handling operations runway collisions were identified as a key risk area.
	1 Fatal Accident 14 Non-Fatal Accidents	An unsurvivable aircraft environment happens in case of on board fire or the rupture of a pressurised cabin causing rapid decompression. In 1% of fatal accidents in the past decade where there was a relation to aerodrome and ground handling operations one of the identified key risk areas was unsurvivable aircraft environment.

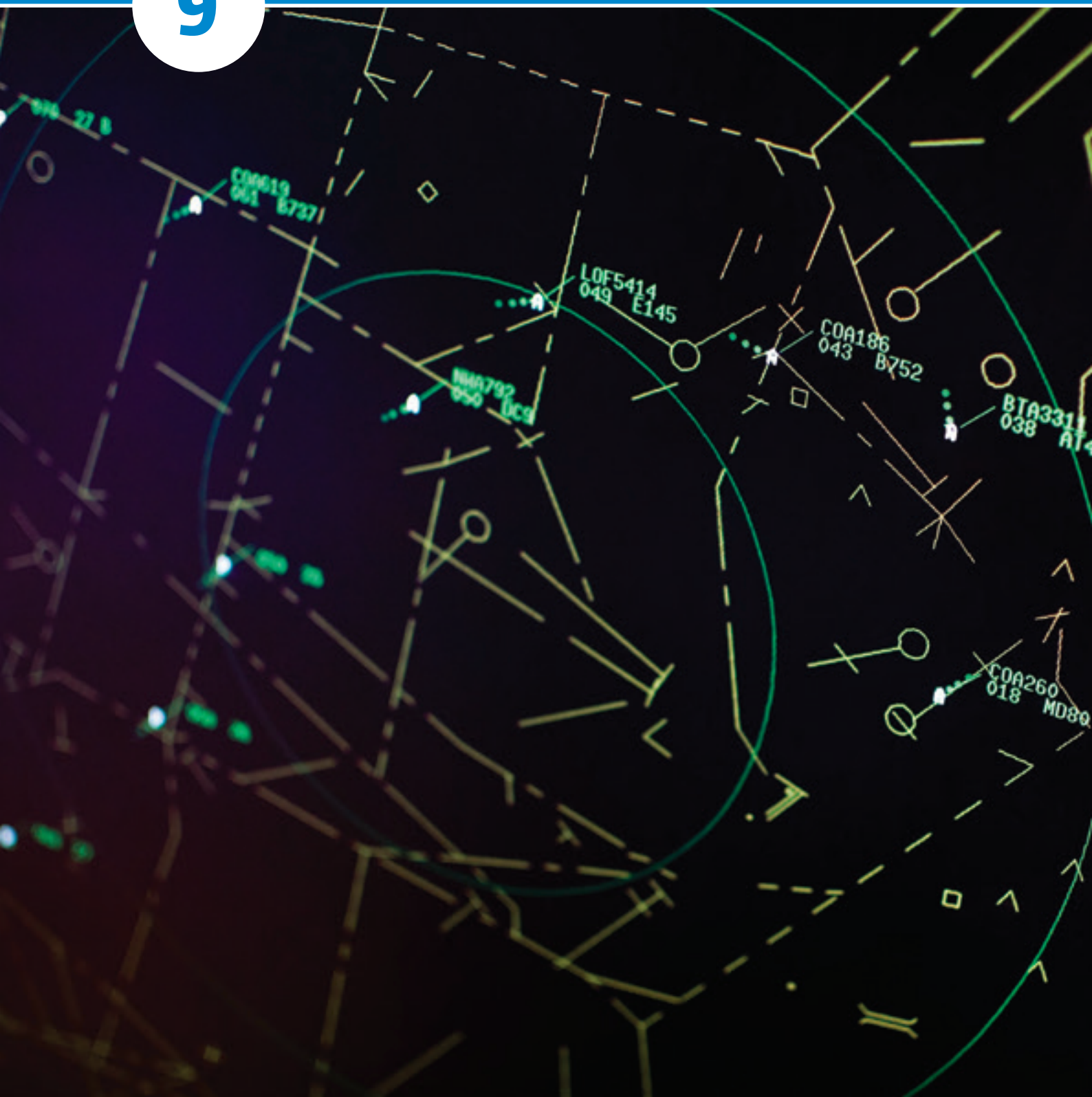
Top Safety Issues and Associated Actions

