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Photocredits

Foreword
by the Executive Director

It is my privilege to present the 2023 Annual Safety Review, which looks back at the safety performance of the European aviation system in 2022.

Last year, the world, and air transport, began its journey to recovery after the unprecedented challenges posed by the COVID-19 pandemic. As we publish this year's safety review in the summer of 2023, traffic levels are at around 93% of the pre-pandemic levels seen in 2019. This remarkable resurgence is a testament to the resilience and adaptability of the aviation industry, and underlines that citizens still have a strong desire to travel by air, which remains the safest form of transport.

It brings me immense satisfaction to recognise that there have been no major accidents involving European operators for many years, and the safety record of aviation continues to be exemplary. Such performance is the result of the collective efforts of all stakeholders who have embraced safety leadership and upheld the highest standards of operational excellence.

However, the absence of major accidents in Europe should not blind us to possible threats. We were fortunate that last summer's difficult operating situation did not lead to safety issues. On the global scale, we are regrettably still seeing around 12-13 fatal commercial air accidents per year.

We must also recognise that the aviation landscape is ever-changing and that new challenges continue to emerge. Hazards such as cyber-security vulnerabilities, war at the borders of the European Union, the entry of new operators, as well as rapid advancements in technology all demand our focused attention. To that end, the Agency works closely with the European Aviation Crisis Coordination Cell and our other European partners. EASA continues its efforts to identify and mitigate these emerging risks to ensure that our industry's excellent safety record persists in the years to come. As one example of action taken, EASA has recently published the acceptable means of compliance and guidance material to support the Part-IS (Information Security) regulation.

The digital revolution has ushered in new opportunities and challenges alike. In collaboration with Member States and Industry stakeholders, EASA is steadfast in preparing the aviation system to embrace digitalisation and artificial intelligence responsibly. We are committed to harnessing the potential of these innovations to further enhance safety, while safeguarding against any potential risks they may bring.

In closing, I extend my heartfelt gratitude to all those who have contributed to the success of the European aviation safety system at such a challenging time in our joint history. Your dedication, expertise, and unwavering commitment to safety have been instrumental in shaping an aviation industry that we can all be proud of. As we look towards the future, I am confident that our collective efforts will continue to benefit aviation safety for the future.

Safe skies and best wishes,

Patrick Ky

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Introduction

EASA would like to welcome you to the 2023 edition of the EASA Annual Safety Review (ASR)[1]. The analysis presented in this review provides the most important aviation safety statistics for Europe in 2022 and a comparison with the past. It is also the data-driven input that supports the European Safety Risk Management (SRM) process and, hence, the European Plan for Aviation Safety (EPAS).

The core document of the ASR provides both a statistical summary of aviation safety in the EASA Member States (MS) and identifies the most important safety challenges faced by European aviation today, outlining the safety risks per aviation and operational domain.

The ASR drives the identification of safety issues, which are further assessed and prioritised using the experience of EASA Member States and the aviation industry to connect the data with the current and future strategic priorities of the Agency and the safety priorities contained in the EPAS. This work is a part of the SRM and benefits from the valuable inputs from the Network of aviation safety Analysts (NoA) and Collaborative Analysis Groups (CAGs).

The safety issues that have been identified from occurrence data are provided in the ASR appendices for the different aviation domains presented in this edition and build upon the work of previous years. For aerodromes and groundhandling, the safety risk portfolio is undergoing a major review. Thus for this year, instead of providing the list of safety issues identified from occurrence data, the appendix for that domain shows the detailed distribution of the type of operational safety events.

How the safety review is produced

Information sources

The data presented in the ASR are based on the accidents and serious incidents collected up to May 2023 by the Agency under Regulation (EU) 996/2010 on accident and serious incident investigation and Regulation (EU) 376/2014 on occurrence reporting, analysis, and follow-up, and complemented through the active search of those events from other official sources. This data collection enables the analysis of two specific data sources:

- **EASA's occurrence database:** The main source of data is the Agency's own database, which covers occurrences and other safety-related information reported to the Agency in its role as competent authority, and accidents and serious incidents notified to the Agency by Safety Investigation Authorities world-wide. This is augmented by information collected by the Agency from other sources.
- **European Central Repository:** The European Central Repository (ECR) is the central database of all occurrences and other safety-related information reported to the competent authorities of the EASA MS, the reporting of which is governed by Regulation (EU) 376/2014 on the reporting, analysis and follow-up of occurrences in civil aviation.

The figures and analyses presented in the ASR may differ from safety reports prepared by other organisations and regulators, which is due to differences in collection methods, in the definitions of the data collected and the subsequent analyses. It is important to identify and understand these differences when comparing safety reports and to keep in mind that each report has its own merits.

1 Publication of the Annual Safety Review is mandated by Article 72(7) of REGULATION (EU) 2018/1139 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency.

European Risk Classification Scheme

Regulation (EU) 376/2014 on the reporting, analysis and follow-up of occurrences in civil aviation introduced the requirement for a common risk classification of occurrences at the national and EASA levels. As a result, the European Risk Classification Scheme (ERCS) was developed to measure the risk using a 2-dimensional matrix. The ERCS is part of the legal framework of Regulation (EU) 376/2014, through a Commission Delegated Regulation[2] published in 2020 and later a Commission Implementing Regulation[3], published in 2021. The application of the ERCS is mandatory as of January 1, 2023.

Within the ERCS safety risk matrix, the rows address the severity, by identifying the worst likely accident outcome that would have resulted if the occurrence being scored had escalated into an accident, which considers both the size of the aircraft involved and the most likely type of accident. Secondly, the columns measure the probability, by looking at how close the occurrence was to that worst likely accident outcome, based on a weighted barrier model.

EASA began using this risk classification scheme in 2017 and has categorised all the accidents and serious incidents in the ASR, including those occurring before 2017. The ERCS is useful because the classification of occurrences into accidents and serious incidents does not necessarily provide an accurate picture of the risk of those occurrences. For example, a very close near mid-air collision would be classified as a serious incident, while a collision between a ground handling vehicle and an aircraft leading to substantial damage to the latter would be classified as an accident. In terms of risk, the serious incident in this example would be of a higher risk category than that of the accident. In addition, the combination of probability and severity would differ significantly. For each domain, an analysis using ERCS-applied occurrence data provides an overview of the risks that were present during the analysed period; however, it does not predict the future risks, which will change due to changing circumstances and the remedial effects of safety mitigating actions.

2 COMMISSION DELEGATED REGULATION (EU) 2020/2034 of 6 October 2020 supplementing Regulation (EU) No 376/2014 of the European Parliament and of the Council as regards the common European risk classification scheme

3 COMMISSION IMPLEMENTING REGULATION (EU) 2021/2082 of 26 November 2021 laying down the arrangements for the implementation of Regulation (EU) No 376/2014 of the European Parliament and of the Council as regards the common European risk classification scheme

Chapter overview

This document is split into nine chapters. Chapter 2 to Chapter 7 cover one operational domain within the European aviation system. The scope of each domain chapter is the EASA MS, either as the state of operator or the state of registry. For the Aerodromes and Ground Handling and Air Traffic Management and Air Navigation Services (ATM/ANS) chapters, the scope is the EASA MS as state of occurrence. Chapter 8 reviews the reporting rates in the ECR, and Chapter 9 provides an overview of EASA's monitoring of the MS's oversight capabilities.

The chapters of this ASR cover the following areas:

Chapter 1 – Safety overview

- **Review of global airline safety:** This provides a review of global safety for large commercial air transport aeroplanes.
- **Cross-domain safety overview of EASA MS:** This provides an overview of the most important statistics across all the different operational domains. It helps to identify which domains are likely to need the greatest focus in the EPAS.

Chapter 2 – Aeroplanes

- **Commercial air transport complex aeroplanes:** This covers all commercial air transport operations (passenger and cargo) involving aeroplanes with a maximum certificated take-off mass exceeding 5700 kg, or aeroplanes equipped with turbofan engine(s) or more than one turboprop engine (e.g., airline, air taxi, air ambulance).
- **Commercial air transport other than complex aeroplanes:** This covers all commercial air transport operations (passenger and cargo) involving aeroplanes other than complex aeroplanes (e.g., airline, air taxi, air ambulance, sightseeing).
- **Non-commercial operations complex aeroplanes:** This covers non-commercial operations involving aeroplanes with a maximum certificated take-off mass exceeding 5700 kg, or aeroplanes equipped with turbofan engine(s) or more than one turboprop engine (e.g., business, demonstration, flight training/instructional, relocation).
- **Specialised operations:** This covers all aerial work/Part SPO operations involving aeroplanes and includes a wide range of different operational activities (e.g., agriculture, aerial advertisement, or photography operations) conducted by EASA MS registered aeroplanes or EASA MS AOC Aeroplanes holders.
- **Non-commercial operations other than complex aeroplanes:** The chapter covers all non-commercial operations involving other than complex aeroplanes and includes analysis of leisure flights as well as flight training and other general aviation activities. Additional information regarding microlights and aircraft registered in third countries has also been included.

Chapter 3 – Helicopters

- **All helicopter operations:** This chapter provides an analysis of all EASA-certified or validated helicopter operations, except for Nationally Regulated Operations (NRO).
- **Commercial air transport:** This covers all commercial air transport operations involving EASA-certified or validated helicopters such as Helicopter Emergency Medical Service (HEMS), air taxi or sightseeing, as well as flights to offshore oil, gas and renewable energy installations.

- **Specialised operations:** This covers all aerial work/Part SPO operations involving EASA-certified or validated helicopters such as sling load, advertisement, or photography with an EASA MS as state of operator or state of registry.
- **Non-commercial operations:** The section covers all non-commercial operations involving EASA-certified or validated helicopters with an EASA MS as state of operator or state of registry. Training flights are included within the non-commercial operations definition.

Chapter 4 – Balloons

This chapter covers all operations involving hot air balloons.

Chapter 5 – Sailplanes

This chapter covers all operations involving sailplanes.

Chapter 6 – Aerodromes and ground handling

This chapter covers aerodrome and ground handling operations that occur within the EASA MS; therefore, the scope for this chapter is EASA MS as state of occurrence.

Chapter 7 – ATM/ANS

This chapter covers ATM/ANS occurrences within the EASA MS; therefore, the scope of the chapter is EASA MS as state of occurrence.

Chapter 8 – ECR reporting rates

This chapter reviews the reporting rates in the European Central Repository.

Chapter 9 – Standardisation

This chapter provides an overview of EASA's standardisation activities which entail assessing the National Competent Authorities' (NCAs) ability to discharge their safety oversight responsibilities on a continuous basis, as well as verifying the implementation of the rules. It provides a summary of information about the application by each Member State of the EASA Basic Regulation and of the delegated and implementing acts adopted on the basis thereof[4].

4 Article 85, paragraph 7 of Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency.

Typical structure for each chapter

Each of the domain chapters in this ASR contains specific information that is useful in understanding the analysis of that domain. The structures of the chapters and appendices, as described below, are as similar as possible across the domain chapter to afford the ability to compare information in each domain.

Key statistics: Every chapter begins with a set of key statistics that provide information on the Tier 1 Safety Performance Indicators (SPIs) for that domain, which includes details on the number of fatal accidents, non-fatal accidents and serious incidents. The key statistics part also outlines the number of fatalities and serious injuries in the domain. In all cases, the figures for 2022 are followed by a comparison with the annual averages over the past 10 years that helps to provide a reference on how this year's performance relates to historical trends; this information is also provided in a graphical format. The key statistics are then complemented with a figure outlining the occurrence categories[5] assigned to the serious incidents and accidents in the past five years.

Domain-specific analysis: As every domain is different, 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 analysis: The next part of the analysis is the domain safety risk analysis. This section provides an overview of the relative risk level and frequency of each key risk area. In the context of a safety performance framework, the key risk areas are the Tier 2 safety performance indicators (SPIs) for the domain. The key risk areas are ordered based on their risk levels, determined using the ERCS.

Domain specific appendix (new): When a safety risk portfolio is existing for the domain, the domain specific appendix outlines the safety issues that have been identified from occurrence data. Safety issues are safety deficiencies related to one or more hazards and are the manifestation of a hazard or combination of several hazards in a specific context. In terms of safety performance, the safety issues are the Tier 2+ SPIs and are ranked based on their aggregated risk contribution using ERCS. The occurrences related to the individual safety issues are identified by mapping event types in the ECCAIRS taxonomy to each safety issue.

Following on from the inclusion of data relating to Human Factors (HF) and Human Performance (HP) in the domain specific analysis for the aeroplane and sailplane domains in 2020, this information is now included in all domains. The term human factors describes human characteristics, abilities and limitations. The knowledge of HF is used throughout the aviation industry to design systems, equipment and work in ways that support humans in performing at their best. HP refers to how people perform their tasks. Following safety occurrences, HF and HP knowledge can also be used diagnostically to better understand what went wrong, what went right and, more importantly, to understand how to prevent such occurrences from happening again. Within the EASA occurrence data, HF and HP have been identified as having contributed to accident and serious incidents, based on information derived from investigation reports. The same ECCAIRS taxonomy that helps us to identify our safety issues and key risk areas also provides us with HF and HP codes. This taxonomy groups event types at different levels, so that all the issues relating to personnel are grouped at the highest level into 'personnel'. The personnel issues are then further subdivided into four categories: experience and knowledge events, physiological events, situational awareness and sensory events, and personnel task performance events. A further two levels of subdivision exist, providing increasing granularity on the type of HF or HP issues identified.

Following on from the development of an airworthiness safety risk portfolio in 2023, an airworthiness analysis is now included in the product related domains. The term airworthiness includes aircraft design, aircraft production, and aircraft maintenance. Within the EASA occurrence data, airworthiness is identified as having contributed to

5 In accordance with the ICAO Accident/Incident Data Reporting (ADREP) taxonomy. Each category has a unique name and identifier to permit common, a text definition, and usage notes to clarify the category and aid in coding occurrences.

accident and serious incidents, based on information derived from investigation reports. The attribute 'event type' in the ECCAIRS taxonomy allows regulators and industry to code the causes and contributing factors to accidents and serious incidents. A first level of airworthiness analysis shows the contribution of the aircraft system loss and malfunction to the accidents and serious incidents, including the distribution of the main Air Transport Association (ATA) chapters. A second level of analysis goes a step further, showing the contribution of design, production, and maintenance to aircraft system loss and malfunction, i.e., highlighting the systemic root cause of a system or equipment failure.

The link with the European Plan for Aviation Safety

The European Plan for Aviation Safety (EPAS) constitutes the Regional Aviation Safety Plan (RASP) for EASA MS and sets out the strategic safety priorities and objectives for the European aviation system, presents the main risk affecting that system and defines the necessary actions to mitigate those risks, to further improve aviation safety in Europe. The plan is prepared by EASA, with technical inputs from the EASA Advisory Bodies representing MS and industry. The EPAS looks at aviation safety in a systemic manner. The safety priorities and corresponding mitigating actions are determined through the European SRM process. The occurrences that are reviewed and analysed during the production of the ASR support the identification of safety issues (Step 1 of the European Safety Risk Management Process, see below) that are listed in the EPAS for further being assessed and mitigated. While EPAS originates with the EASA MS, it forms the basis of the RASP for all States in the ICAO EUR Region.

In addition to the safety intelligence gained through analysing occurrence data, roadmaps have been developed for the general aviation and the rotorcraft domains. These domain specific roadmaps, which are monitored and will continue to develop, augment the overall safety intelligence picture when determining the safety priorities contained in the EPAS.

More information on the EPAS can be found on the EASA website: https://www.easa.europa.eu/easa-and-you/safety-management/european-plan-aviation-safety

The European SRM Process

The main safety risks and corresponding mitigation actions feeding the EPAS are developed through the European SRM process, which is defined in 5 specific steps as described below:

Identification of safety issues: The identification of safety issues is the first step in the SRM process and is performed through the analysis of occurrence data and other safety-related information and supporting information by the Collaborative Analysis Groups (CAGs). These safety issues are formally captured by the Agency and are then subject to a preliminary safety assessment (the safety issues are listed in the Volume III of the EPAS); 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 outputs 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: The safety issues assessed as posing the highest risk to aviation safety are subject to a more detailed Safety Issue Assessment (SIA). The assessment process is led by EASA and is supported by the NoA and the CAGs; this external support is vital to achieving the best possible results. The SIA provides potential mitigating actions for the EPAS and is followed by an impact assessment through the best intervention strategy (BIS) document, defining possible mitigation actions, assessing the implications and benefits of each possible action, and making recommendations on the best mitigation action(s) to be implemented in the EPAS.

Definition and programming of safety actions: Using the combined SIA/BIS, formal EPAS actions proposals are then submitted to the EASA advisory bodies. Once discussed, agreed upon and the required resources secured, the actions are then included in the next version of the EPAS. Prior to publication, the EPAS is approved by the EASA Management Board. Actions that are low-cost or require more rapid intervention are often fast-tracked and appear in the next available update of the EPAS. In some cases, more immediate safety actions are needed that could be completed before the next EPAS is published. Naturally, these are not included within EPAS. Such actions could include the publication of a Safety Information Bulletin (SIB) or take the form of immediate Safety Promotion activities.

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 different types of actions within the EPAS, including research, rulemaking, Member State tasks, safety promotion, and evaluation.

Safety performance measurement: The final stage in the process is 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 SPIs. Tier 1 transversally monitors all the domains and the overview of the performance in each domain. Tier 2 covers the key risk areas at domain level, while Tier 2+ monitors the safety issues. The ASR is the annual review of the Safety Performance Framework and identifies safety trends and highlights priority domains, key risk areas and safety issues. From this step, the SRM process begins again.

Chapter 1
Safety overview

1.1 Global airline fatal accidents

This section covers large aeroplane passenger and cargo operations worldwide. The figures show the contribution of EASA MS operators to the number of global fatal accidents and fatalities. Figure 1.1 shows that the number of fatal accidents in recent years has stabilised since 2020 and that the number of fatal accidents in 2022 is the third lowest in the decade. For the context of these safety figures, it is to be noted that after two years of severe traffic reductions in 2020 and 2021, the aviation industry in Europe experienced, a strong recovery in terms of traffic since summer 2022.

Despite the stabilisation in the number of accidents, the number of fatalities in 2022 has increased compared to 2021 and one fatal accident (a runway incursion of a motorcycle) involving an EASA MS operator led to two fatalities in Guinea this year after an accident-free period of 5 years for European operators. The accident of a Boeing 737-800 on the 21 March 2022 near Wuzhou in China has contributed in 2022 to three-quarters of the total number of fatalities in large aeroplane passenger and cargo operations worldwide.

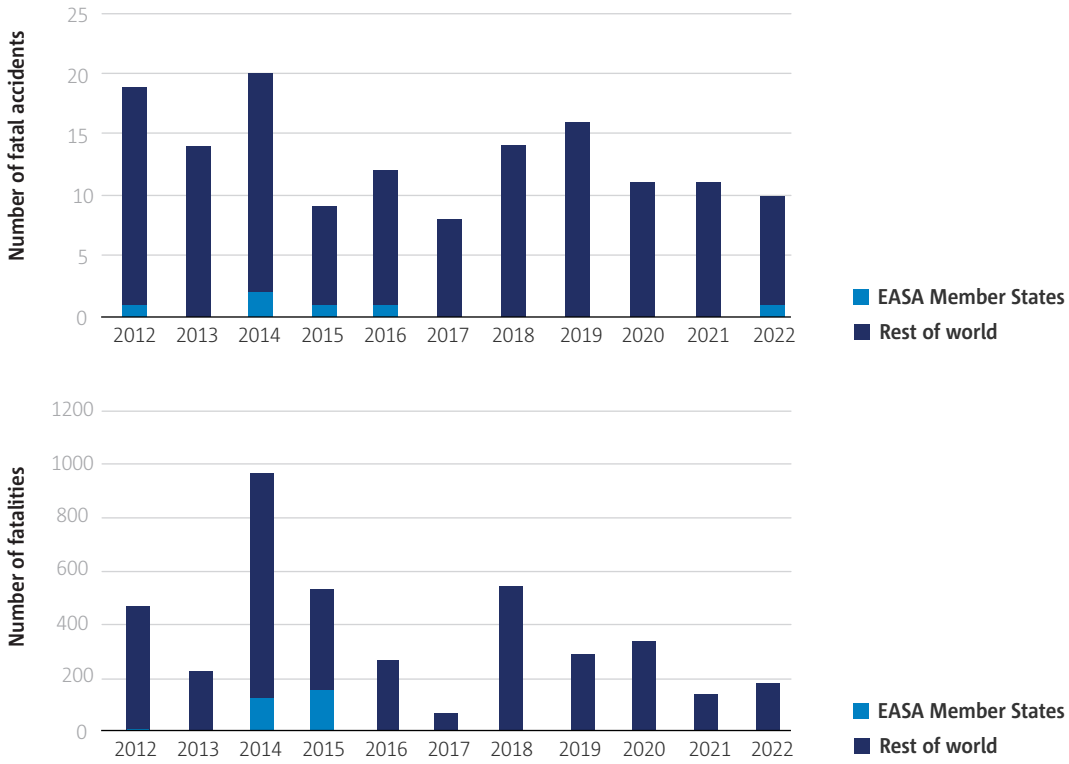


Figure 1.1 Fatal accidents and fatalities involving large aeroplane passenger and cargo operations, EASA Member States and the rest of the world

The definition of an accident is set out in EU law[6] and in Annex 13 to the Convention on International Civil Aviation (Chicago Convention). Although this definition excludes unlawful acts (as stowaway, hijacking, bombs, shot down, etc.), such acts have often been investigated by safety investigation authorities and the management of safety and security risks are increasingly connected. The data presented in Figure 1.2 has been divided to show the fatalities related to accidents and those related to unlawful acts. Whereas accidents have reduced markedly since 1970 and then more slowly in recent years, fatalities related to unlawful acts have re-emerged since 2014.