The list of safety issues have been developed during the first meeting of the Aerodromes and Ground Handling CAG, which met in the first quarter of 2017. These has since be matched with data and a check was made to ensure that there were no safety issues missing from the data. The top safety issues in addition to the general safety issue on human performance, identified from the data are:

- Decision making and planning.
- Baggage and cargo loading.
- Perception and situational awareness.
- Experience, training and competence of individuals.
- CRM and operational communication.
- Aerodrome design and layout.
- Control and coordination of turnarounds.

ATM/ANS

9



This chapter covers accidents and serious incidents related to the provision of ATM/ANS services in the EASA Member States. The analysis includes accidents and serious incidents extracted from EASA's occurrence database that occurred within an EASA MS as State of Occurrence, involving at least one CAT, fixed-wing aircraft with MTOM of 2250 kg or above.

It is worth noting that the accidents and serious incidents mentioned in this chapter are those related to the provision of ATM/ANS services, which means that the ATM system may or may not have had a contribution to the given occurrence, but it may play a role in preventing or decreasing the severity of similar occurrences in the future. These are named as "ATM/ANS related". Among them, there are occurrences where the ATM/ANS provision of services was a factor contributing to the occurrence, or at least one ATM/ANS factor potentially increased the level of risk, or it played a role in the occurrence encountered by the aircraft. These events are usually known as events with "ATM/ANS contribution". In the chapter, these two types of events are distinguished when necessary.

Currently, an ATM/ANS safety risk portfolio is being developed so as to identify key risk areas and main Safety Issues in relation to the ATM/ANS provision of services. To accomplish this task, an ATM/ANS Collaborative Analysis Group (CAG) has been launched in 2017 to engage related stakeholders (i.e., ANSPs, national supervisory authorities, air traffic controller associations, airports and airline operators). The chapter introduces the initial draft portfolio, which is under construction and foreseen to be consolidated during 2017, to provide a first hint on the major candidate safety issues. In addition, the safety issues will also serve to prioritise actions included in the European Plan for Aviation Safety (EPAS).

Key Statistics

There were no fatal accidents related to ATM/ANS services provided in an EASA MS in 2016, which continues the trend since 2012. The total number of non-fatal accidents and the number of serious incidents in 2016 remains in line with the average of the preceding ten-year period. Although there were no fatalities associated to ATM/ANS related accidents, the number of serious injuries was significantly higher than the average of the ten-year period.

Table 23 Key statistics in ATM/ANS

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
2006-2015 average	0.5	5.7	35.5
2016	0	6	33
% difference	-100% ↓	5% ↑	-7% ↓

	Fatalities	Serious Injuries
2006-2015 average	1.8	3.7
2016	0	8
% difference	-100% ↓	+116% ↑

Figure 34 shows the total CAT (fixed-wing aircraft > 2,250kg) accidents ATM/ANS related between 2006 and 2016 (light blue bars) including those accidents with ATM/ANS contribution for the EASA MS.

The decreasing trend in the number of ATM/ANS related accidents observed since 2014 continued in 2016, despite the increase in traffic. In addition, the number of accidents with ATM/ANS contribution has remained relatively constant and low during the last decade with none observed in 2016. It is worth noting that no ATM/ANS related fatal accident has been recorded since 2012, and that no fatal accident with ATM/ANS contribution was registered in the last decade, thus making them rare.

Figure 34 ATM/ANS related fatal and non-fatal accidents and ATM/ANS contribution per year, 2006-2016, in EASA MS

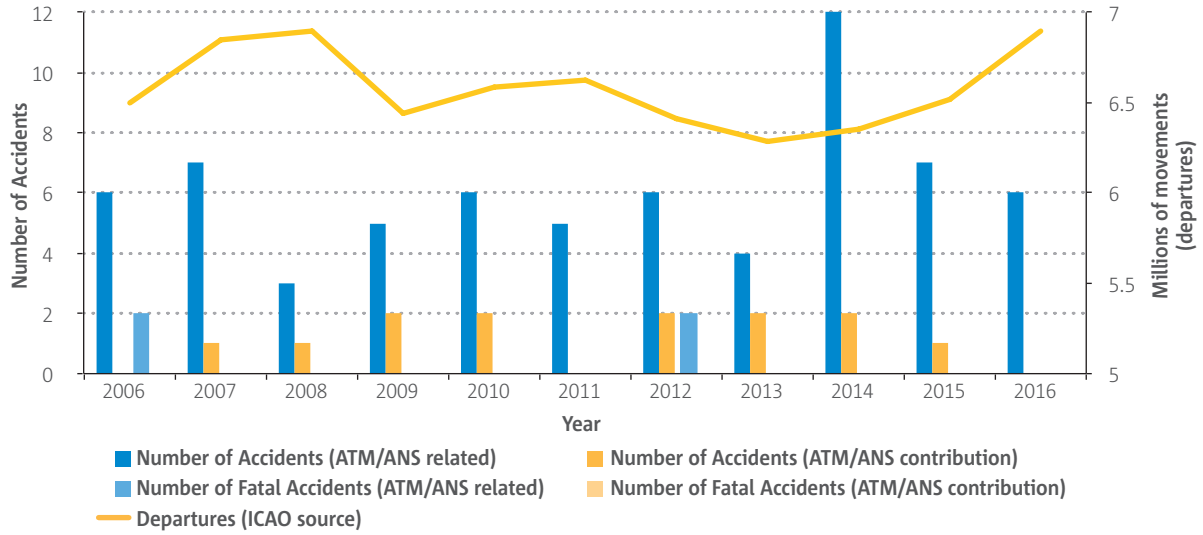


Figure 35 shows ATM/ANS-related serious incidents and serious incidents with ATM/ANS contribution in CAT (fixed-wing aircraft > 2250kg) in EASA MS area between 2006 and 2016. Following the decreasing trend from 2010, it seems that 2016 shows a change in the trend line with an increasing number of ATM/ANS-related serious incidents being recorded. However, the number of those with ATM/ANS contribution has remained relatively stable for the last six years.

Figure 35 ATM/ANS related serious incidents and ATM/ANS contribution per year, 2006-2016, in EASA MS