6 Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC

When focussing on the last decade (2013-2022), the fatalities caused by unlawful acts represent a bit less than a fourth of the total number of fatalities with fortunately an improvement over the last two years since there have been no civil aviation accidents due to unlawful acts during this period. This observation, in conjunction with the current challenges associated with the developing geopolitical situations with numerous conflict zones worldwide, increasingly focuses concern on security matters that require an integrated risk management approach in order to be adequately mitigated.

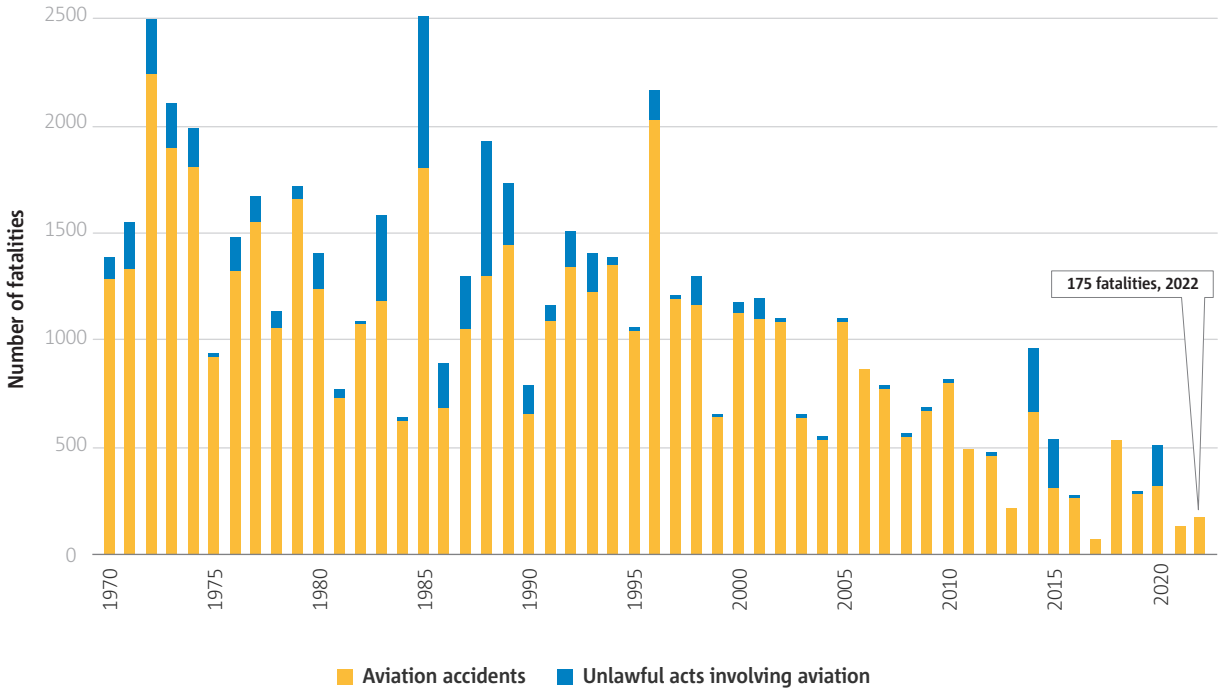


Figure 1.2 Fatalities involving large aeroplane passenger and cargo operations worldwide

The same requirements that define an aviation accident also require that these accidents must be investigated with a view to understanding the causes and preventing similar events in the future. Based on the information from accident reports and from preliminary information where the investigations are ongoing, the fatal accidents between 2018 and 2022 had the following characteristics:

- The most common underlying cause to these accidents is associated to the flight crews' management of challenging circumstances created by technical failures or poor weather conditions, including heavy rains and thunderstorms, during approach. Safety management continues to emerge as an important factor in preventing accidents;
- Aircraft upset, runway excursion and terrain collision remain as the most common accident outcomes. The most common flight phase for fatal accidents is approach and landing, however accidents occurring en-route contribute to more than half of the total number of fatalities;
- The design of safe and effective human-machine interfaces remains a challenge and although progress continues to be made in this area, many aircraft continue to operate with older designs that do not take account of lessons learned from previous accidents;
- Cargo accidents continue to be slightly disproportionately represented in fatal accidents, at approximately 30% of the accidents over the past five years.

1.2 EASA Member States cross domain safety overview

Each domain presented in this review provides the number of fatal accidents and fatalities for 2022 as compared with the preceding ten years, 2012-2021. These figures are consolidated here, to provide a cross-domain safety overview.

In almost all domains, the number of fatal accidents and fatalities was close to the minimum of the preceding decade. The exceptions to this are the commercial helicopter operations and the sailplanes operations which were close or equal to the maximum of the preceding decade, a identified in Table 1.1.

Table 1.1 Cross domain comparison of EASA Member States aircraft fatal accidents and fatalities

AIRCRAFT DOMAIN	FATAL ACCIDENTS 2022	FATAL ACCIDENTS 2012 - 2021 MIN - MAX	FATALITIES 2022	FATALITIES 2012-2021 MIN - MAX	FATALITIES 2012-2021 MEDIAN
AEROPLANES					
CAT operations with complex aeroplanes	1	0 - 2	2	0 - 150	1
CAT operations with aeroplanes other than complex	0	0 – 1 [7]	0	0 – 4 [7]	0 [7]
Non-commercial operations with complex aeroplanes	2	0 - 2	10	0 - 10	0
Specialised operations	3	3 - 11	5	4 - 31	13
Non-commercial operations with aeroplanes other than complex	31	28 - 55	58	58 - 90	82
HELICOPTERS					
Overall	10	5 - 11	24	10 - 30	24
CAT Operations	4	0 - 4	17	0 - 22	6
Specialised Operations	1	0 - 5	1	0 - 11	2
Non-commercial Operations	3	2 - 8	4	1 - 20	7
BALLOONS	2	0 - 3	1	0 - 4	2
SAILPLANES	27	15-31	32	15 - 32	21

7 2014-2021, no data available before 2014 for this operational domain.

A separate table is used for aerodromes and ground handling, and for ATM/ANS[8]. The table includes all fatal accidents and fatalities that happened at aerodromes or in airspace in an EASA MS. Therefore, the infrastructure table not only counts fatal accidents and fatalities that are already in the table for the aircraft chapters, but also some that involved operators or aircraft registered outside of a MS. This is identified in Table 1.2.

Table 1.2 Cross domain comparison of EASA Member States infrastructure fatal accidents and fatalities

INFRASTRUCTURE DOMAIN	FATAL ACCIDENTS 2022	FATAL ACCIDENTS 2012 - 2021 MIN - MAX	FATALITIES 2022	FATALITIES 2012-2021 MIN - MAX	FATALITIES 2012-2021 MEDIAN
AERODROMES AND GROUND HANDLING	0	0 - 3	0	0 - 5	0
AIR TRAFFIC MANAGEMENT & AIR NAVIGATION SERVICES	0	0 - 0	0	0 -0	0

8 For the ATM/ANS domain, the data cannot be compared with the one published in previous ASR as the scope for this domain this year now focuses only on accidents with an ATM/ANS contribution.

The following graphs (Figures 1.3 to 1.6) show the number of fatal accidents, non-fatal accidents and serious incidents for each aircraft domain, while providing a visual comparison. Please note that the scale of the y-axis is not the same for each chart, although they have in some cases been adjusted to make a comparison easier.

Figure 1.3 EASA Member States accidents and serious incidents per year for CAT and non-commercial complex aeroplanes, CAT other than complex aeroplanes, and SPO aeroplanes

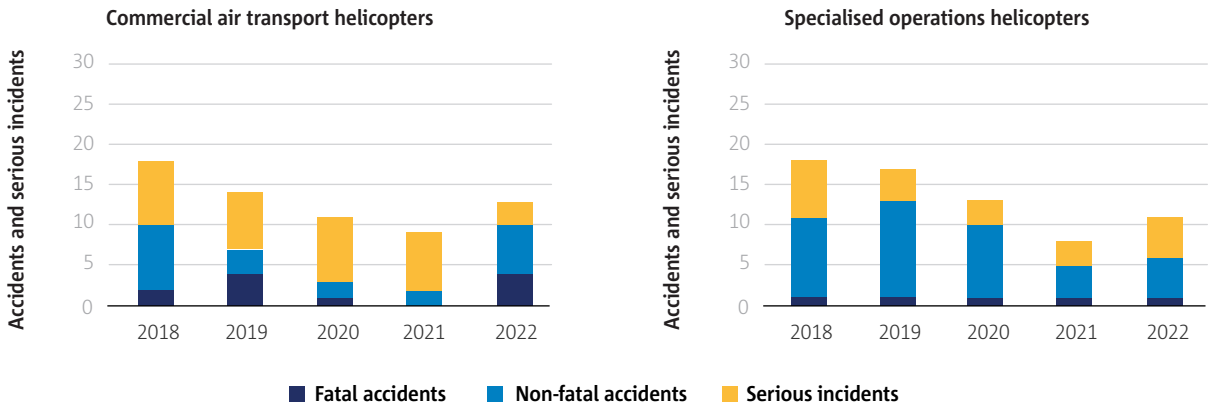


Figure 1.4 EASA Member States accidents and serious incidents per year for CAT helicopters and SPO helicopters

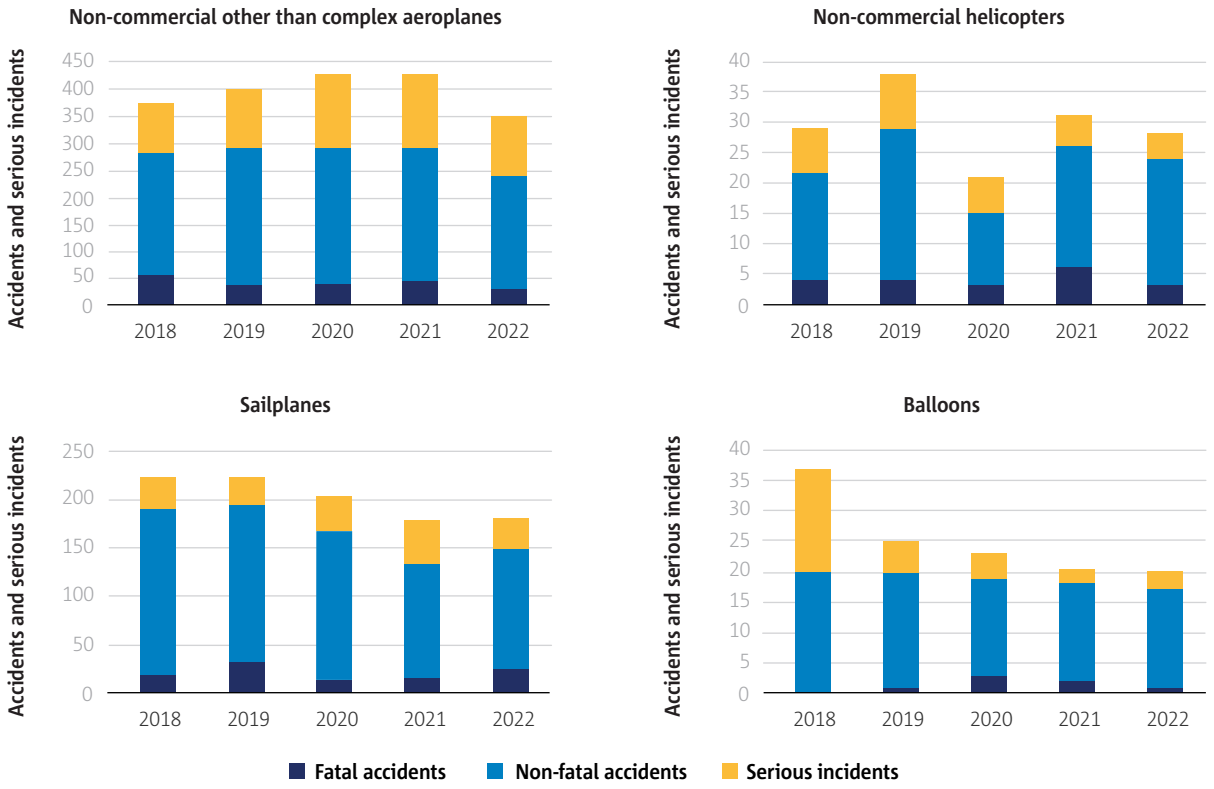


Figure 1.5 EASA Member States accidents and serious incidents per year for non-commercially operated other than complex aeroplanes and helicopters, and all sailplane and balloon operations

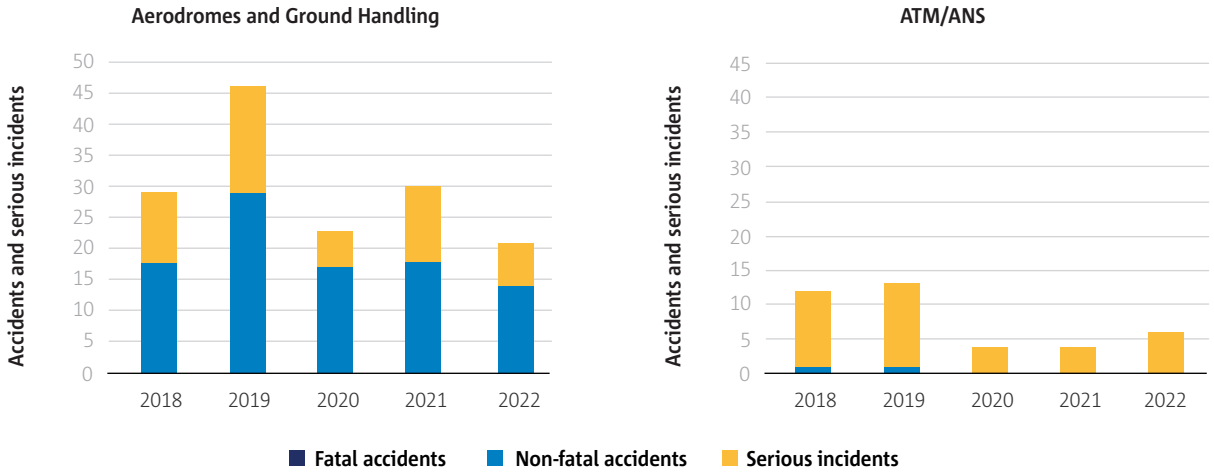


Figure 1.6 EASA Member States infrastructure related accidents and serious incidents per year

Chapter 2
Aeroplanes

This chapter covers aeroplane operations. The chapter is divided into five main sections:

1. Commercial air transport (CAT) passenger and cargo operations conducted by EASA Air Operators Certificate (AOC) holders with complex aeroplanes with a maximum certificated take-off mass exceeding 5700 kg or equipped with (a) turbofan engine(s) or more than one turboprop engine. Examples include airline, air taxi, air ambulance, etc.;
2. CAT passenger and cargo operations conducted by EASA AOC holders with non-complex aeroplanes, having a maximum take-off mass below 5700 kg or not equipped with (a) turbofan engine(s) or more than one turboprop engine. Examples include airline, air taxi, air ambulance, sightseeing, etc.;
3. EASA Member State (MS) registered, or operated complex aeroplanes carrying out non-commercial complex (NCC) operation with a maximum certificated take-off mass exceeding 5700 kg or equipped with (a) turbofan engine(s) or more than one turboprop engine. Examples include business, demonstration, flight training/instructional, relocation, etc.;
4. Specialised operations (SPO) conducted by EASA MS registered aeroplanes or EASA MS AOC holders. Examples include agriculture, aerial advertisement, photography, etc.;
5. Non-commercial operations conducted by EASA MS registered non-complex aeroplanes, having a maximum take-off mass below 5700 kg or not equipped with (a) turbofan engine(s) or more than one turboprop engine, and not covered in the sections above.

The data presented are based on the accidents and serious incidents collected by the Agency under Regulation (EU) 996/2010 on accident and serious incident investigation and Regulation (EU) 376/2014 on occurrence reporting, follow-up, and analysis, and through the active search of those events from other official sources.

For each section, the key statistics, the occurrence categories and the safety risks at the key risk area (KRA) level are presented in the core document. Advanced statistics are then provided per aviation domain in domain-specific appendices, giving an overview of the contributors to the safety risks identified in the core document for these types of operations at the European level. The advanced statistics are solely derived from occurrence data from the EASA occurrence repository and the European Central Repository (ECR).

The list of fatal accidents associated with the scope of this chapter is provided in Appendix 1, as is a list of fatal accidents involving non-certified aeroplanes (Annex I that lists aircraft the operation of which involves low risk for aviation safety).

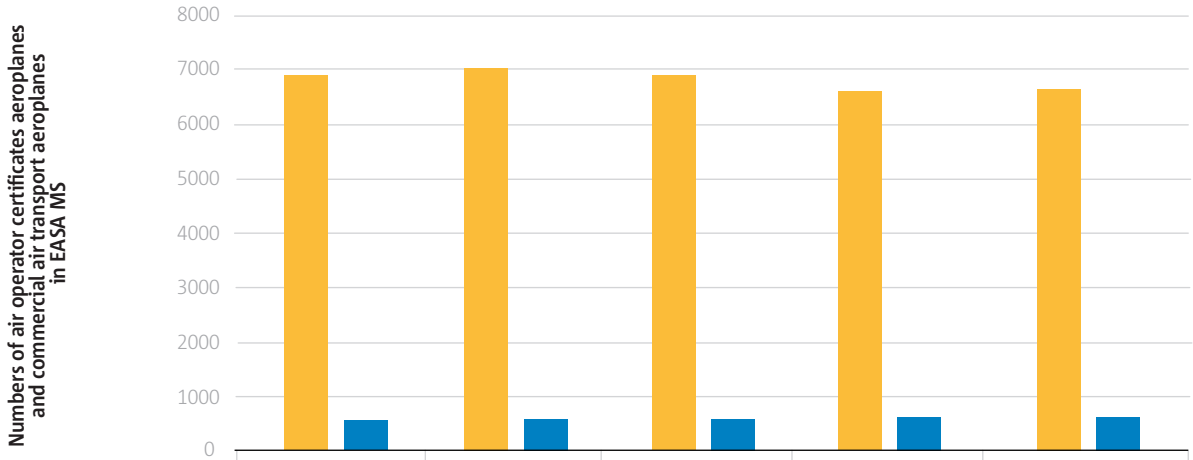
The advanced statistics associated with the scope of this chapter are provided in Appendix 2 – Advanced Statistics Aeroplanes.

2.1 CAT - complex aeroplanes

This section covers the CAT[9] passenger and cargo operations conducted by EASA AOC holders with complex aeroplanes with a maximum certificated take-off mass exceeding 5700 kg or equipped with (a) turbofan engine(s) or more than one turboprop engine. Examples include airline, air taxi, air ambulance, etc.

Numbers of AOC holders and AOC aeroplanes

Figure 2.1 shows the number of AOC holders and the number of commercial air transport aeroplanes within EASA MS. It shows that in 2022, the number of AOC aeroplane holders has slightly dropped in comparison to the previous year but exceeds the numbers of period from 2018 to 2020. The number of Commercial Air Transport (CAT) aeroplanes, after the drop in 2020 and 2021, in 2022 has slightly increased but has still remained below the numbers of the years from 2018 to 2020.



	2018	2019	2020	2021	2022
Aeroplanes (CAT ops)	6904	7017	6883	6593	6623
AOC (A)	603	585	575	635	615

Figure 2.1 Numbers of AOC Aeroplanes and CAT aeroplanes in EASA MS

9 As per REGULATION (EU) 2018/1139 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, 'commercial air transport' means an aircraft operation to transport passengers, cargo or mail for remuneration or other valuable consideration.

Key statistics

The key statistics for this domain are depicted in Table 2.1 and Table 2.2 and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the last year and the 10-year period[10]. It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe. In 2022 there was one fatal accident involving EASA CAT AOC holder. This accident was a collision on the runway with a motorcycle in Guinea, with two fatalities on the ground. The numbers of non-fatal accidents and serious incidents were lower than the average of the previous 10-year period.

Table 2.1 Key statistics for CAT complex aeroplanes

	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**6**	**1**	↑
Non-fatal accidents	**162**	**13**	↓
Serious incidents	**672**	**51**	↓

Table 2.2 Fatalities and serious injuries involving CAT complex aeroplanes

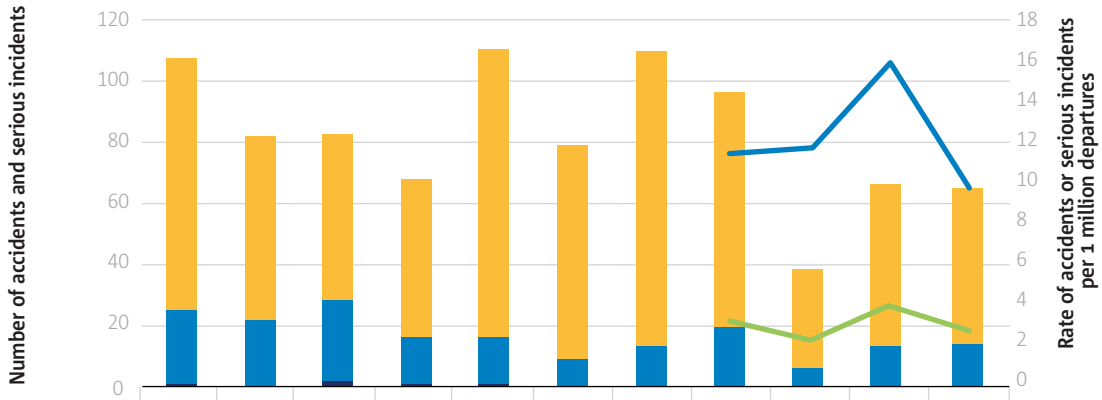
	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**278**	**82**
Yearly max number over 2012-2021	**150**	**17**
Yearly min number over 2012-2021	**0**	**3**
Total number in 2022	**2**	**5**

Figure 2.2 shows that the number of non-fatal accidents in 2022 has remained the same as in the previous year. The number of serious incidents has slightly decreased in comparison with the previous year. The air traffic in 2022 had reached approximately 80% of the 2019 traffic level[11]. These figures should be considered in the context of the recovery from the COVID-19 pandemic and the impact of the Russian Federation's invasion of Ukraine.

Figure 2.2 also shows that the rate of accidents and serious incidents has decreased in 2022. The rates are displayed for years 2019 onwards due to a change in exposure data (number of flights) structure by the data provider. The rate of accidents is now lower than in 2019 and 2021, but higher than in 2020. The rate of serious incidents, which at times bear a higher risk than accidents, is lower than in the three preceding years.

10 On 4 August 2018, a Junker-52 crashed in the Swiss Alps while performing a sightseeing flight resulting in 20 fatalities. Due to the type of aircraft involved (not certified by EASA and an "Annex I aircraft" of Regulation (EU) 2018/1139) and the specific type of operation being carried, this accident has not been included in the statistics of this chapter.

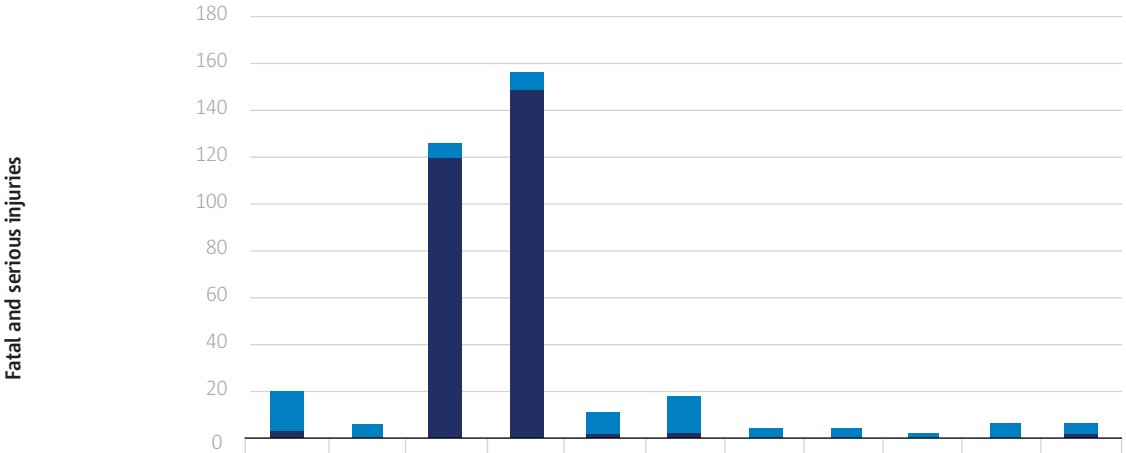
11 Source: EUROCONTROL



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	83	60	55	52	94	70	97	76	32	53	51
Non-fatal accidents	24	22	26	15	15	8	13	20	6	13	13
Fatal accidents	1	0	2	1	1	1	0	0	0	0	1
Serious incident rate								11.5	11.7	15.8	9.6
Accident rate								3.0	2.2	3.9	2.6

Figure 2.2 Numbers and rates of fatal accidents, non-fatal accidents and serious incidents per million departures involving CAT complex aeroplanes

The number of serious injuries, slightly decreased in 2022 and reached the numbers of 2018 and 2019. Injuries in 2022 were attributable to passengers being injured during disembarkation by falling from the stairs, and encounters with turbulence during flight. The number of fatalities per year relates to the operation type (passenger or cargo), size and occupancy of the aeroplane involved in the accident. Two fatalities were sustained by persons on a motorcycle after a collision on the runway in Guinea.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	17	7	7	7	9	15	5	5	3	7	5
Fatalities	3	0	120	150	2	3	0	0	0	0	2

Figure 2.3 Fatal and serious injuries per year involving CAT complex aeroplanes

Occurrence categories

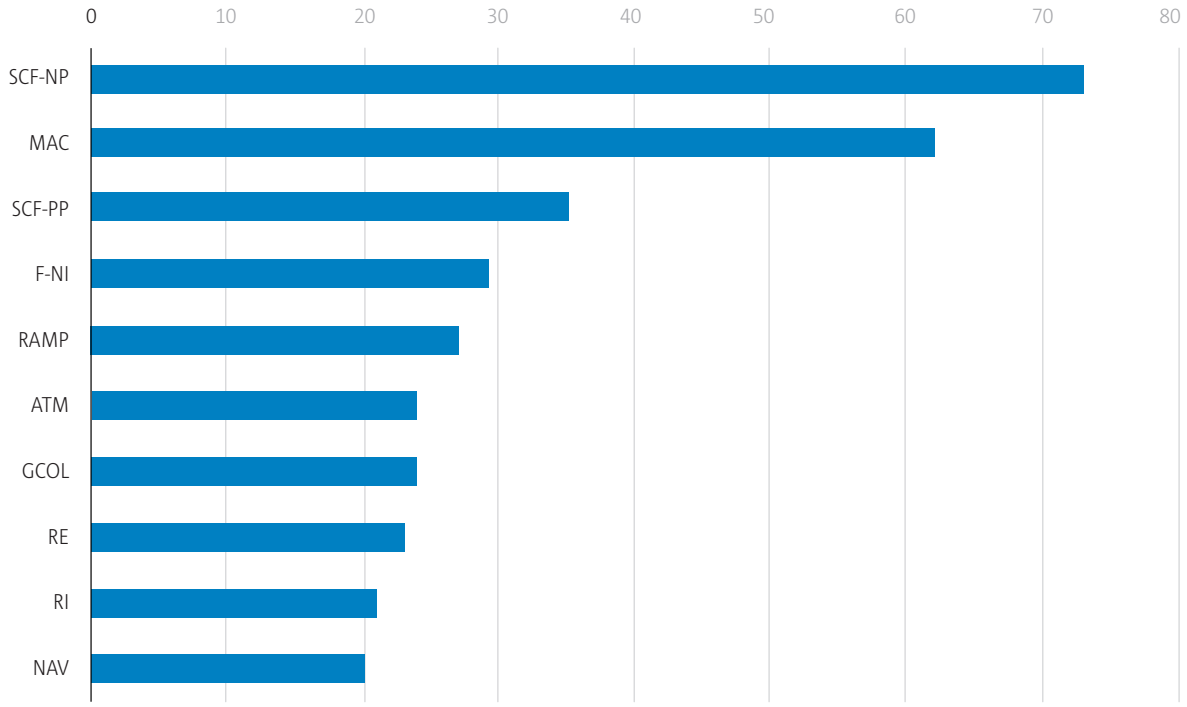
Figure 2.4 outlines the top 10 categories assigned to the accidents and serious incidents in the past five years. Occurrences are categorised using the ICAO Accident Incident Data Reporting (ADREP) taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed.

Categories are of different natures, for example:

- Operational such as low altitude operations (LALT);
- Environmental such as turbulence encounter (TURB);
- Technical such as system/ component failure or malfunction [non-powerplant] (SCF-NP):
- Consequential such as fire/ smoke resulting from impact (F-POST); etc.

Multiple categories may therefore be assigned to a single occurrence. For example, if an engine failure occurred, and loss of control followed, the occurrence would be coded in both categories, i.e., SCF-PP: powerplant failure or malfunction and LOC-I: loss of control in flight. The sum of the numbers of occurrences per category may therefore be greater than the total number of occurrences that were realised in the period.

In the period of 2018-2022, the highest number of accidents and serious incidents were system component failure related, followed by mid-air collision, and system component failure - powerplant categories.

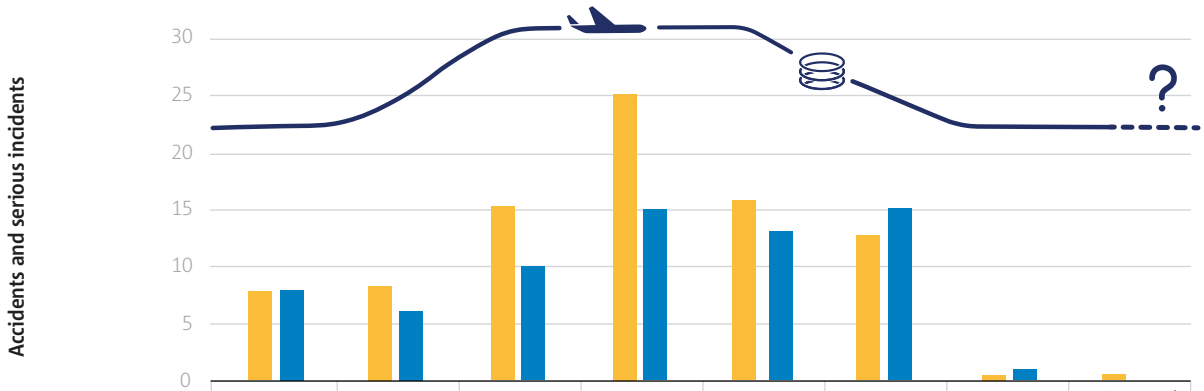


SCF-NP: System/component failure or malfunction [non-powerplant]; MAC: Airprox/ ACAS alert/ loss of separation/(near) mid-air collisions; SCF-PP: powerplant failure or malfunction; F-NI: Fire/ smoke (non-impact); RAMP: Ground handling; ATM: ATM/ CNS; GCOL: Ground collision; RE: Runway excursion; RI: Runway incursion - vehicle, aircraft or person; NAV: Navigation error

Figure 2.4 Numbers of occurrences by occurrence category involving commercial air transport complex aeroplanes

Phase of flight

The numbers for 2022 in Figure 2.5 show a distribution of accidents and serious incidents per flight phase with a greater number during en-route and landing, approach, and take-off. The number of accidents and serious incidents during landing, critical phase of flight, in 2022 was higher than the 2012-2021 average. In 2022 accidents and serious incidents during the standing and tow phases were slightly above the average. The unknown/ blank flight phase corresponds to those occurrences where no data was available, and it normally relates to the second aircraft in some of the occurrences.

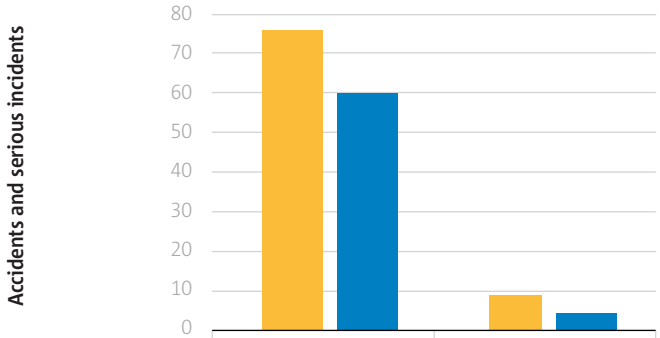


	Standing	Taxi	Take-off	En route	Approach	Landing	Tow	Unknown/ Blank
Average 2012-2021	7.8	8.2	15.2	25.2	15.8	12.7	0.5	0.4
2022	8	6	10	15	13	15	1	0

Figure 2.5 Accidents and serious incidents by phase of flight involving CAT complex aeroplanes

Operation type

Figure 2.6 compares the number of accidents and serious incidents per operation type (passenger and cargo), showing the figures for the last year compared with the previous 10-year average. In 2022, like in 2020 and 2021, the number of occurrences for passenger flight operations remained below the 10-year average. The number of accidents and serious incidents for cargo flights was lower than the 10-year average.

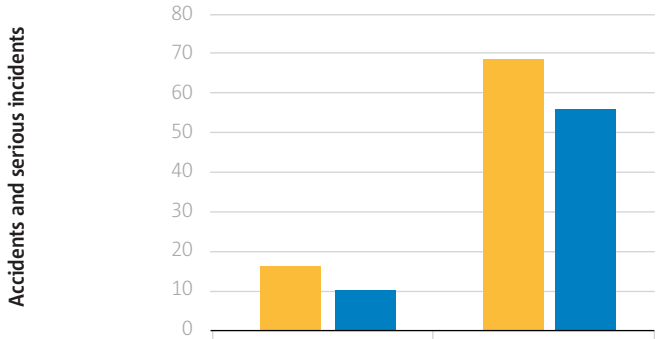


	Passenger	Cargo
Average 2012-2021	75.8	8.6
2022	60	4

Figure 2.6 Accidents and serious incidents by operation type involving CAT complex aeroplanes

Propulsion type

Figure 2.7 shows the distribution by propulsion type for the last year compared with the previous 10-year average. The figure shows a similar pattern between the 2022 figures and the 2012-2021 average figure, although the absolute numbers are lower in 2022 compared with the 10-year average (2012-2021). The split between turbofan and turboprop is consistent with the aircraft fleet sizes and utilisation.



	Turboprop	Turbofan
Average 2012-2021	16.2	68.8
2022	10	56

Figure 2.7 Accidents and serious incidents by propulsion type involving CAT complex aeroplanes

2.2 CAT - other than complex aeroplanes

This section covers the safety performance of CAT passenger and cargo operations conducted by EASA AOC holders with non-complex aeroplanes, having a maximum take-off mass below 5 700 kg or not equipped with (a) turbofan engine(s) or more than one turboprop engine. Examples include airline, air taxi, air ambulance, sightseeing, etc. This is a new section that was introduced in this year's annual safety review. Due to data availability for this domain, it covers the period from 2014 to 2022.

Key statistics

The key statistics for this domain are in the tables below and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the last year and the previous 8-year period. Also included is a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

In 2022 there was no fatal accident involving EASA CAT AOC holder operating non-complex aeroplanes. The numbers of non-fatal accidents and serious incidents were higher than the average of the previous 8-year period.

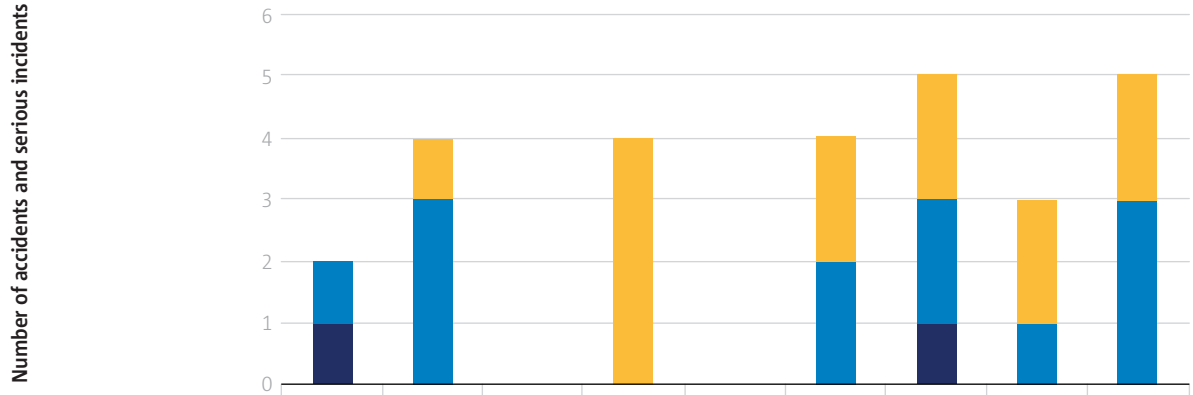
Table 2.3 Key statistics for CAT other than complex aeroplanes

	Total number of occurrences per occurrence class over 2014-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2014-2021 per occurrence class
Fatal accidents	**2**	**0**	↓
Non-fatal accidents	**9**	**3**	↑
Serious incidents	**11**	**2**	↑

Table 2.4 Fatalities and serious injuries involving CAT other than complex aeroplanes

	Number of fatalities	Number of serious injuries
Total number over 2014-2021	**6**	**4**
Yearly max number over 2014-2021	**4**	**4**
Yearly min number over 2014-2021	**2**	**0**
Total number in 2022	**0**	**2**

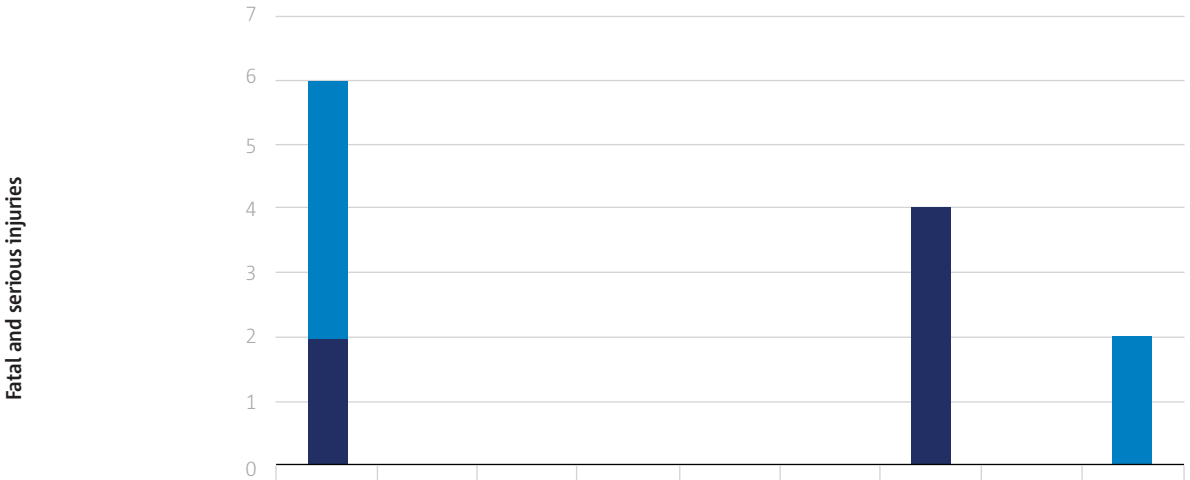
Figure 2.8 shows that the number of non-fatal accidents in 2022 has increased, when compared with the previous year and has reached the level of 2015. The number of serious incidents has remained the same as in 2019, 2020 and 2021.



	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	0	1	0	4	0	2	2	2	2
Non-fatal accidents	1	3	0	0	0	2	2	1	3
Fatal accidents	1	0	0	0	0	0	1	0	0

Figure 2.8 Numbers and rates of fatal accidents, non-fatal accidents and serious incidents per million departures involving CAT other than complex aeroplanes

The number of serious injuries, increased in 2022 but was still below the level of 2014. Two serious injuries in 2022 were attributable to persons on board being injured during the crash of a sightseeing flight.



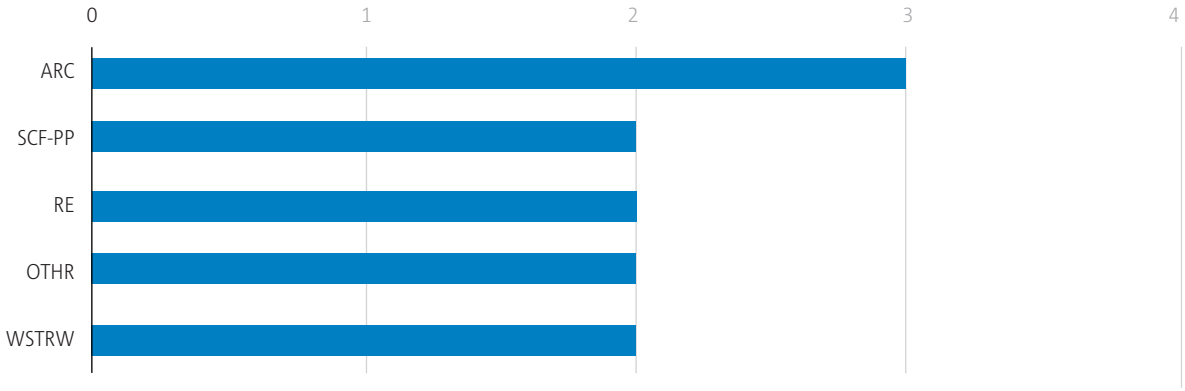
	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious injuries	4	0	0	0	0	0	0	0	2
Fatalities	2	0	0	0	0	0	4	0	0

Figure 2.9 Fatal and serious injuries per year involving CAT other than complex aeroplanes

Occurrence categories

Figure 2.10 outlines the top 5 categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the ICAO ADREP taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed.

In the period of 2018-2022 the highest number of accidents and serious incidents were abnormal runway contact related.

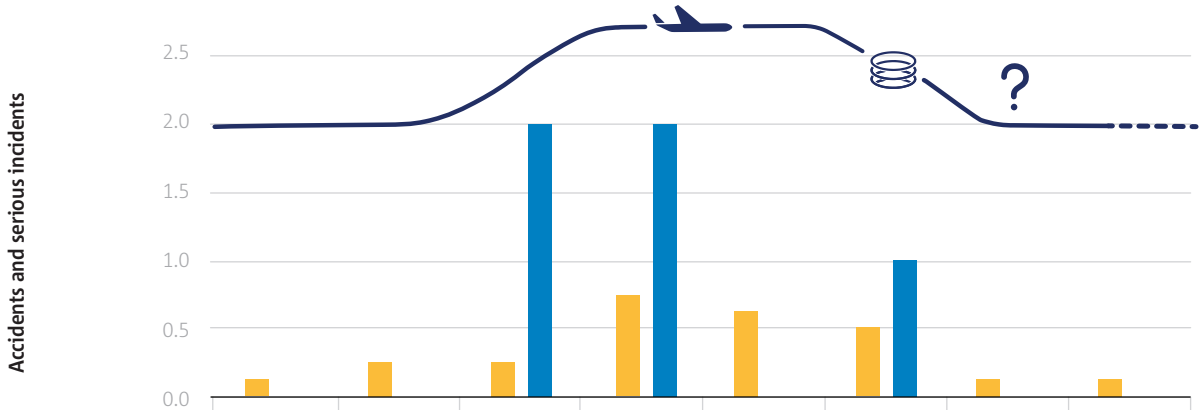


ARC: Abnormal runway contact; SCF-PP: powerplant failure or malfunction; RE: Runway excursion; OTHR: Other; WSTRW: Windshear or thunderstorm

Figure 2.10 Numbers of occurrences by occurrence category involving CAT other than complex aeroplanes

Phase of flight

The low numbers in this domain do not allow any comparison in terms of flight phase. However, the data are still presented for information in Figure 2.11.