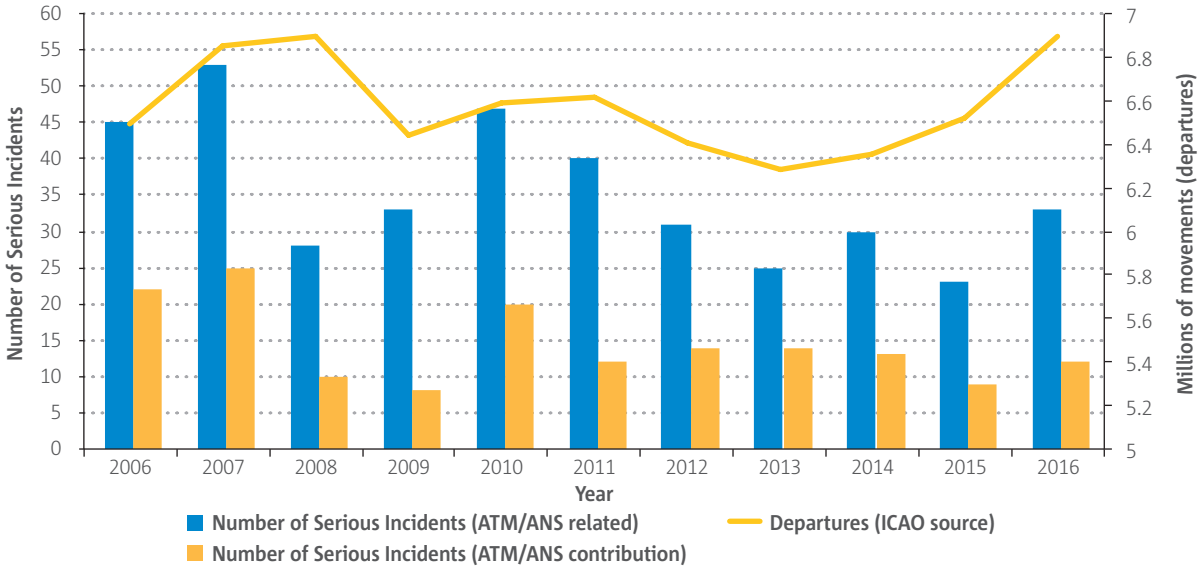


Figure 36 shows the ATM/ANS-related accident fatalities and serious injuries in CAT (fixed-wing aircraft > 2,250kg) in EASA MS area between 2006 and 2016. While the number of serious injuries has increased in 2016, no fatalities have been associated with ATM/ANS related accidents since 2012, thus maintaining this trend in 2016.

Figure 36 ATM/ANS-related accident fatalities and serious injuries per year 2006-2016 in EASA MS

Phase of Flight

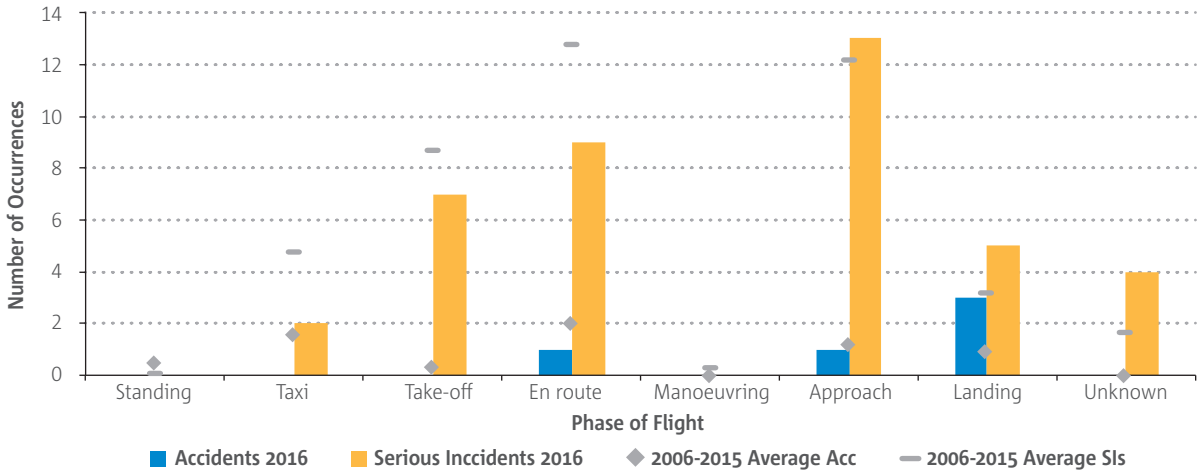
In terms of flight phase, the majority of accidents and serious incidents in ATM/ANS-related accidents took place during the en-route and approach phases, followed by take-off, taxi and landing phases. In comparing the 2016 data with the 2006-2015 average, differences can be seen in almost all phases. While accidents and serious incidents during taxi were reduced by one-third compared to the preceding ten-year period, en route and take-off were also reduced, but those during the landing phase were almost doubled. The approach phase remains relatively constant.