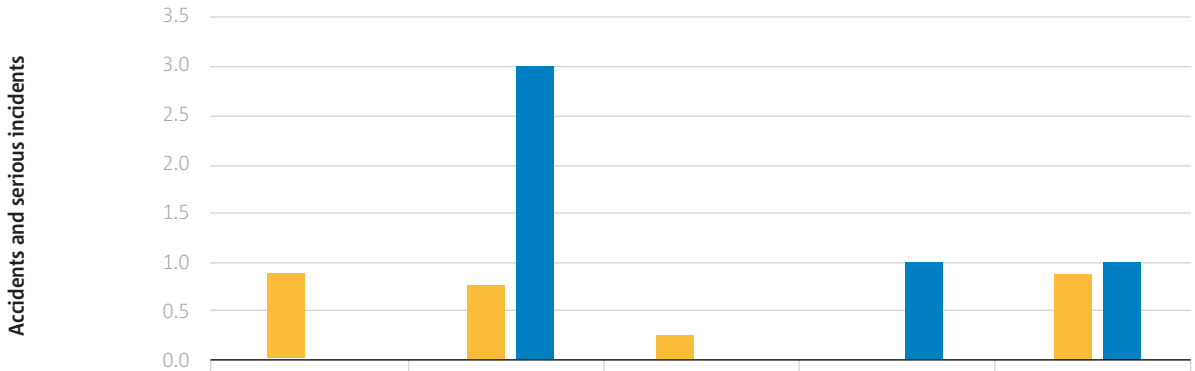


	Standing	Taxi	Take-off	En route	Approach	Landing	Unknown	Blank
Average 2014-2021	0.1	0.3	0.3	0.8	0.6	0.5	0.1	0.1
2022	0	0	2	2	0	1	0	0

Figure 2.11 Accidents and serious incidents by phase of flight involving CAT other than complex aeroplanes

Operation type

Figure 2.12 compares the number of accidents and serious incidents per operation type (passenger and cargo), showing the figures for the last year compared with the previous 8-year average. In 2022 majority of accidents and serious incidents occurred during the sightseeing flights.

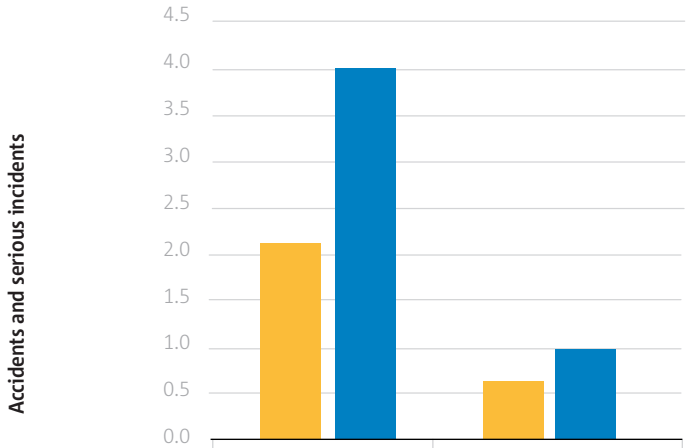


	Air Taxi	Sightseeing	Air Ambulance	Airline	Blank
Average 2014-2021	0.9	0.8	0.3	0	0.9
2022	0	3	0	1	1

Figure 2.12 Accidents and serious incidents by operation type involving CAT other than complex aeroplanes

Propulsion type

The low numbers in this domain do not allow any comparison between the two main propulsion types. However, the data are still presented for information in Figure 2.13.



	Reciprocating	Turboprop
Average 2014-2021	2.1	0.6
2022	4	1

Figure 2.13 Accidents and serious incidents by propulsion type involving CAT large aeroplanes

2.3 NCC aeroplanes

This section covers the safety performance of EASA MS registered, or operated complex aeroplanes operating NCC with a maximum certificated take-off mass exceeding 5700 kg or equipped with (a) turbofan engine(s) or more than one turboprop engine. Examples include business, demonstration, flight training/instructional, relocation, etc.

Key statistics

The key statistics for this domain are in the tables below and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the last year and the previous 10-year period. Also included is a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

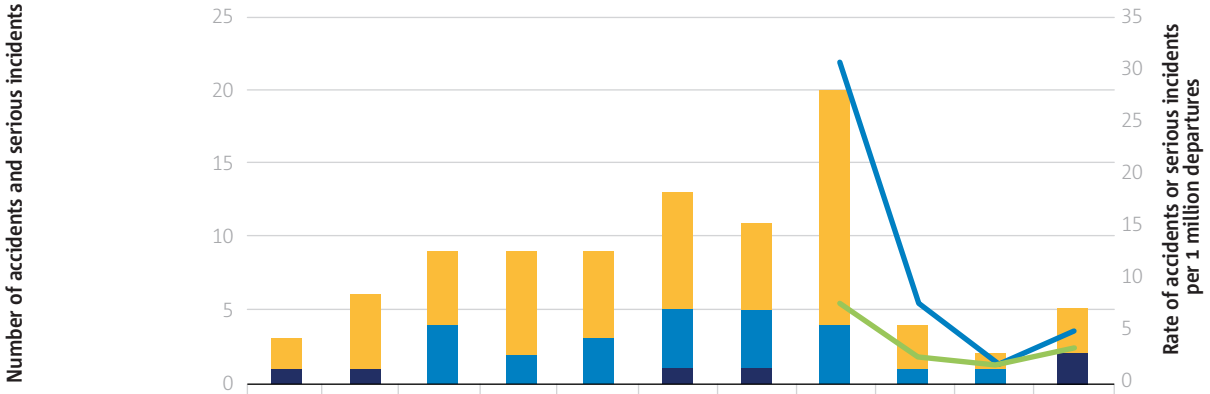
Table 2.5 Key statistics for non-commercial complex aeroplanes

	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**4**	**2**	↑
Non-fatal accidents	**23**	**0**	↓
Serious incidents	**59**	**3**	↓

Table 2.6 Fatalities and serious injuries involving NCC aeroplanes

	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**7**	**3**
Yearly max number over 2012-2021	**4**	**2**
Yearly min number over 2012-2021	**0**	**0**
Total number in 2022	**10**	**0**

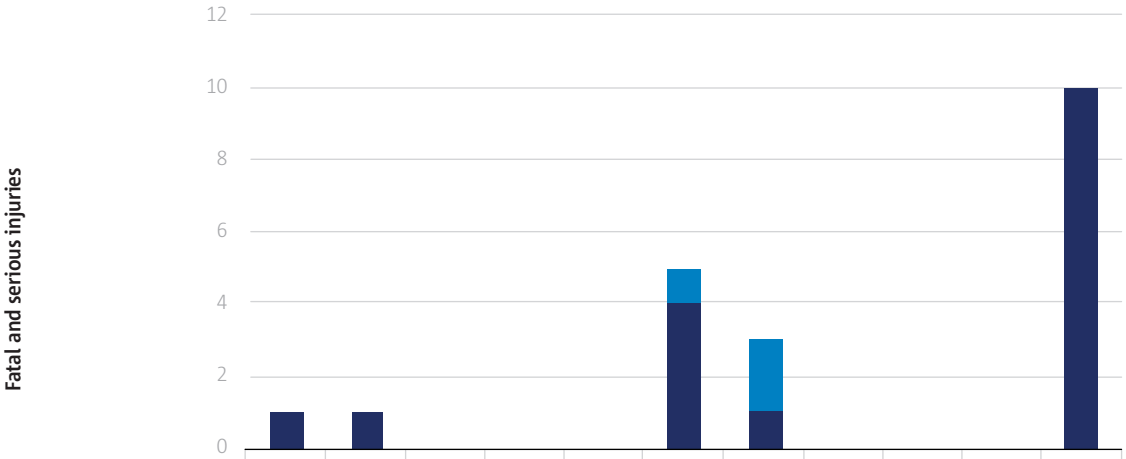
Figure 2.14 shows that during 2022, there were two fatal accidents involving an EASA MS registered NCC aeroplane. CESSNA – 551 crashed in the Baltic sea with four fatalities, and PIAGGIO - P180 - AVANTI II crashed in the sea of the coast of Costa Rica resulting in six fatalities.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	2	5	5	7	6	8	6	16	3	1	3
Non-fatal accidents	0	0	4	2	3	4	4	4	1	1	0
Fatal accidents	1	1	0	0	0	1	1	0	0	0	2
Serious incident rate								30.8	7.5	1.8	5.0
Accident rate								7.7	2.5	1.8	3.4

Figure 2.14 Fatal accidents, non-fatal accidents and serious incidents per year involving NCC aeroplanes

The number of fatalities and serious injuries per year is shown in Figure 2.15. In 2022 there were 10 fatalities that is the highest number when compared with the previous 10-year period (2012-2021).



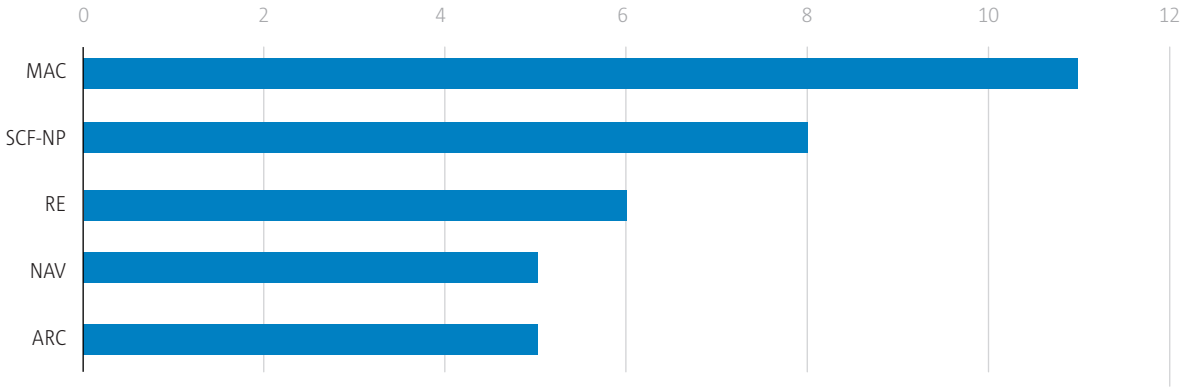
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	0	0	0	0	0	1	2	0	0	0	0
Fatalities	1	1	0	0	0	4	1	0	0	0	10

Figure 2.15 Fatal and serious injuries per year involving NCC aeroplanes

Occurrence categories

Figure 2.16 outlines the top 5 categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the ICAO ADREP taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed.

In the period of 2018-2022 the highest number of accidents and serious incidents were mid-air collision occurrence category related, Followed by system component failure or malfunction - non-powerplant.

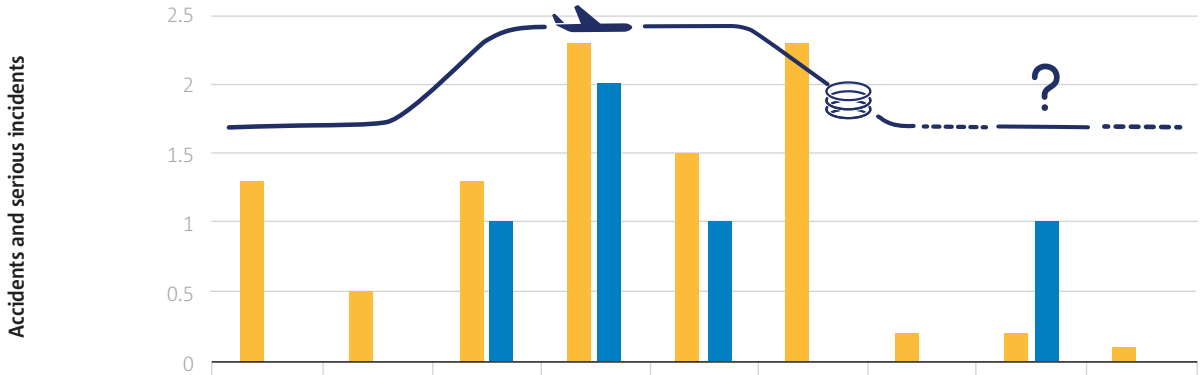


MAC: Airprox/ ACAS alert/ loss of separation/ (near) mid-air collisions; SCF-NP: System/component failure or malfunction [non-powerplant]; RE: Runway excursion; NAV: Navigation error; ARC: Abnormal runway contact

Figure 2.16 Numbers of occurrences by occurrence category involving NCC aeroplanes

Phase of flight

The low numbers in this domain do not allow any comparison in terms of flight phase. However, the data are still presented for information in Figure 2.17.

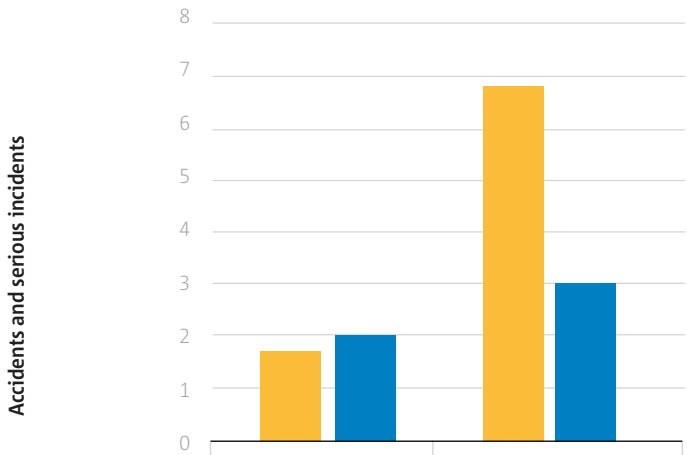


	Standing	Taxi	Take-off	En route	Approach	Landing	Manoeuvring	Unknown	Blank
Average 2012-2021	1.3	0.5	1.3	2.3	1.5	2.3	0.2	0.2	0.1
2022	0	0	1	2	1	0	0	1	0

Figure 2.17 Accidents and serious incidents by phase of flight involving NCC aeroplanes

Propulsion type

The low numbers in this domain do not allow any comparison between the two main propulsion types. However, the data are still presented for information in Figure 2.18.



	Turboprop	Turbofan
Average 2012-2021	1.7	7
2022	2	3

Figure 2.18 Accidents and serious incidents by propulsion type involving NCC aeroplanes

2.4 Safety risks for CAT and NCC aeroplanes

CAT complex aeroplanes and NCC aeroplanes are covered by a single portfolio due to the similarity of the main risk areas for aircraft operated, as well as the small amount of data available for NCC.

The key risk areas (KRAs) for CAT and NCC aeroplanes are shown in Figure 2.19.

KRAs and occurrence categories (refer to Figure 2.4 and Figure 2.16) have different purposes. While occurrence categories describe actual factors and outcomes of an occurrence, KRAs describe the potential outcome of an occurrence. The KRA is defined by the most likely type of accident that an occurrence could have escalated to. Unlike occurrence categories, where multiple categories may be assigned to a single occurrence, there can only be one KRA per occurrence. The KRA is one element of the European Risk Classification Scheme (ERCS). This scheme is applied when determining the safety risk score of an occurrence and is further detailed in the ASR introduction.

The risk picture by KRAs has retained the airborne collision as the highest KRA, when compared to the previous year. However, there are some corrections for the following KRAs, namely, collision on runway and aircraft upset have now higher aggregated risk score than runway excursion. This means that risks associated with aircraft upset have increased for the domain. The reasons for this can be explained by the moving period of included data set – being five-years and nature of accidents and serious incidents that occurred within this period.

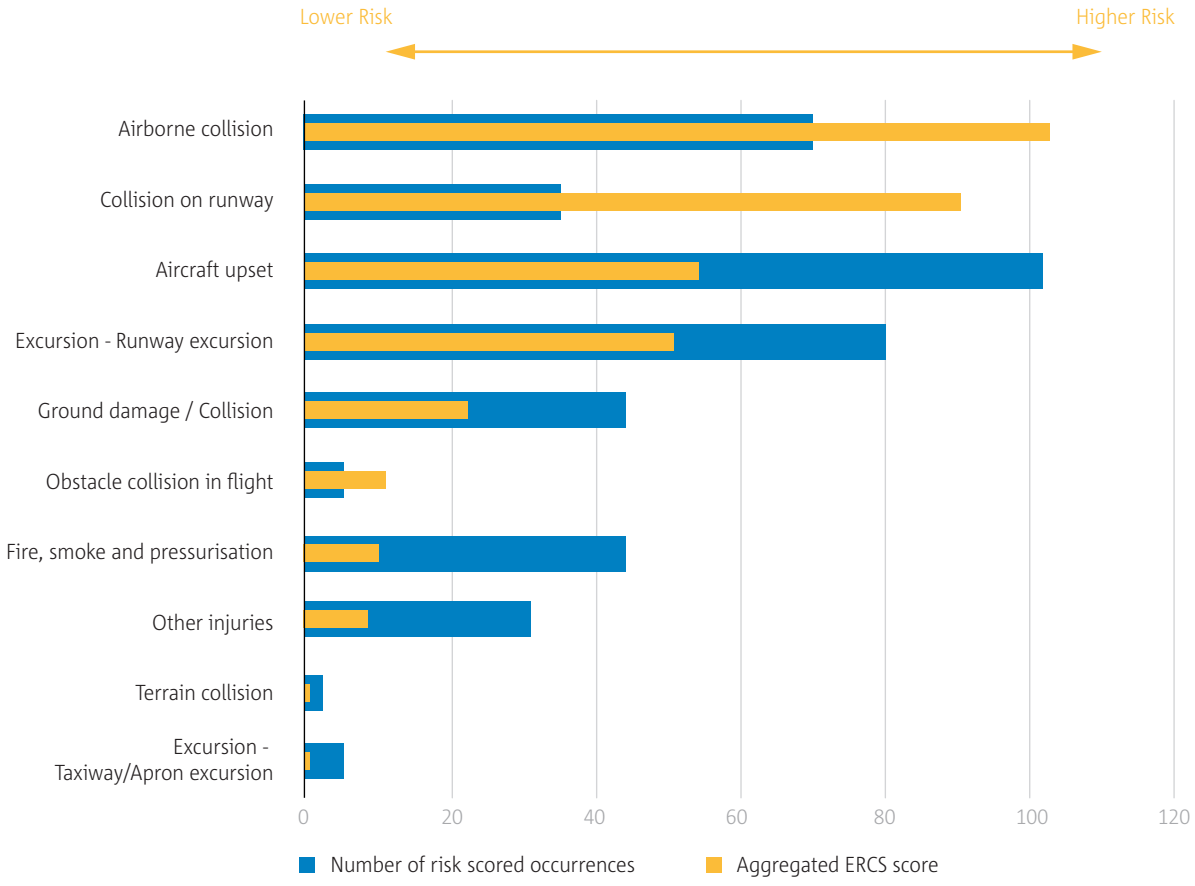


Figure 2.19 KRAs by aggregated ERCS score and number of risk-scored occurrences involving CAT large aeroplanes and NCC aeroplanes

As illustrated in Figure 2.19, the higher-risk KRAs are:

- **Airborne collision** includes all occurrences involving actual or potential airborne collisions between aircraft, while both aircraft are airborne, and between aircraft and other airborne objects (excluding birds and wildlife). In 2022 the highest risk contributors were occurrences such as a loss of separation, and TCAS resolution advisories cases. This KRA is mainly managed through safety issues identified in the ATM/ANS safety risk portfolio.
- **Collision on runway** includes occurrences involving collisions or near-collisions between an aircraft and another object (other aircraft, vehicles, etc.) or person that occurs on a runway of an aerodrome or other predesignated landing area. It does not include collisions with birds or wildlife. In 2022 the highest risk contributors were occurrences involving loss of separation between two airliners, one landing and departing one still being on the runway, runway incursion by motorcycle leading to collision and fatalities on ground, aircraft landing on the wrong runway, unsafe ATC clearance related, and runway incursion by large aeroplane while take-off is in progress. This KRA is mainly managed through safety issues identified in the ATM/ANS and the Aerodromes and Ground handling safety risk portfolios.
- **Aircraft upset** includes an undesired aircraft state characterised by unintentional divergences from parameters normally experienced during operations, which might ultimately lead to an uncontrolled impact with terrain. In 2022 the highest risk contributing occurrences were aircraft operating a pleasure flight crashing into the sea, unstable approach and difficulties in controlling the aircraft after missed approach (both pilots making simultaneous inputs to the flight controls), partial electrical failure and control difficulties during approach, and broken aileron cable requiring abnormal control inputs to keep wings level.
- **Runway excursion** includes all occurrences involving actual or potential situations when an aircraft leaves the runway or movement area of an aerodrome or landing surface of any other predesignated landing area, without getting airborne. In 2022 the highest risk contributors were occurrences involving the actual runway excursions related with unstable approaches, poor runway surface condition, adverse weather conditions, and hard landings.

2.5 SPO aeroplanes

The scope of this section covers SPO involving aeroplanes of all mass categories having an EASA MS as state of registry or state of operator.

Key statistics

The key statistics for this domain are in Table 2.7 and Table 2.8 and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the last year and the previous 10-year period. It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

The cumulated number of fatal accidents, non-fatal accidents and serious incidents in 2022 remained below the average of the preceding decade for each occurrence class. From the three fatal accidents in 2022, two of them occurred during glider towing operations after emergency release of the glider, the other one during parachute operations after the skydivers exited the aeroplanes. The numbers of fatalities and serious injuries in 2022 were close to the minimum values of the preceding decade.