Table 24 ATM/ANS related accidents and serious incidnets by phase of flight during 2006-2016 in EASA MS

Phase of Flight	Accidents and SIs	
	2006-2015 average	2016
Standing	0.6	0
Taxi	6.4	2
Take-off	9	7
En route	14.8	10
Manoeuvring	0.3	0
Approach	13.4	14
Landing	4.1	8
Unknown	1.7	4

The distribution of ATM/ANS –related accidents and serious incidents are shown below, separately, by phase of flight. The data show that accidents happened only in three phases, namely landing, approach and en-route, and the serious incidents are unevenly distributed among the phases.

Figure 37 ATM/ANS-related accident fatalities and serious injuries per year 2006-2016 in EASA MS



ATM/ANS Safety Risk Portfolio

The initial safety risk portfolio for this domain has been prepared by the Agency using EASA's occurrence database. This portfolio will be further developed by the ATM CAG during the second half of 2017.

ATM/ANS									
Outcome Percentage of Fatal Accidents (2007-2016)	2	100%	50%	50%	0%	0%	0%	0%	
Outcome Percentage of Non-Fatal Accidents (2007-2016)	59	3%	5%	0%	46%	29%	15%	5%	
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)				
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Terrain Collision	Airborne Collision	Obstacle Collision in Flight	Aircraft Upset	Ground Damage	Runway Excursion	Runway Collision
Operational											
Deconfliction between IFR/VRF traffic with one or more traffic uncontrolled						●					
ACAS RA not followed						●					

ATM/ANS

Outcome Percentage of Fatal Accidents (2007-2016)	2				100%	50%	50%	0%	0%	0%	0%	
Outcome Percentage of Non-Fatal Accidents (2007-2016)	59				3%	5%	0%	46%	29%	15%	5%	
Safety Issues	Total number of occurrences in 2012-2016 per safety issue				Key Risk Areas (Outcomes and precursors)							
	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Terrain Collision	Airborne Collision	Obstacle Collision in Flight	Aircraft Upset	Ground Damage	Runway Excursion	Runway Collision	
Deconfliction of aircraft operating without transponder or dysfunctional one						●						
Conflict detection with closest aircraft (blind spot)						●						
Level Bust						●						
Airspace infringement						●						
High energy runway conflict											●	
Undetected occupied runway											●	
Landing without clearance											●	
Procedure design and obstacle publication					●		●					
Provision of weather information (turbulance/ windshear/ convective weather)					●		●	●		●		
Provision of weather information (wind at low heigh					●		●	●		●		

ATM/ANS

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ATM influence on the non-stabilised apporaches					●		●			●		
Coordination/ handling of pushback									●			
Ground Operations in Adverse Weather Conditions									●		●	
Technical												
Failure of Navigation service					●	●	●		●	●	●	
Failure of Surveillance service					●	●	●		●	●	●	
Failure of Air/Ground communications					●	●	●	●	●	●	●	
Ab-normal operating conditions/ Degraded modes					●	●	●	●	●	●	●	
Human												
Compliance with ATM procedures (e.g. clearances)					●	●	●		●	●	●	
New technologies and automation (e.g. rTWR, SWIM)					●	●	●	●	●	●	●	

ATM/ANS

Outcome Percentage of Fatal Accidents (2007-2016)	2				100%	50%	50%	0%	0%	0%	0%	
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	Incidents (ECR data)	Serious Incidents	Non-Fatal Accidents	Fatal Accidents	Terrain Collision	Airborne Collision	Obstacle Collision in Flight	Aircraft Upset	Ground Damage	Runway Excursion	Runway Collision	
Experience, Training and Competence of Individuals					●	●	●	●	●	●	●	
Personal Pressure and Arousal					●	●	●	●	●	●	●	
Fatigue					●	●	●	●	●	●	●	
Perception and Situational Awareness					●	●	●	●	●	●	●	
Decision Making and Planning					●	●	●	●	●	●	●	
Operational Communication					●	●	●	●	●	●	●	
Organisational												
Effectiveness of Safety Management					●	●	●	●	●	●	●	
Understanding/ monitoring system performance interdependencies					●	●	●	●	●	●	●	
Other												
Cybersecurity												
Integration of RPAS/Drones						●						

Priority Key Risk Areas

Following the first meeting of the ATM CAG in May 2017, the key risk areas derived as a result of EASA analysis were revised. The two major key risk areas for the ATM/ANS domain are airborne collision and runway collision.

1 Fatal Accident

3 Non-Fatal Accidents

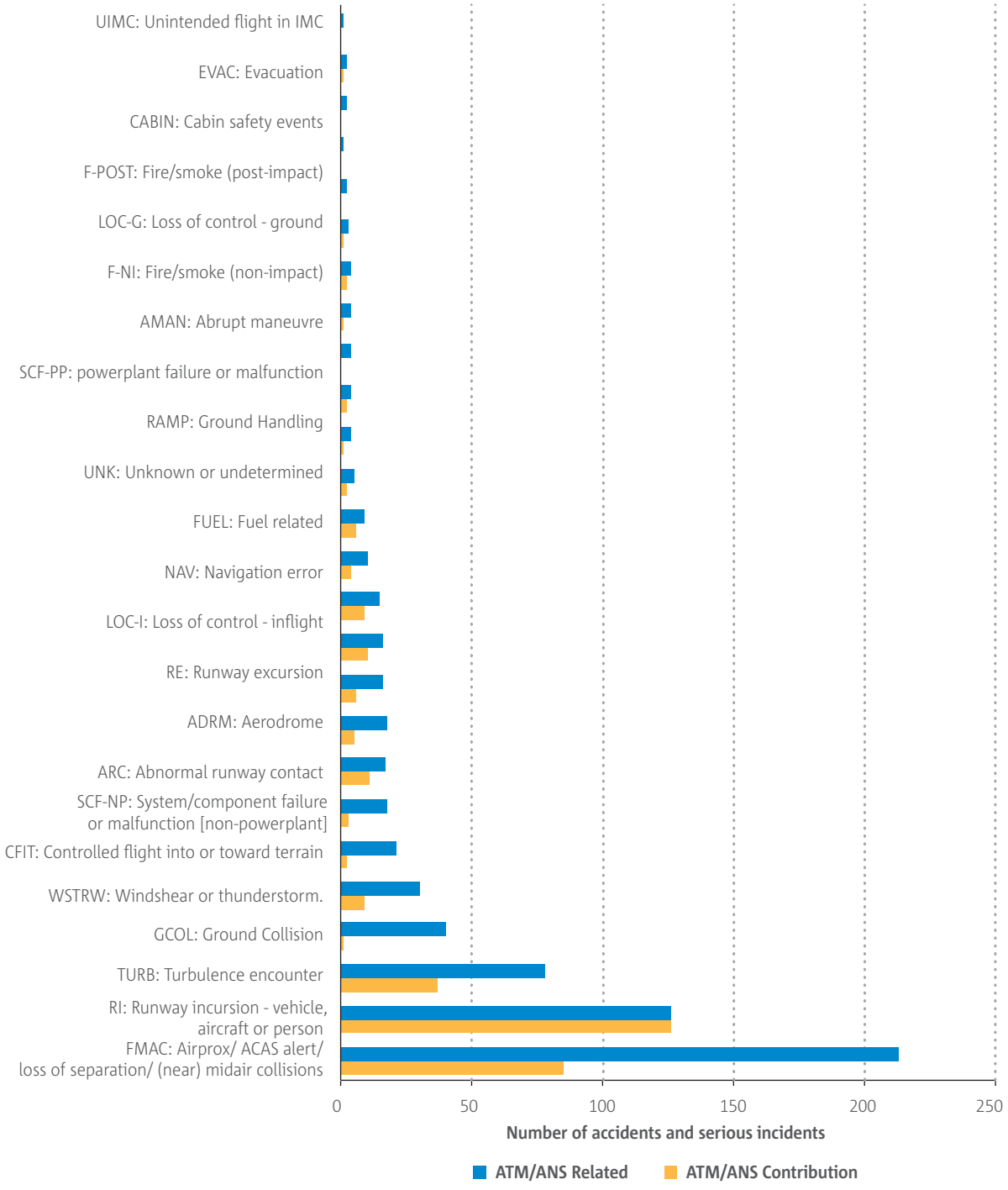
From an ATM perspective, airborne collision is the first safety priority. Analysis of MAC/airprox occurrences with the EASA MS in the NoA identified a number of specific HF related safety issues that will be subject to individual safety risk assessment with the different ATM safety partners.