Table 2.7 Key statistics for SPO aeroplanes

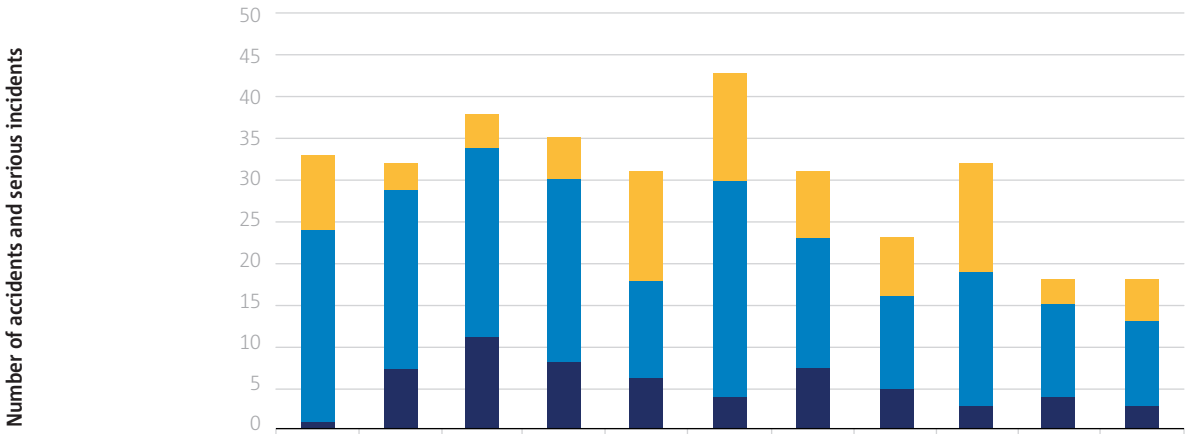
	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**56**	**3**	↓
Non-fatal accidents	**182**	**10**	↓
Serious incidents	**78**	**5**	↓

Table 2.8 Fatalities and serious injuries involving CAT complex aeroplanes

	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**128**	**61**
Yearly max number over 2012-2021	**31**	**16**
Yearly min number over 2012-2021	**4**	**1**
Total number in 2022	**5**	**2**

The number of accidents and serious incidents per year is shown in Figure 2.20.

Except 2012, where only one fatal accident was recorded, the number of fatal accidents in 2022 was equal to the minimum values of the preceding decade. The number of serious incidents in 2022 was close to the number in 2021. The number of non-fatal accidents in 2022 was lower than in all years in the preceding decade. As in all years of the preceding decade, the number of non-fatal accidents is higher than the number of serious incidents and the number of fatal accidents in 2022.

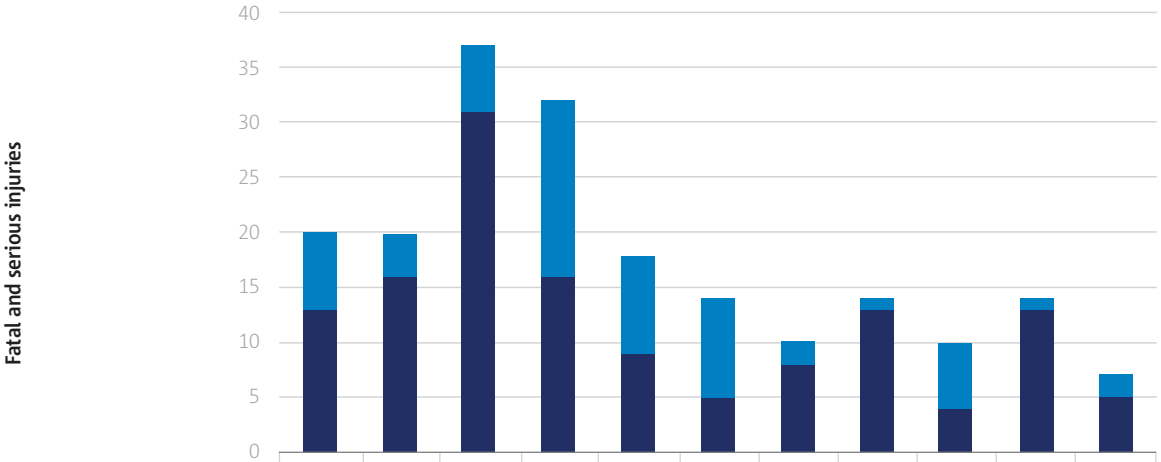


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	9	3	4	5	13	13	8	7	13	3	5
Non-fatal accidents	23	22	23	22	12	26	16	11	16	11	10
Fatal accidents	1	7	11	8	6	4	7	5	3	4	3

Figure 2.20 Fatal accidents, non-fatal accidents and serious incidents per year involving SPO aeroplanes

The number of fatalities and serious injuries per year is shown in Figure 2.21.

The numbers of fatalities and serious injuries in 2022 are close to the lowest numbers of the preceding decade, most recently recorded in 2020 for the number of fatalities and in 2021 for the number of serious injuries. The number of serious injuries in 2022 is low in relation to the number of non-fatal accidents. Seven of the ten non-fatal accidents resulted in substantial damage to the aircraft with minor or no injuries. In two other non-fatal accidents, the aircraft was destroyed, one accident resulting in one serious injury, the other in a minor injury. The last non-fatal accident resulted in runway excursion, with unknown damage to the aircraft, and no injuries.



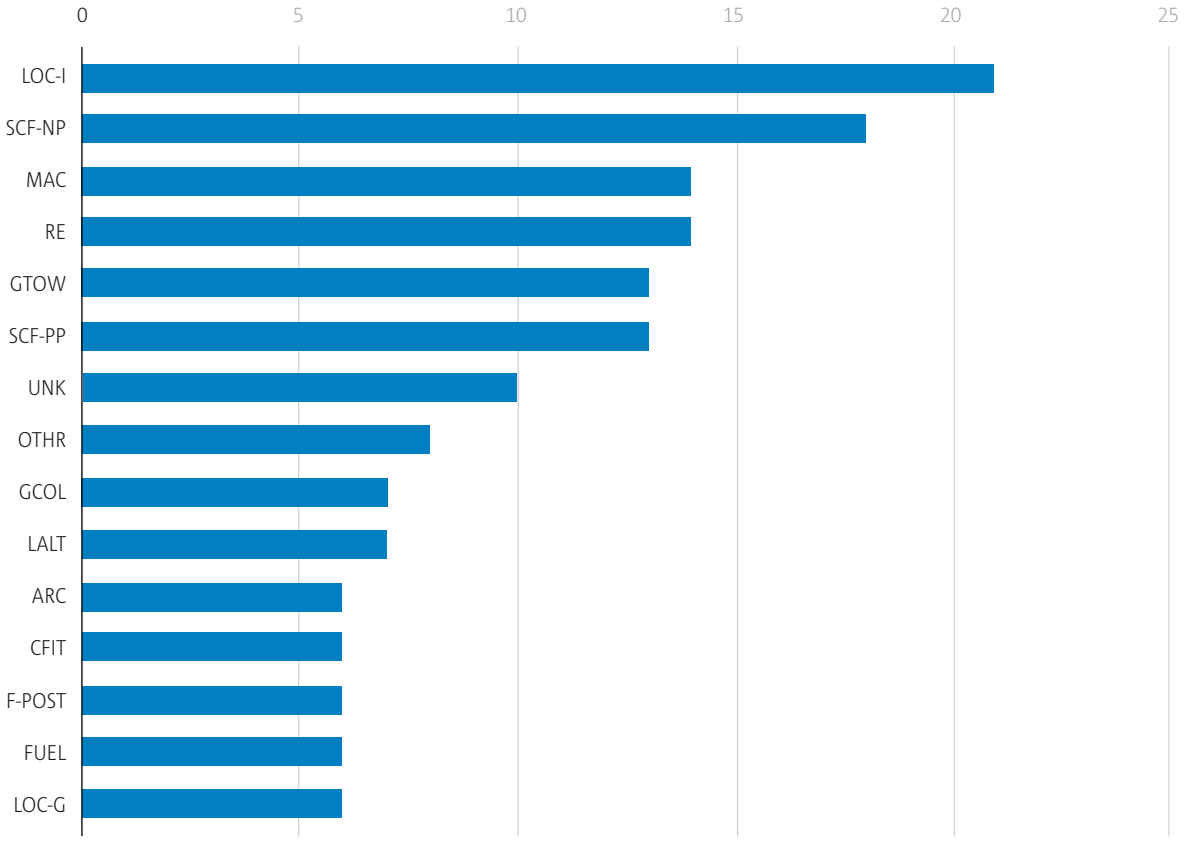
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	7	4	6	16	9	9	2	1	6	1	2
Fatalities	13	16	31	16	9	5	8	13	4	13	5

Figure 2.21 Fatal and serious injuries per year involving SPO aeroplanes

Occurrence categories

Figure 2.22 outlines the top 15 categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the ICAO ADREP taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed.

For the period 2018-2022, there were 122 serious incidents and accidents involving SPO aeroplanes. The occurrence category LOC-I: loss of control in flight was assigned to 21 serious incidents and accidents, amongst which ten resulted in fatalities. While being assigned to 18 serious incidents and accidents, the occurrence category SCF-NP: System/component failure or malfunction [non-powerplant] did not contribute to any fatal accident. The occurrence categories MAC: Airprox/ ACAS alert/ loss of separation/ (near) mid-air collisions and RE: Runway excursion were both assigned to 14 serious incidents and accidents. While the occurrence category MAC: Airprox/ ACAS alert/ loss of separation/ (near) mid-air collisions was involved in two fatal accidents that occurred during parachute operations, the occurrence category RE: Runway excursion was only involved in serious incidents and non-fatal accidents. Five of the 13 serious incidents and accidents, where the occurrence category GTOW: Glider towing related events was assigned, resulted in fatalities. No fatalities were recorded for the serious incidents and accidents which the occurrence category SCF-PP: powerplant failure or malfunction contributed to.



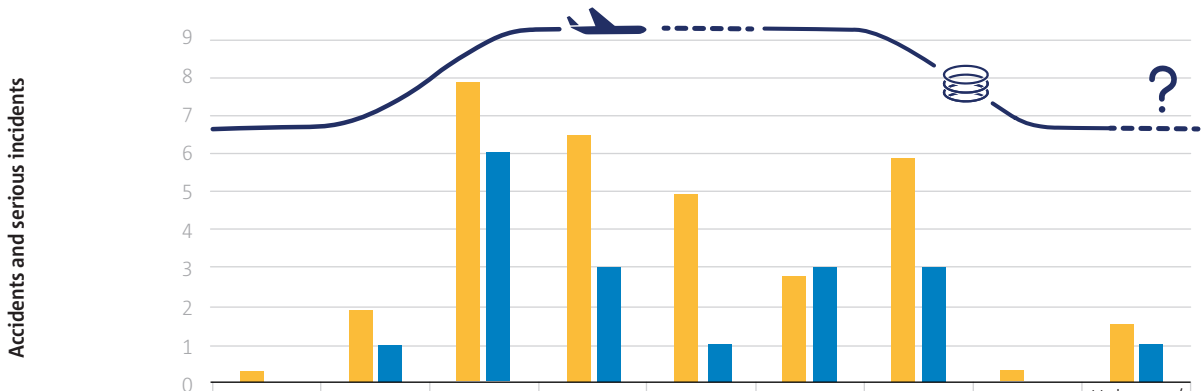
LOC-I: Loss of control - inflight; SCF-NP: System/ component failure or malfunction [non-powerplant]; MAC: Airprox/ ACAS alert/ loss of separation/ (near) mid-air collisions; RE: Runway excursion; GTOW: Glider towing related events; SCF-PP: powerplant failure or malfunction; UNK: Unknown or undetermined; OTHR: Other; GCOL: Ground collision; LALT: Low altitude operations; ARC: Abnormal runway contact; CFIT: Controlled flight into or toward terrain; F-POST: Fire/smoke (post-impact); FUEL: Fuel related; LOC-G: Loss of control - ground

Figure 2.22 Numbers of occurrences by occurrence category involving SPO aeroplanes

Phase of flight

Figure 2.23 shows the distribution of accidents and serious incidents by flight phase.

The numbers of serious incidents and accidents in 2022 were lower than the average of the preceding decade for all flight phases except approach. In 2021, 12 out of the 18 accidents and serious incidents occurred at take-off, during approach or at landing.



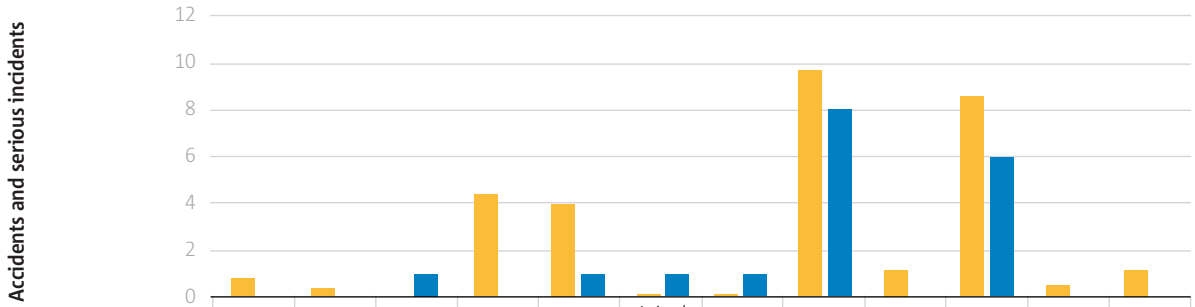
	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Tow	Unknown/ Blank
Average 2012-2021	0.3	1.9	7.9	6.5	4.9	2.8	5.9	0.3	1.5
2022	0	1	6	3	1	3	3	0	1

Figure 2.23 Accidents and serious incidents by phase of flight involving SPO aeroplanes

Operation type

Figure 2.24 shows the number of accidents and serious incidents by SPO.

In 2022 the number of accidents and serious incidents were equal or lower than the average of the preceding decade for all operation types except aerial survey, animal herding/ mustering, and calibration operations. In 2022, 14 out of the 18 serious incidents and accidents were in parachute drop and sailplane towing operations. There were no accidents or serious incidents in aerial advertising, aerial observation, agricultural, and photography operations.



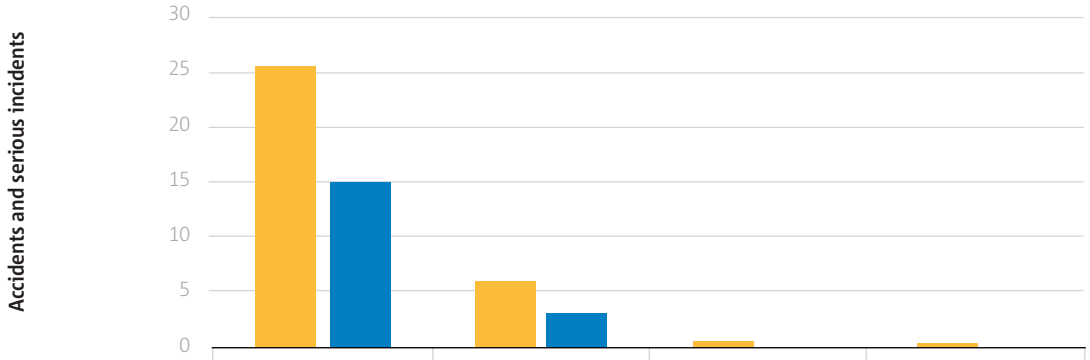
	Aerial advertising	Aerial observation	Aerial survey	Agri-cultural	Airshow /race	Animal herding/ mustering	Calibration	Parachute drop	Photo-graphy	Sailplane towing	Other	Unknown / Blank
Average 2012-2021	0.8	0.4	0	4.4	4	0.1	0.1	9.7	1.2	8.6	0.5	1.2
2022	0	0	1	0	1	1	1	8	0	6	0	0

Figure 2.24 Accidents and serious incidents by SPO type involving aeroplanes

Propulsion type

Figure 2.25 shows the number of accidents and serious incidents by propulsion type.

The number of accidents and serious incidents in 2022 involving aircraft with reciprocating engines or turboprop engines were around half of the average of the preceding decade. There were no accidents or serious incidents involving turbofan and turbojet engines in 2022.



	Reciprocating	Turboprop	Turbofan	Turbojet
Average 2012-2021	25.5	5,9	0.2	0.2
2022	15	3	0	0

Figure 2.25 Accidents and serious incidents by propulsion type involving SPO aeroplanes

Safety risks for SPO aeroplanes

The KRAs for specialised operations involving aeroplanes are shown in Figure 2.26.

KRAs and occurrence categories (refer to Figure 2.22) have different purposes. While occurrence categories describe actual factors and outcomes of an occurrence, KRAs describe the potential outcome of an occurrence. The KRA is defined by the most likely type of accident that an occurrence could have escalated to. Unlike occurrence categories, where multiple categories may be assigned to a single occurrence, there can only be one KRA per occurrence. The KRA is one element of the ERCS. This scheme is applied when determining the safety risk score of an occurrence and is further detailed in the ASR introduction.

It can be stated that aircraft upset was the most likely type of accident to which accidents and serious incidents escalated / could have escalated for the period 2018-2022 (52 occurrences out of 122). Aircraft upset also presented the highest safety risk in the domain. While 27 occurrences escalated to/ could have escalated to excursion, the safety risk was much lower than the safety risks associated with terrain collision, airborne collision and obstacle collision in flight. With only 10 occurrences out of 122, terrain collision presented however the second highest safety risk for the domain.

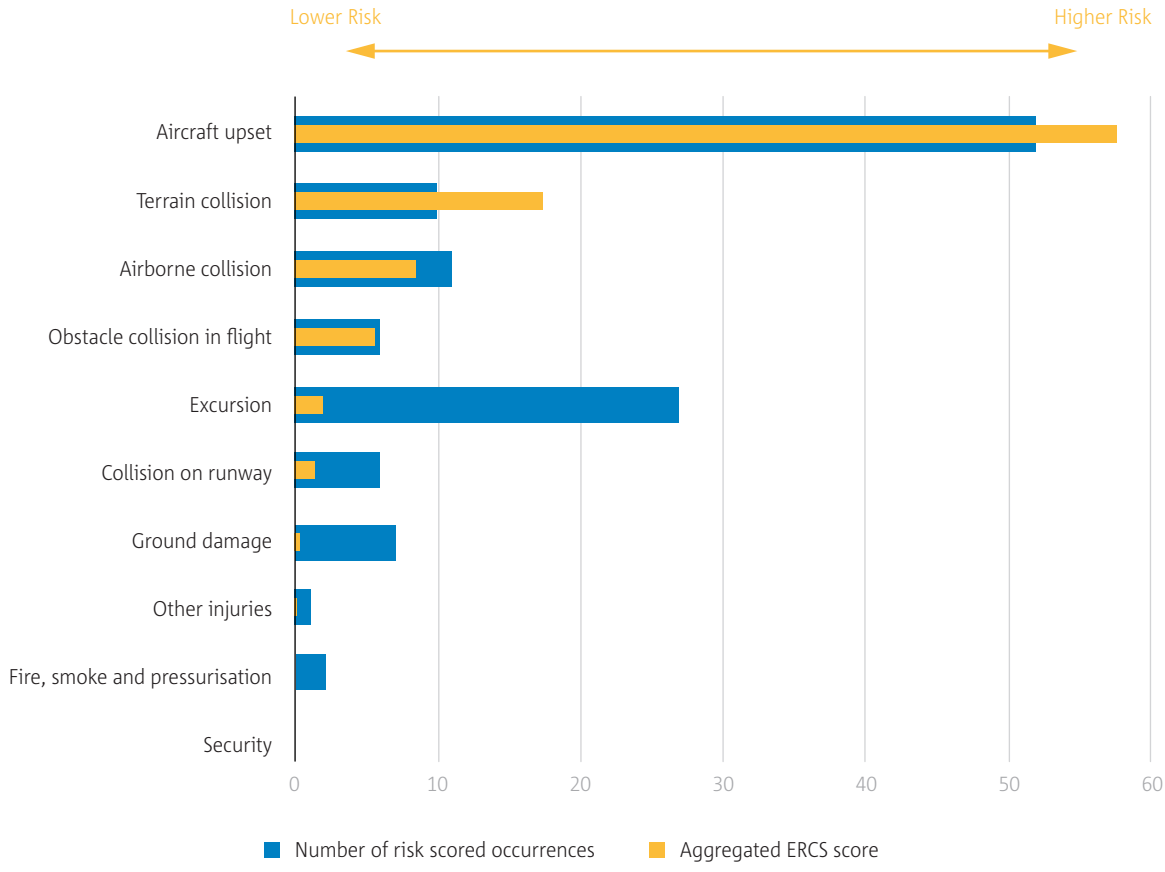


Figure 2.26 KRAs by aggregated ERCS score and number of risk-scored occurrences involving SPO aeroplanes

2.6 Non-commercial other than complex aeroplanes

The scope of this section covers Non-commercial operations conducted by EASA MS registered non-complex aeroplanes, having a maximum take-off mass below 5700 kg or not equipped with (a) turbofan engine(s) or more than one turboprop engine, and not covered in the sections above. This dataset includes certified small aeroplanes as well as Light Sport Aeroplanes (LSA) and Very Light Aeroplanes (VLA). Ultralights, microlights, and other aircraft not certified are excluded from this dataset but are examined further in the microlights chapter. These statistics are therefore not fully comparable with previous editions of the ASR due to the better filtering of the dataset.

This chapter uses a consolidated dataset from the ECR database and the EASA database as its main source for the key statistics. However, the safety issues, human factors and human performance, and airworthiness figures (available in the Appendix 2) use the EASA database only, which contains more relevant information for the evaluation of safety issues and human factors.

Key statistics

The key statistics for this domain are in the tables below and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the last year and the previous 10-year period. It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

Table 2.9 shows a decrease of fatal and non-fatal accidents in 2022. Fatal accidents decreased by 23%, non-fatal accidents by 13% and serious incidents increased by 44% compared to the 10-year average

Table 2.9 Key statistics for non-commercial other than complex aeroplanes

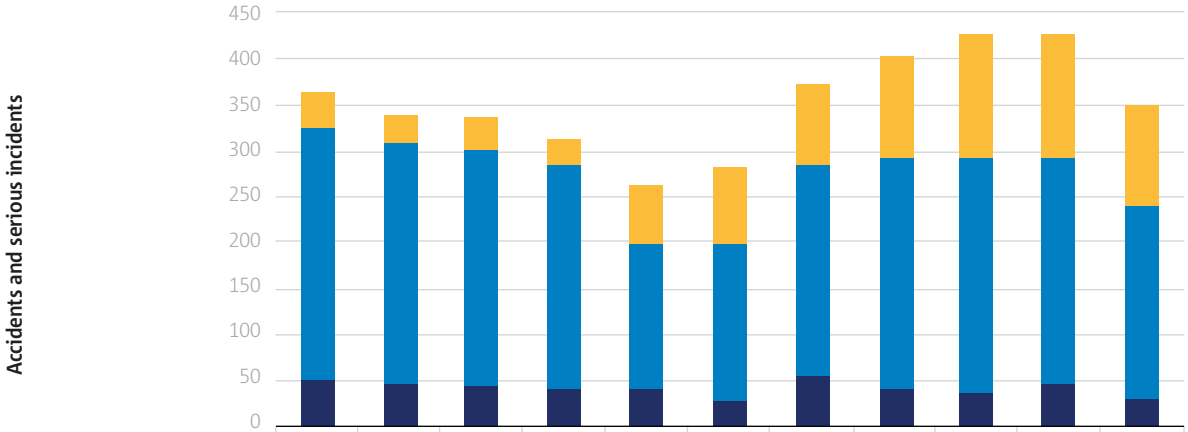
	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**400**	**31**	↓
Non-fatal accidents	**2211**	**193**	↓
Serious incidents	**741**	**107**	↑

Table 2.10 presents the numbers of fatalities and serious injuries last year compared to the 10-year period. The table shows a 24% decrease in the number of fatalities in 2022 and there was a 48% decrease in serious injuries compared to the 10-year average.

Table 2.10 Numbers of fatalities and serious injuries involving non-commercial other than complex aeroplanes

	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**764**	**405**
Yearly max number over 2012-2021	**88**	**48**
Yearly min number over 2012-2021	**55**	**29**
Total number in 2022	**58**	**21**

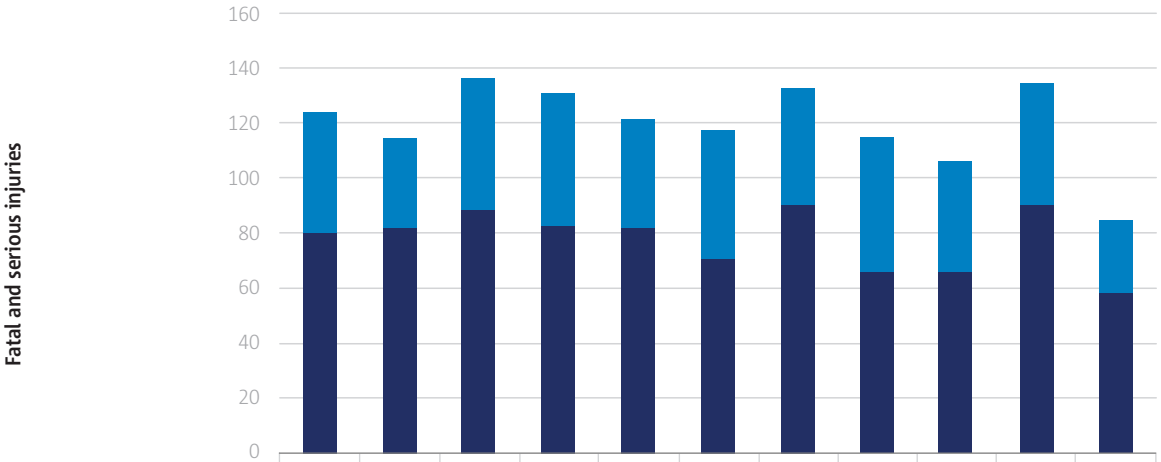
Figure 2.27 shows the numbers of fatal and non-fatal accidents and serious incidents per year. The figure shows a drop in fatal and non-fatal accidents between 2021 and 2022. Given the fact that Regulation (EU) 376/2014 better established occurrence reporting, it is possible that serious incidents were under-reported in the period before the regulation entered into force in late 2015.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	38	29	36	26	63	82	89	111	134	134	107
Non-fatal accidents	277	265	256	243	160	171	229	252	257	247	210
Fatal accidents	49	45	44	42	40	28	55	40	36	46	31

Figure 2.27 Fatal accidents, non-fatal accidents and serious incidents per year involving non-commercial other than complex aeroplanes

Figure 2.28 shows the total number of fatalities and serious injuries over time. The number of fatalities in 2022 was significantly lower compared to the 10-year average. The number of serious injuries was close to half of the 10-year average of the preceding decade.



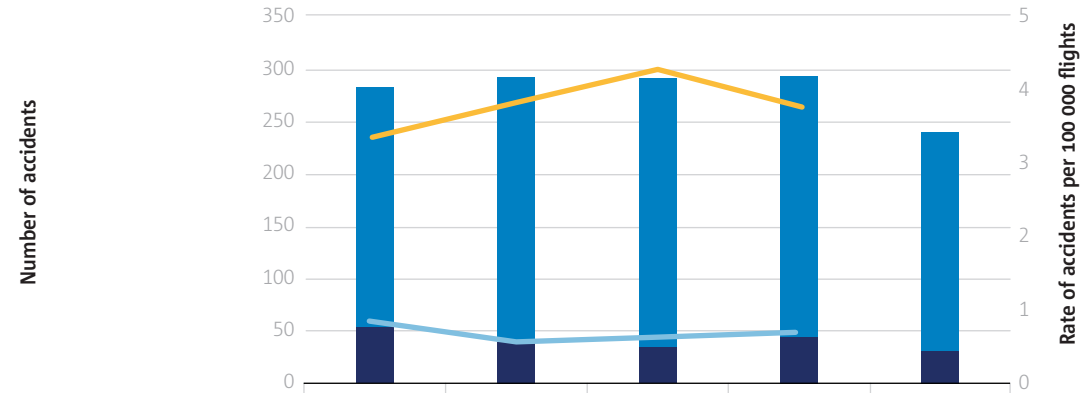
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	43	33	48	48	39	48	43	49	40	45	27
Fatalities	81	82	88	83	82	70	90	66	66	90	58

Figure 2.28 Fatal and serious injuries per year involving non-commercial other than complex aeroplanes

Rates of accidents

Six years ago, EASA published accident rates for non-commercially operated small aeroplanes for the first time, using the results of a joint EASA/AOPA survey in 2014. These figures have been updated in recent years using an AOPA/GAMA survey. The utilisation data from this year's survey for 2022 is not available at the time of this writing. However, it is EASA's assumption that the drop in number of accidents in 2022 can be attributed to less flying being performed due to the increased inflation rate in Europe.

Figure 2.29 displays the number of fatal and non-fatal accidents for the past 5 years and the accident rates per 100000 flights.



	2018	2019	2020	2021	2022
Non-fatal accidents	229	252	257	247	210
Fatal accidents	55	40	36	46	31
Fatal accident rate	0.9	0.6	0.6	0.7	
Non-fatal accident rate	3.4	3.9	4.3	3.8	

Figure 2.29 Numbers and rates of accidents involving non-commercial other than complex aeroplanes

Figure 2.30 compares the number of accidents per month from 2020-2022. It can be observed that the 2020 line is steeper than the other lines creating a peak from May to September. This is the period where COVID-19 restrictions were lifted. The extended period of not flying due to COVID-19 restrictions may have caused a deterioration of the pilot-flight competences, resulting in various problems. Please note that the section on safety risks in Appendix 2.4 for further information. It is also worth noting the 2022 line. It coincides well with the key statistics and shows a more even distribution of accidents throughout the year, but now likely to be affected by the increased inflation in Europe due to the Russian invasion into Ukraine.

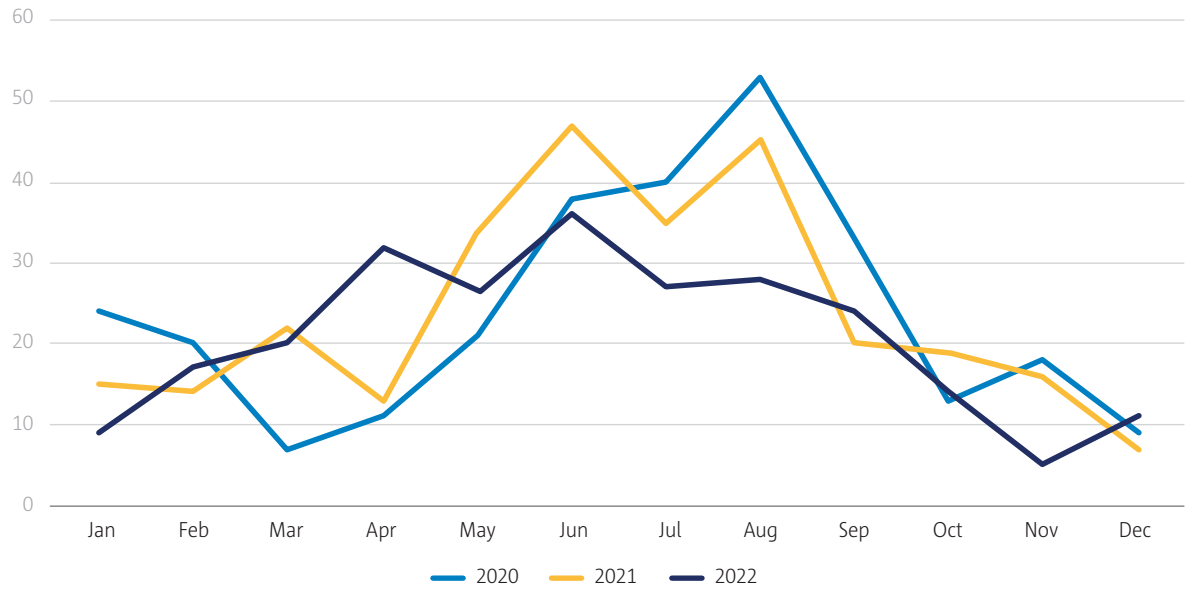
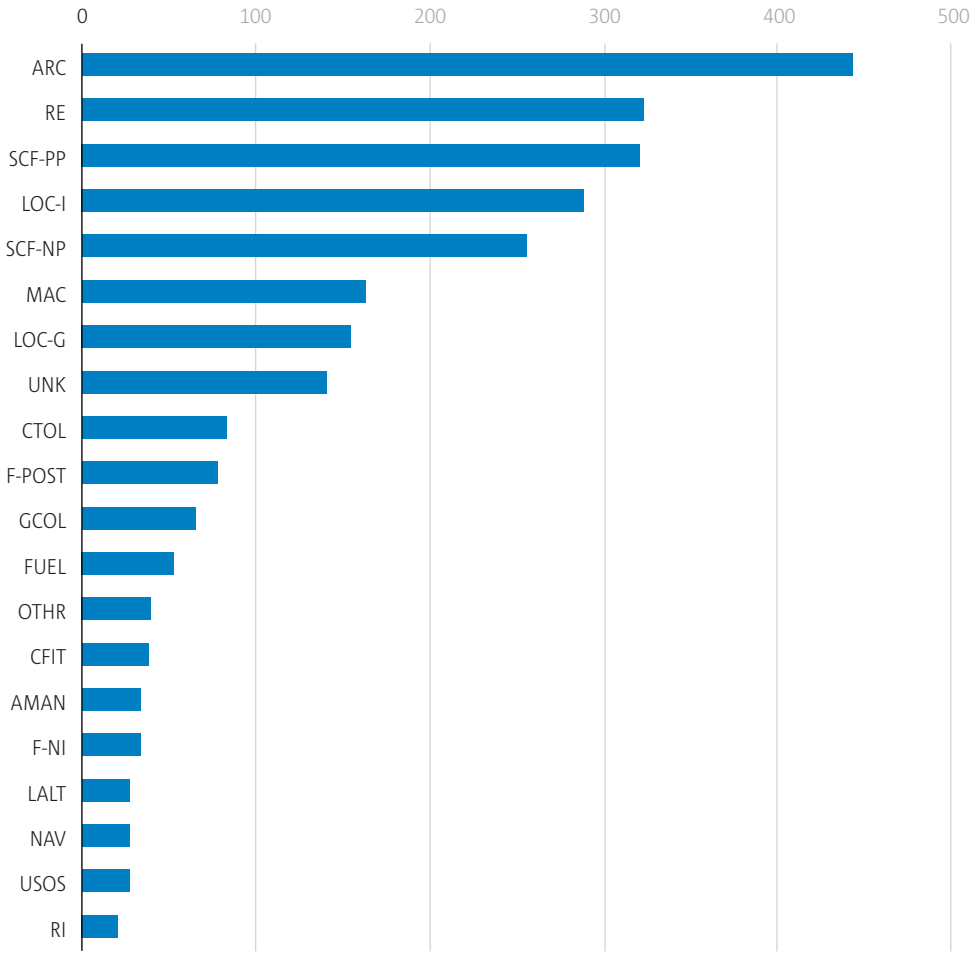


Figure 2.30 Comparison of number of accidents involving non-commercial other than complex aeroplanes per month

EASA encourages pilots to thoroughly plan their flights and mentally prepare themselves for different scenarios and what decisions they will make if they come up. This enhances the pilot's comprehension of the problems and improves their decision making, their clear thinking, as well as their chances of landing the aircraft with minimal negative consequences.

Occurrence categories

Figure 2.31 outlines the top 20 categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the Commercial Aviation Safety Team (CAST)/ ICAO Common Taxonomy Team (CICTT) taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed. Categories are of different nature, e.g., operational such as low altitude operations (LALT), environmental such as turbulence encounter (TURB), technical such as system/ component failure or malfunction [non-powerplant] (SCF-NP), consequential such as fire/ smoke resulting from impact (F-POST), etc. Multiple categories may therefore be assigned to a single occurrence. For example, if an engine failure occurred, and loss of control followed, the occurrence would be coded in both categories, i.e., SCF-PP: powerplant failure or malfunction and LOC-I: loss of control in flight. The sum of the numbers of occurrences per category may therefore be greater that the total number of occurrences that realised in the period.

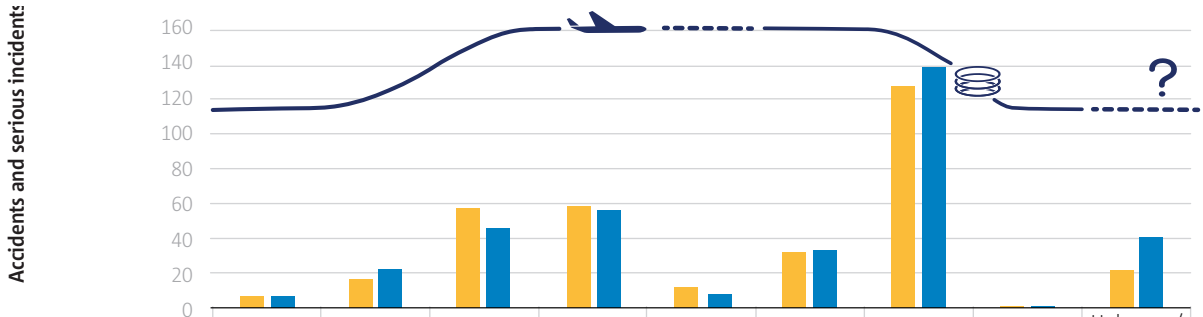


ARC: Abnormal runway contact; RE: Runway excursion; SCF-PP: powerplant failure or malfunction; LOC-I: Loss of control - inflight; SCF-NP: System/component failure or malfunction [non-powerplant]; MAC: Airprox/ACAS alert/loss of separation/(near) mid-air collisions; LOC-G: Loss of control - ground; UNK: Unknown or undetermined; CTOL: Collision with obstacle(s) during take-off and landing; F-POST: Fire/smoke (post-impact); GCOL: Ground Collision; FUEL: Fuel related; OTHR: Other; CFIT: Controlled flight into or toward terrain; AMAN: Abrupt maneuvre; F-NI: Fire/smoke (non-impact); LALT: Low altitude operations; NAV: Navigation error; USOS: Undershoot/ overshoot; RI: Runway incursion - vehicle, aircraft or person

Figure 2.31 Numbers of occurrences by occurrence category involving non-commercial other than complex aeroplanes

Phase of flight

The accidents in general aviation most commonly occur in the landing phase. The year 2022 was no exception and there was a decrease in most flight phases compared to the 10-year average. A 5% decrease is reflected in the flight phases of landing, and 23% fewer accidents occurred during take-off, compared to the 10-year average. The unknown/blank column has also increased. This is considered normal as investigations often take up to three years to complete and all relevant information is sometimes not immediately available.

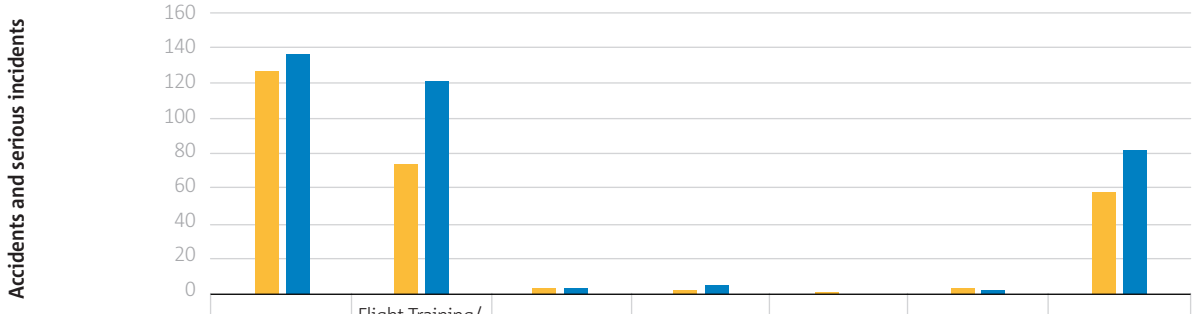


	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Tow	Unknown/ Blank
Average 2012-2021	6.8	15.7	57.2	58.2	12	32.2	127.7	0.3	21.3
2022	6	22	46	57	8	33	139	0	41

Figure 2.32 Accidents and serious incidents by phase of flight involving non-commercial other than complex aeroplanes

Operation type

The two main operation types in non-commercial operations (NCO) are pleasure/recreational flying and training flights. In Figure 2.33, it can be observed when examining the data table, that the 2012 and 2013 data is vastly lower than the rest. The reason is the ECR data and the fact that the EASA data before 2014 has not been uploaded to the ECR. This skews the average, especially for the pleasure and flight training data and should be taken cautiously. The unknown/blank column has been manually adjusted for 2012 and 2013 to reflect this loss of data in the average figures. The number of accidents in pleasure flying is similar as there were in flight training in 2022. This is proportionally comparable to the 10-year average.



	Pleasure	Flight Training/ instructional	Relocation	Test flight	Demonstration	Other	Unknown/Blank
Average 2012-2021	126.4	73.3	3.3	2.1	1.21	3.1	57.8
2022	136	124	3	5	0	2	82

Figure 2.33 Accidents and serious incidents by operation type involving non-commercial other than complex aeroplanes

Safety risks for non-commercial other than complex aeroplanes

The KRAs for SPO involving aeroplanes are shown in Figure 2.34.

KRAs and occurrence categories (refer toFigure 2.31) have different purposes. While occurrence categories describe actual factors and outcomes of an occurrence, KRAs describe the potential outcome of an occurrence. The KRA is defined by the most likely type of accident that an occurrence could have escalated to. Unlike occurrence categories, where multiple categories may be assigned to a single occurrence, there can only be one KRA per occurrence. The KRA is one element of the ERCS. This scheme is applied when determining the safety risk score of an occurrence and is further detailed in the ASR introduction.

The KRA with the highest risk is aircraft upset. This KRA has 469 occurrences over the period 2018-2022 and it produces the highest risk score and is therefore the area where the greatest need for intervention lies. To contrast these figures, it can be observed that the KRA runway excursion has over 650 occurrences. The risk of fatalities or injuries is however very low. Other KRAs worth mentioning are terrain collision, airborne collision, and obstacle collision in flight.