0 Fatal Accidents

3 Non-Fatal Accidents

The next safety priority for ATM is the prevention of runway incursions and ultimately collisions on the runway.

Figure 38 ATM/ANS-related accidents and serious incidents, and those with ATM/ANS contribution during 2006-2016



Top Safety Issues and Associated Actions

The elaboration of safety issues is under development and it is premature to present the top safety issues in this domain until the analysis has been completed and a consolidated version of the ATM Safety Risk Portfolio is issued later in 2017 based on the work of the ATM CAG.

The table below lists all actions that address the service providers of ATM/ANS services or the Member States with an impact on these service providers that are included in the EPAS 2017-2021[3].

Table 25 ATM/ANS related actions included in the EPAS

RMT.0148	**Rulemaking**	Requirements on air navigation service provision
RMT.0157	**Rulemaking**	Requirements on competent authorities in ATM/ANS
RMT.0469	**Rulemaking**	Assessment of changes to functional systems by service providers in ATM/ANS and the oversight of these changes by competent authorities
RMT.0473	**Rulemaking**	Technical requirements and operational procedures for the provision of meteorological services
RMT.0681	**Rulemaking**	Alignment of implementing rules & AMC/GM with Regulation (EU) No 376/2014
RMT.0706	**Rulemaking**	Update of authority requirements
MST.001	**Action on Member States**	Member States to give priority to the work on SSPs
MST.002	**Action on Member States**	Promotion of SMS
SPT.057	**Safety Promotion**	SMS international cooperation
SPT.059	**Safety Promotion**	SMS implementation support in ATM
SPT.062	**Safety Promotion**	Comparable risk classification of events across the industry
SPT.063	**Safety Promotion**	Continuous monitoring of ATM safety performance
RMT.0486	**Rulemaking**	Alignment with ICAO on ATCO fatigue management provisions
FOT.003	**Focused Oversight**	Unavailability of adequate personnel in competent authorities
FOT.004	**Focused Oversight**	Unavailability of adequate personnel in competent authorities
RMT.0703	**Rulemaking**	Runway safety
MST.007	**Action on Member States**	Include runway excursions in national SSPs
MST.011	**Action on Member States**	Runway safety teams
MST.014	**Action on Member States**	Include runway incursions in national SSPs
RMT.0445	**Rulemaking**	Technical requirements and operating procedures for airspace design, including flight procedure design
RMT.0464	**Rulemaking**	Requirements for air traffic services
RMT.0477	**Rulemaking**	Technical requirements and operational procedures for aeronautical information services and aeronautical information management
RMT.0593	**Rulemaking**	Technical requirements and operational procedures for the provision of data for airspace users for the purpose of air navigation
MST.010	**Action on Member States**	Include MACs in national SSPs
MST.024	**Action on Member States**	Loss of separation between civil and military aircraft
SPT.087	**Safety Promotion**	Weather awareness for pilots
MST.016	**Action on Member States**	Airspace infringement risk in General Aviation
SPT.089	**Safety Promotion**	European Safety Promotion on Mid-air collisions and airspace infringement
FOT.010	**Focused Oversight**	Service provision to GA flights
RMT.0230	**Rulemaking**	Introduction of a regulatory framework for the operation of drones
SPT.091	**Safety Promotion**	European Safety Promotion on civil drones
SPT.071	**Safety Promotion**	Cybersecurity road map
MST.020	**Action on Member States**	Loss of radar detection

3 https://www.easa.europa.eu/system/files/dfu/EPAS_2017-2021.pdf

EASA
European Aviation Safety Agency

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