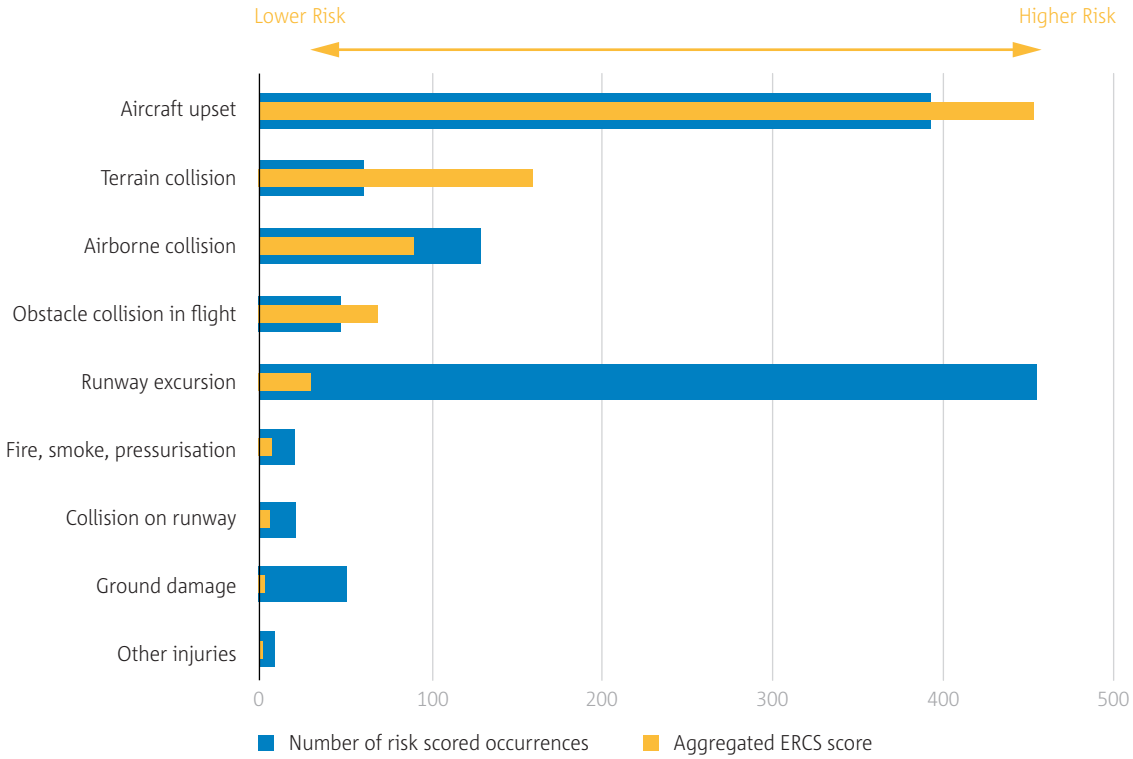


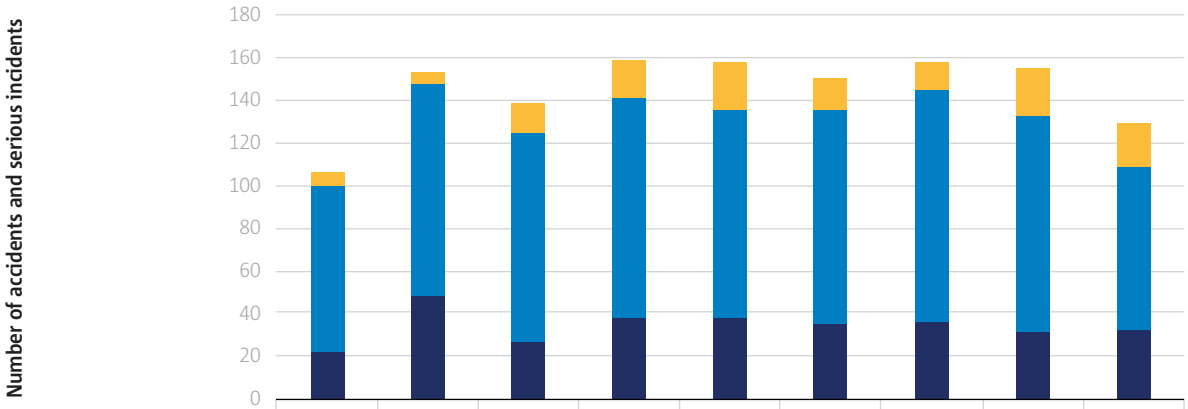
Figure 2.34 KRAs by aggregated ERCS score and number of risk-scored occurrences, involving non-commercial other than complex aeroplanes

Microlights

The diversity of general aviation exceeds EASA´s regulatory remit. However, most accidents involving EASA MS registered microlights and ultralights also occur in Europe, with some accidents also occurring outside Europe. Figure 2.35 shows accidents and serious incidents on EASA MS registered microlights and ultralights from 2014 to 2022 that have been reported into the ECR and to EASA. The dataset used is the same consolidated dataset as used for non-commercial other than complex aeroplanes. The data for 2012 and 2013 were excluded as

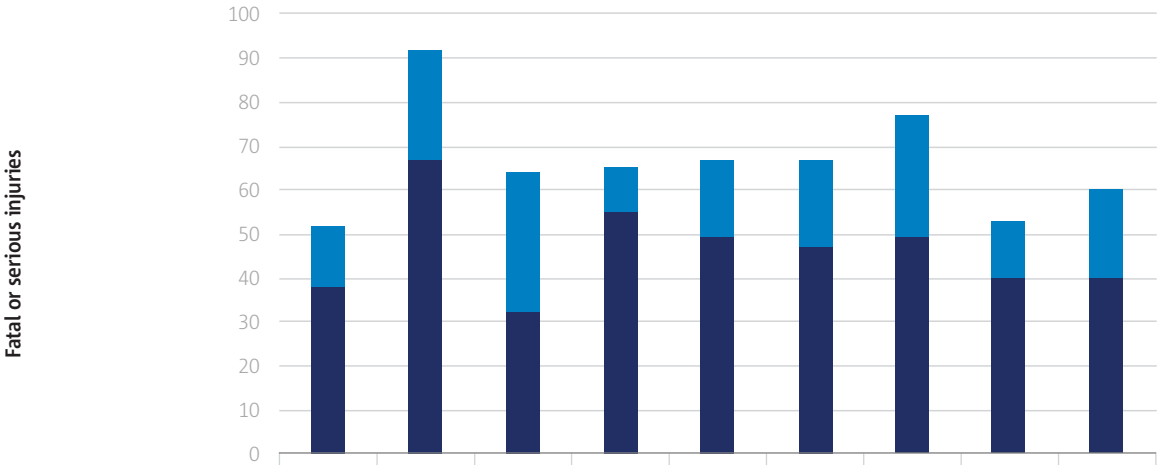
ultralights do not specifically fall under EASA's remit and was not within scope when the data was collected at the time. Therefore, such data were not always entered systematically into the databases. Regulation (EU) 376/2014 entered into force in 2015, since reporting rates have increased.

Figure 2.36 provides an overview of the reported fatalities and injuries during the same period. The dataset used is the same consolidated dataset as used for non-commercial other than complex aeroplanes. Overall, the number of accidents, serious injuries and fatalities is slowly showing a downward trend over time. The number of fatalities and serious injuries shown Figure 2.36 largely coincides with the data on accidents and serious incidents shown in Figure 2.35. However, in 2022 the numbers of fatal accidents and serious incidents was similar to 2021, but non-fatal accidents decreased by 25% in comparison with 2021.



	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	6	5	14	18	22	14	13	22	20
Non-fatal accidents	79	101	98	104	99	102	110	103	77
Fatal accidents	21	47	26	37	37	34	35	30	32

Figure 2.35 Numbers of fatal accidents, non-fatal accidents and serious incidents per year involving non-commercially operated microlights



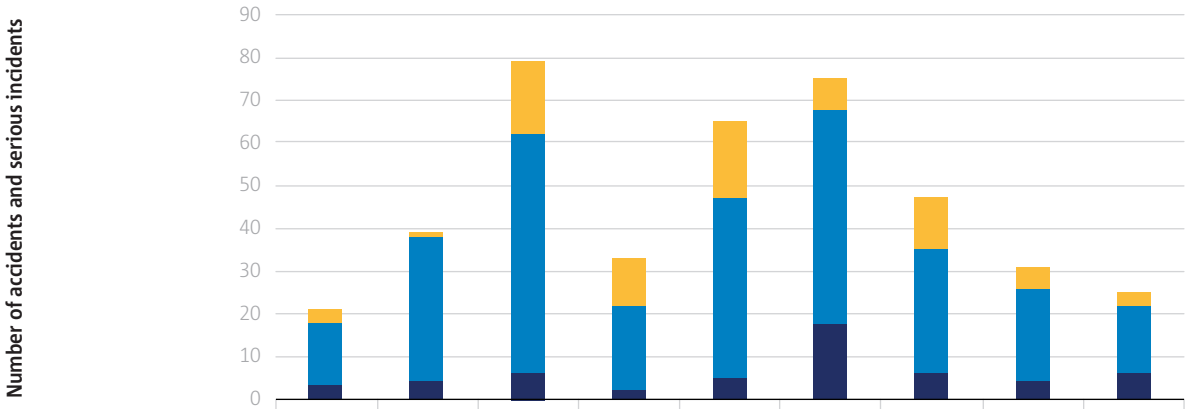
	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	14	25	32	10	18	20	28	13	20
Fatalities	38	67	32	55	49	47	49	40	40

Figure 2.36 Numbers of fatal and serious injuries per year involving non-commercially operated microlights

Aeroplanes registered outside the EASA MS

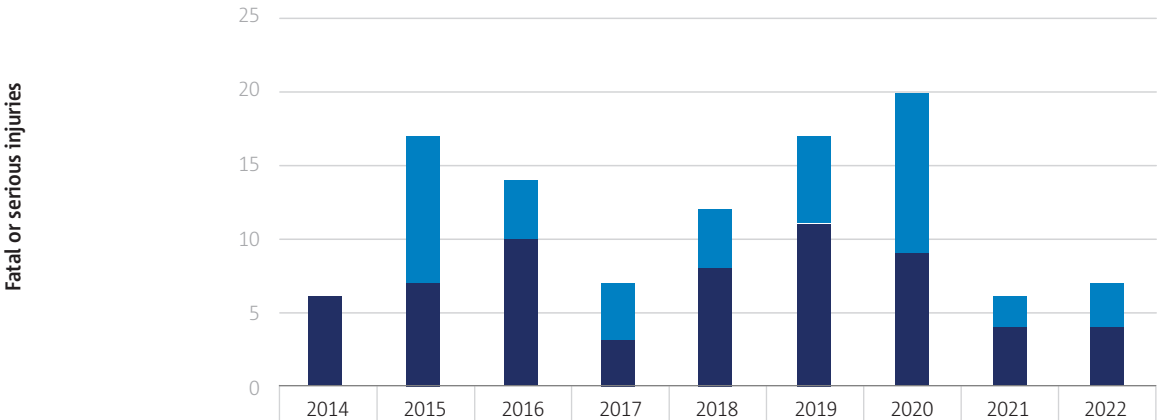
Aeroplanes registered outside the EASA MS but operated inside the union, also fall outside of EASA's remit. Most of these aeroplanes are registered in the United States of America (N-registered aeroplanes), and now also in the United Kingdom (G-registered aircraft). To provide an overview of this sector, EASA provides figures of accidents and serious incidents that have been reported to or collected by EASA.

Figure 2.37 shows 262 non-fatal and 43 fatal accidents from 2012-2022. Figure 2.38 shows that these accidents resulted in 62 fatalities and 44 serious injuries over the period.



	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	3	1	17	11	18	11	12	5	3
Non-fatal accidents	15	34	56	20	42	28	29	22	16
Fatal accidents	3	4	6	2	5	7	6	4	6

Figure 2.37 Numbers of fatal accidents, non-fatal accidents, and serious incidents in EU/EEA MS per year involving non-commercially operated aircraft not registered in an EASA MS.



	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	0	10	4	4	4	6	11	2	3
Fatalities	6	7	10	3	8	11	9	4	4

Figure 2.38 Numbers of fatal and serious injuries per year involving non-commercially operated aircraft not registered in the EASA MS

Figure 2.39 shows that over the 2014-2022 period that 99 N-registered aeroplanes, 81 G-registered aircraft, 12 non-EASA Member State registered aircraft and 19 aircraft of unknown registration were involved in fatal and non-fatal accidents in EU/EEA MS. There were 43 fatal accidents in the period on these aeroplanes.

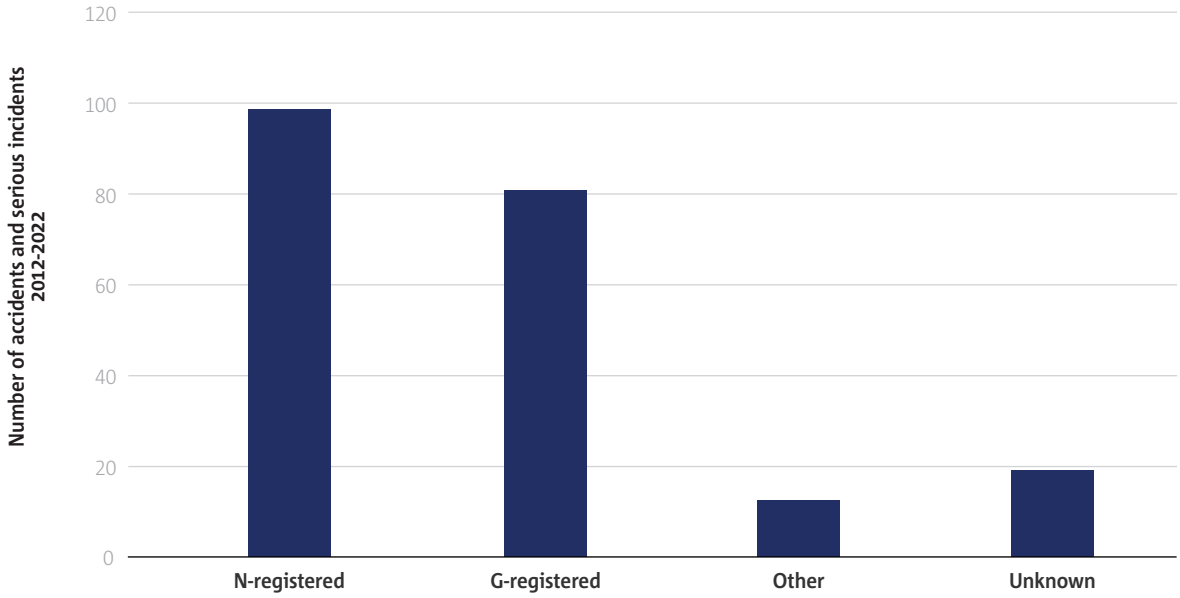


Figure 2.39 Numbers of fatal and non-fatal accidents on non-commercially operated aircraft not registered in the EASA MS and occurring within the EASA MS.

Chapter 3
Helicopters

This chapter covers all operations involving EASA certified or validated helicopters. The chapter is divided in four main sections:

- **All helicopter operations** providing aggregated statistics on EASA certified or validated helicopters performing CAT, SPO or non-commercial operations, and for which an EASA MS is either state of operator, state of registry or state of occurrence;
- **CAT flights** conducted by EASA AOC holders and using certified or validated helicopters. This section brings together CAT helicopter operations for both onshore flights and includes HEMS, air ambulance, air taxi or sightseeing, and those flights to offshore oil, gas and renewable energy installations;
- **SPO** involving certified or validated helicopters, such as sling load, advertisement, and photography with an EASA MS as the state of operator or state of registry;
- **Non-commercial operations** involving certified or validated helicopters, with an EASA MS as the state of operator or state of registry. This section includes, particularly training flights.

2022 saw a welcome lifting of COVID restrictions and a return to relatively normal flying operations, albeit with global flight fast approaching pre-pandemic levels.

The data presented are based on the accidents and serious incidents collected by the Agency under Regulation (EU) 996/2010 on accident and serious incident investigation and Regulation (EU) 376/2014 on occurrence reporting and in order to gain a wider picture, data has been supplemented by usage data from the airframe manufacturers or searching for those events from other official sources.

For each section, the key statistics, the occurrence categories and the safety risks at KRA level are presented in the core document. Advanced statistics are then provided per aviation domain in domain-specific appendices, giving an overview of the contributors to the safety risks identified in the core document for these types of operations at the European level. The advanced statistics are solely derived from occurrence data from the EASA occurrence repository and the ECR. It is important to note that the fleet size data has been extracted from the Cirium[12] database regarding the total EASA MS fleet for the period between 2018-2022.

The list of fatal accidents associated with the scope of this chapter is provided in Appendix 1 of this document.

The advanced statistics associated with the scope of this chapter are provided in Appendix 3 of this document.

12 Source: Cirium Fleets Analyzer. Extraction date: 13 June 2023. Includes all civil (i.e., non-military and non-state) CS-27 and CS-29 rotorcraft that are operated by EASA MS operators. EASA Type I rotorcraft are excluded. Cirium makes no warranties, express or implied, as to the accuracy, adequacy, timeliness, or completeness of its data or its fitness for any particular purpose. Cirium disclaims all liability relating to or fully arising out of use of its data and other content or permissible by law. The total fleet is based on data for all EASA MSs, excluding the United Kingdom.

3.1 All helicopter operations

The scope of this section covers the key safety statistics for certified or validated helicopters performing CAT, SPO or non-commercial operations, and for which an EASA MS is either the state of operator, state of registry or state of occurrence.

Key statistics

The key statistics for this domain are in Table 3.1 and Table 3.2. It includes a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the last year and the previous 10-year period. Similarly, a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe is also included. In absolute numbers of fatal accidents, 2022 marks an increase compared to the average of the preceding decade, whereas the number of non-fatal accidents was similar to this average and the number of serious incidents was lower than the 10-year average.

Table 3.1 Key statistics for all helicopter operations

	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**83**	**10**	↑
Non-fatal accidents	**374**	**37**	=
Serious incidents	**145**	**13**	↓

Table 3.2 Fatalities and serious injuries involving all helicopter operations

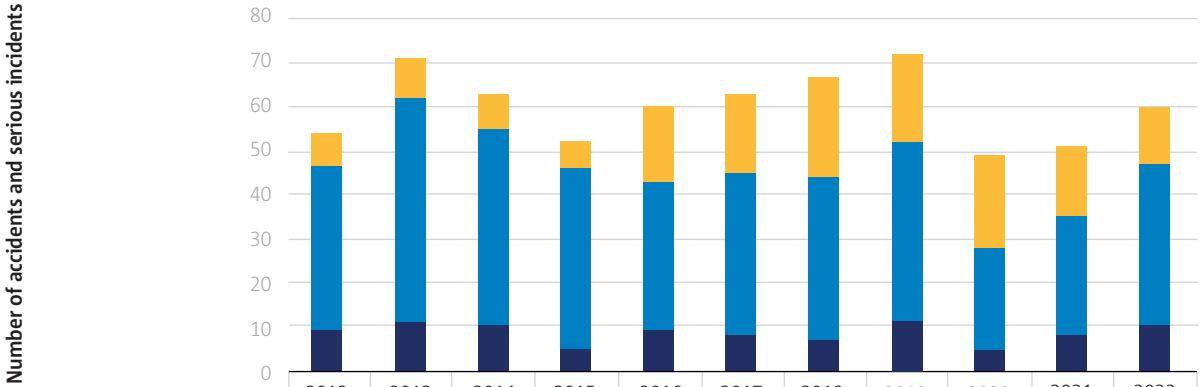
	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**200**	**110**
Yearly max number over 2012-2021	**30**	**19**
Yearly min number over 2012-2021	**10**	**6**
Total number in 2022	**24**	**11**

The number of accidents and serious incidents per year are shown in Figure 3.1. In absolute numbers, the total number of fatal accidents and non-fatal accidents have increased during 2022, but it has decreased for the number of serious incidents.

The number of fatalities in 2022 was higher than the preceding decade's average, and the number of serious injuries in 2022 was similar to this average.

In the last 5-year period (2018-2022) covered by this analysis, there were 93 fatalities in the identified accidents. Considering all accidents (fatal and non-fatal) gives a mean fatality rate of 0.43 fatalities per accident. Considering only fatal accidents, the mean fatality rate becomes 2.1 fatalities per accident.

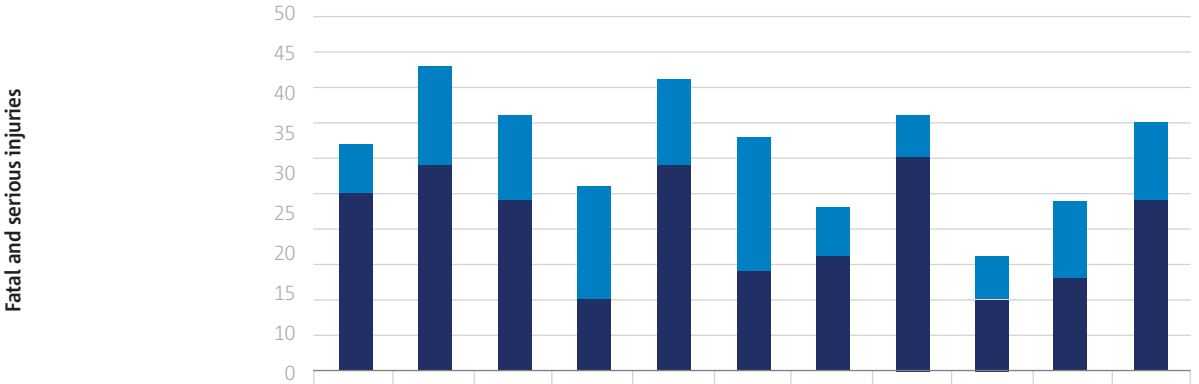
Since these figures are not normalised with traffic data, the number of occurrences should be interpreted cautiously, as the exact variation of helicopter flying activity at the European level over the past two years is difficult to assess. The Agency is currently taking action to address the recurrent challenge of evaluating the level of helicopter flying activity in Europe by engaging with the industry and National Competent Authorities (NCA) to collect and consolidate helicopter exposure data. For this, EASA through the Network of aviation safety Analysts (NoA) has made a step forward to include the digitalisation and centralised collection from the NCAs of the Airworthiness Review Certificate (ARC) Forms, as part of the repository of information under the EASA Basic Regulation Article 72 Information gathering, exchange and analysis. This project will enable the collection of helicopter flight hours, to improve the estimation of helicopter flying activity in Europe.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	7	9	8	6	17	18	23	20	21	16	13
Non-fatal accidents	38	51	45	41	34	37	37	41	23	27	37
Fatal accidents	9	11	10	5	9	8	7	11	5	8	10

Figure 3.1 Fatal accidents, non-fatal accidents and serious incidents per year involving all helicopter operations

The number of fatalities and serious injuries per year is shown in Figure 3.2. Considering that the air traffic recovery is fast approaching pre-pandemic levels, we saw also that the overall trend is increasing. The absolute number of fatalities in 2022 has almost doubled compared to the year before, whereas the figures for serious injuries were similar.

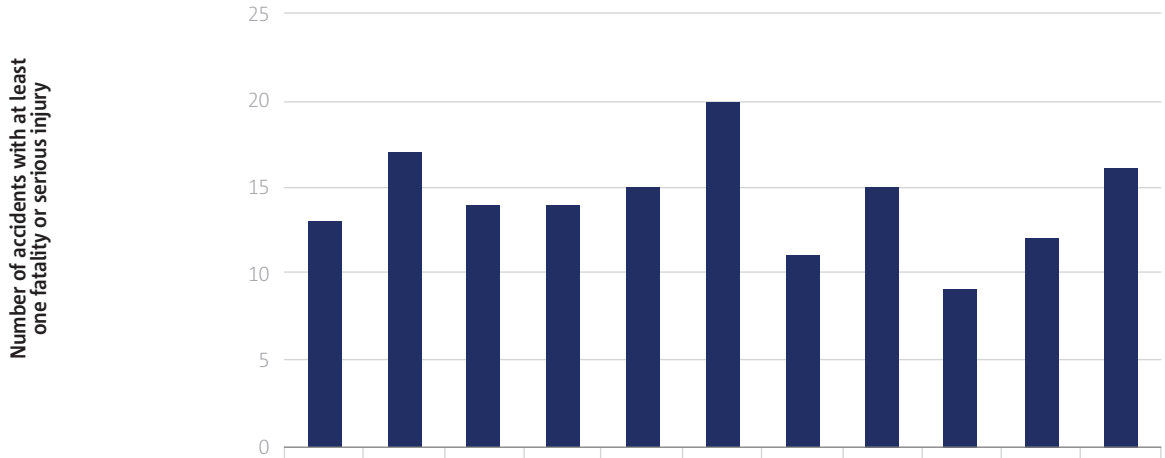


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	7	14	12	16	12	19	7	6	6	11	11
Fatalities	25	29	24	10	29	14	16	30	10	13	24

Figure 3.2 Fatal and serious injuries per year involving all helicopter operations

Rotorcraft safety roadmap SPI

The number of accidents that have caused at least one fatality or serious injury is the SPI used to monitor the effectiveness of the EASA Rotorcraft Safety RoadMap which was launched in 2018. This indicator is shown in Figure 3.3. In absolute numbers, there were more accidents with at least one fatality or serious injury in 2022 as compared to the previous year and is the third highest observed number since 2012.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Roadmap SPI	13	17	14	14	15	20	11	15	9	12	16

Figure 3.3 Number of accidents with a least one fatality or serious injury for all helicopter operations

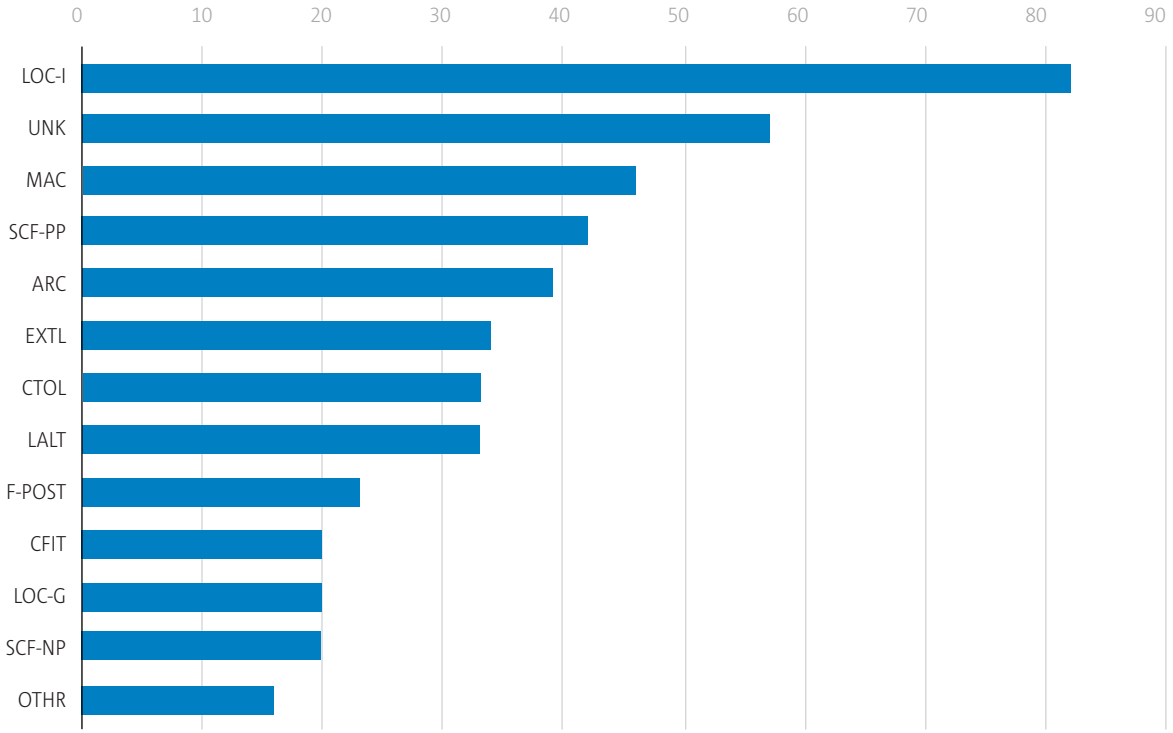
© Eurocopter

Occurrence categories

Figure 3.4 outlines the top 13 categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the ICAO ADREP taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed. Categories are of different natures, e.g., operational such as low altitude operations (LALT), environmental such as turbulence encounter (TURB), technical such as system/ component failure or malfunction [non-powerplant] (SCF-NP), consequential such as fire/ smoke resulting from impact (F-POST), etc. Multiple categories may therefore be assigned to a single occurrence. For example, if an engine failure occurred, and loss of control (LOC) followed, the occurrence would be coded in both categories, i.e., SCF-PP: powerplant failure or malfunction and LOC-I: loss of control in flight. The sum of the number of occurrences per category may therefore be greater than the total number of occurrences that were realised in the period.

When it comes to the high-risk accident occurrence categories, the occurrence category LOC-I: loss of control inflight has been one of the most significant causes of fatal accidents over the 5-year period. Inland helicopter pilots primarily fly based on visual references to the terrain, according to visual flight rules (VFR). In marginal visibility, this could lead to LOC.

The occurrence category UNK: unknown is one of the three high-risk accident occurrence categories which appears in the figure. As the aviation industry continues its recovery from Covid-19 and flights significantly rise, good quality of reporting safety occurrences has never been more important. As well as helping to raise direct issues it also helps to see emerging trends and act before they develop into a more serious issue.



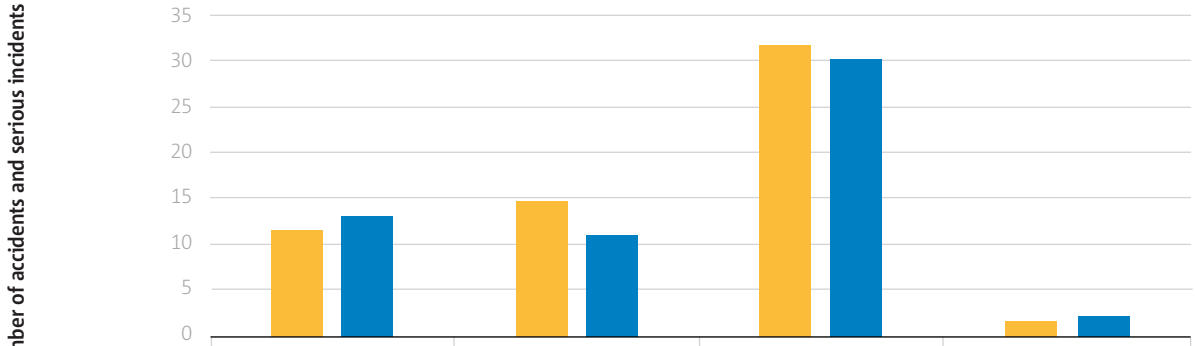
LOC-I: Loss of control – inflight; UNK: Unknown or undetermined; MAC: Airprox/ACAS alert/loss of separation/(near) midair collisions; SCF-PP: powerplant failure or malfunction; ARC: Abnormal runway contact; EXTL: External load related occurrences; CTOL: Collision with obstacle(s) during take-off and landing; LALT: Low altitude operations; F-POST: Fire/smoke (post-impact); CFIT: Controlled flight into or toward terrain; LOC-G: Loss of control – ground; SCF-NP: System/component failure or malfunction [non-powerplant]; OTHR: Other

Figure 3.4 Numbers of occurrences by occurrence category for all helicopter operations

Helicopter operations sub-domains

Figure 3.5 shows the numbers of accidents and serious incidents for the 4 main sub-domains of operations involving certified and validated helicopters. Over the decade 2012-2021, the proportions of each domain are the following:

- 52% of all accidents and serious incidents involved certified and validated helicopters performing non-commercial operations and for which an EASA MS was either the state of operator or state of registry;
- 24% of all accidents and serious incidents involved certified and validated helicopters performing SPO and for which an EASA MS was either the state of operator or state of registry;
- 21% of all accidents and serious incidents involved certified and validated helicopters performing CAT conducted by EASA MS AOC holders;
- 2% of all accidents and serious incidents involved certified helicopters whose state of operator and state of registry were a third country but for which the state of occurrence was an EASA MS.

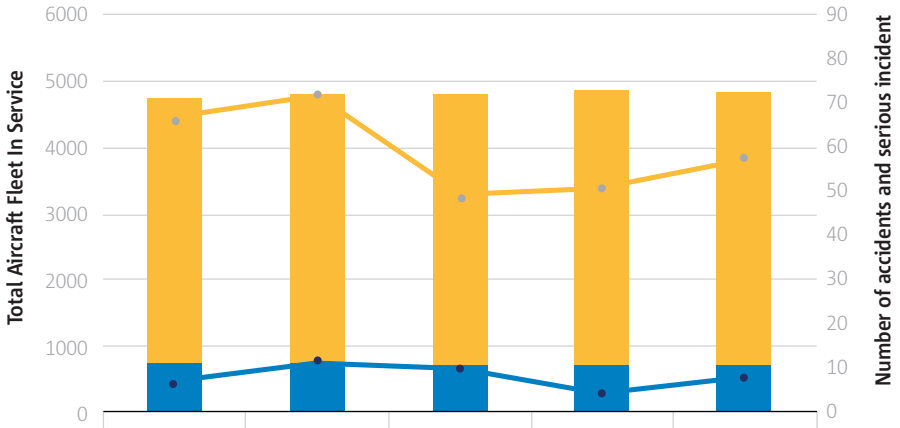


	CAT-EASA MS AoC holder	SPO-EASA MS operated or registered	Non commercial - EASA MS operated or registered	Third country registered
Average 2012-2021	11.4	14.6	31.7	1.6
2022	13	11	30	2

Figure 3.5 Accidents and serious incidents by helicopter operation sub-domains

Type of certified helicopter (CS27/CS29)

Figure 3.6 shows the distribution over the 5-year period of the EASA MS rotorcraft fleets in total by type of certification specification, Certification Specifications for Small Rotorcraft (CS-27) and the Certification Specifications for Large Rotorcraft (CS-29), with a trendline of accidents and serious incidents in the given period. The total fleet in service is shown in the primary vertical axis of the graph, whereas the total number of accidents and serious incidents in each period is shown in the secondary vertical axis.



	2018	2019	2020	2021	2022
CS 27 Total In Service	4012	4063	4076	4136	4121
CS 29 Total In Service	736	741	731	731	724
CS 27 Accidents and Serious incidents	60	61	39	47	49
CS 29 Accidents and Serious incidents	7	11	10	4	8

Figure 3.6 Accidents and serious incidents by certification specification for all helicopter operations with the breakdown of aircraft certification type for the reported fleet

3.2 CAT helicopters

The scope of this section covers the key safety statistics for EASA certified or validated helicopters performing CAT and operated by an EASA MS AOC holder. This includes offshore flights, as well as onshore HEMS, air ambulance, sightseeing tours, air taxis or any other operation to transport passengers, cargo or mail for remuneration or other valuable consideration.

European CAT helicopter fleet

Figure 3.7 and Figure 3.8 show the size of the helicopter CAT sector in the EASA MS and its evolution over the period 2018-2022.

The number of helicopter AOC holders had a small increase in 2022 compared to the preceding year. An increase was observed in the number of helicopters performing CAT. The average number of helicopters per AOC holders in 2022 was between 8 and 9.

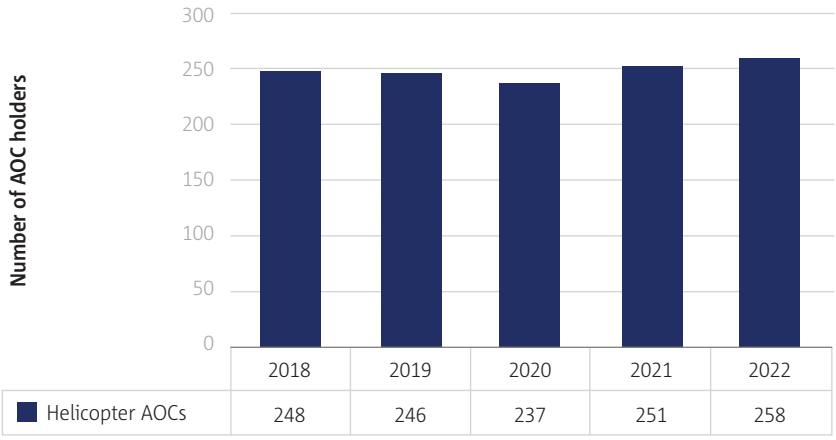


Figure 3.7 Number of helicopter AOC holders in the EASA MS

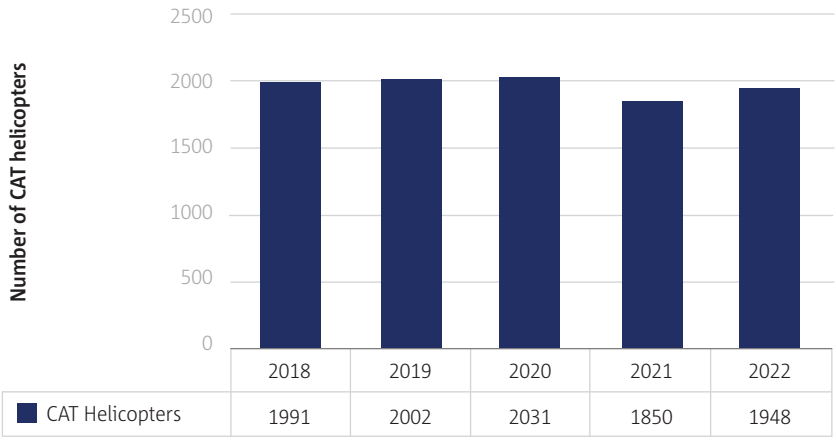


Figure 3.8 Number of helicopters performing CAT in the EASA MS

Key statistics

The key statistics for this domain are in Table 3.3 and Table 3.4, which include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the last year and the previous 10-year period. It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

The number of accidents, fatalities, and serious injuries in 2022 are on an increasing trend compared to the average of the previous decade.

Table 3.3 Key Statistics for CAT helicopters

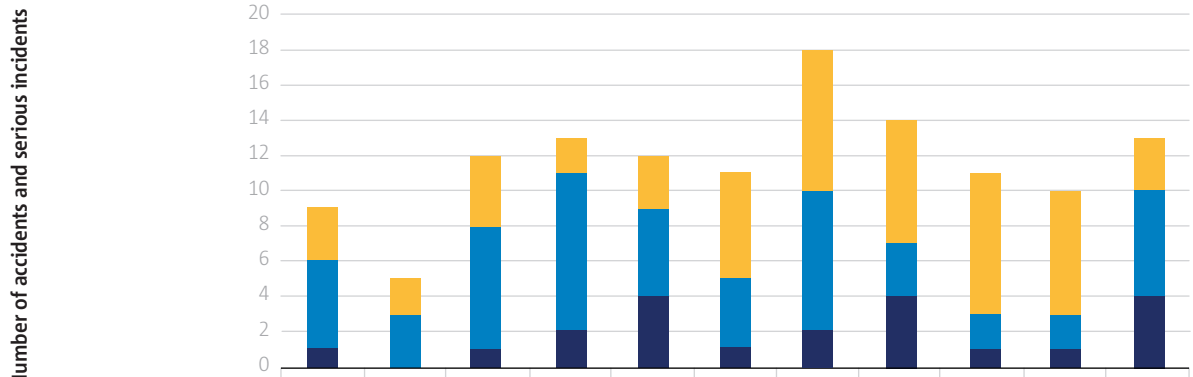
	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**16**	**4**	↑
Non-fatal accidents	**48**	**6**	↑
Serious incidents	**50**	**3**	↓

Table 3.4 Fatalities and serious injuries involving CAT helicopters

	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**69**	**24**
Yearly max number over 2012-2021	**22**	**7**
Yearly min number over 2012-2021	**0**	**0**
Total number in 2022	**17**	**2**

The numbers of accidents and serious incidents per year are shown in Figure 3.9.

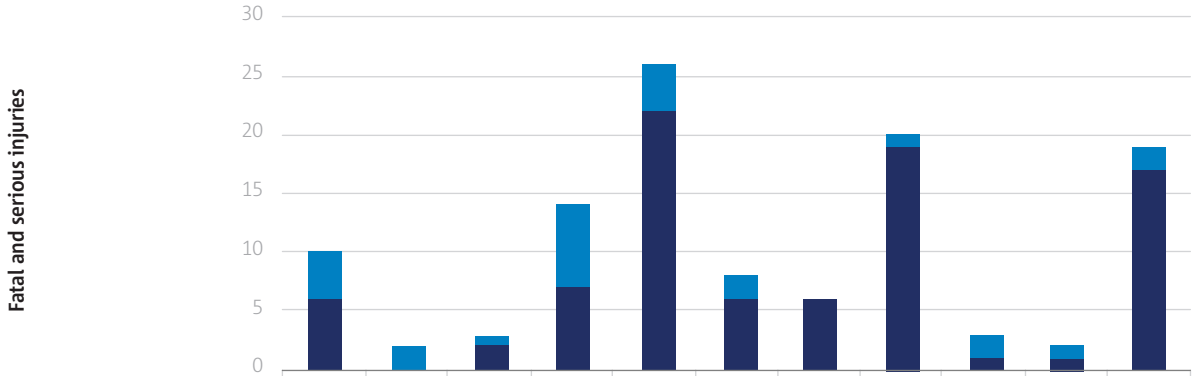
Whereas the number of serious incidents in 2022 has dropped to a minimum over the previous 10-year period, the number of fatal and non-fatal accidents in 2022 has increased to the maximum level observed since 2012.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incident	3	2	4	2	3	6	8	7	8	7	3
Non-fatal accident	5	3	7	9	5	4	8	3	2	2	6
Fatal accident	1	0	1	2	4	1	2	4	1	1	4

Figure 3.9 Fatal accidents, non-fatal accidents and serious incidents per year involving CAT helicopters

The numbers of fatalities and serious injuries per year are shown in Figure 3.10. With two serious injuries, but a significant increase of fatalities, the 2022 is the third highest over the last decade.



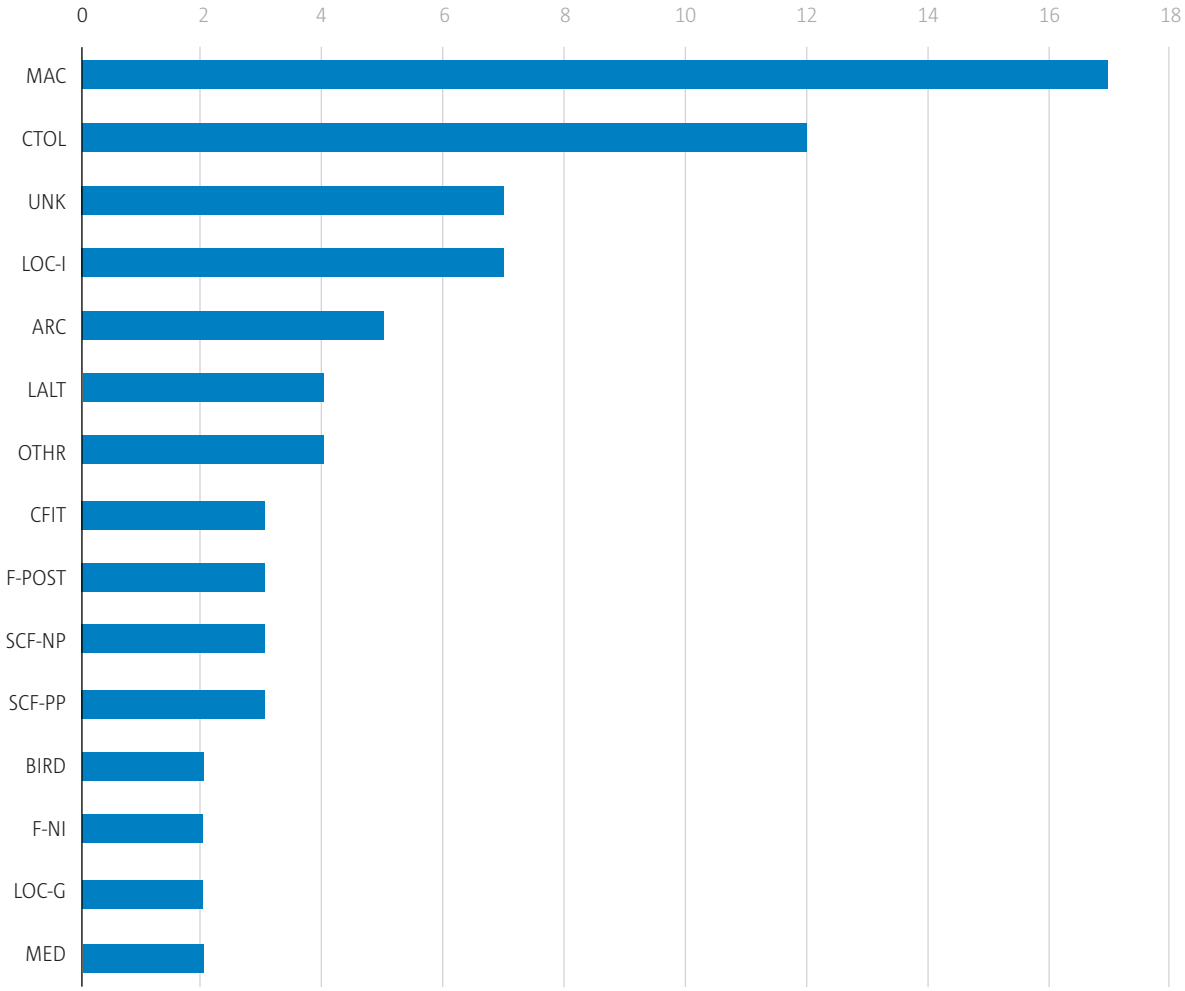
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	4	2	1	7	4	2	0	1	2	1	2
Fatalities	6	0	2	7	22	6	6	19	1	1	17

Figure 3.10 Fatal and serious injuries per year involving CAT helicopters

Occurrence categories

Figure 3.11 outlines the top 15 categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the ICAO ADREP taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed.

Based on this analysis, the most frequent occurrence category associated with all accidents and serious incidents is MAC: Airprox/ACAS alert/loss of separation/(near) midair collisions, followed by CTOL: collision with obstacle(s) during take-off and landing, whereas the occurrence category remains UNK: unknow for seven occurrences.

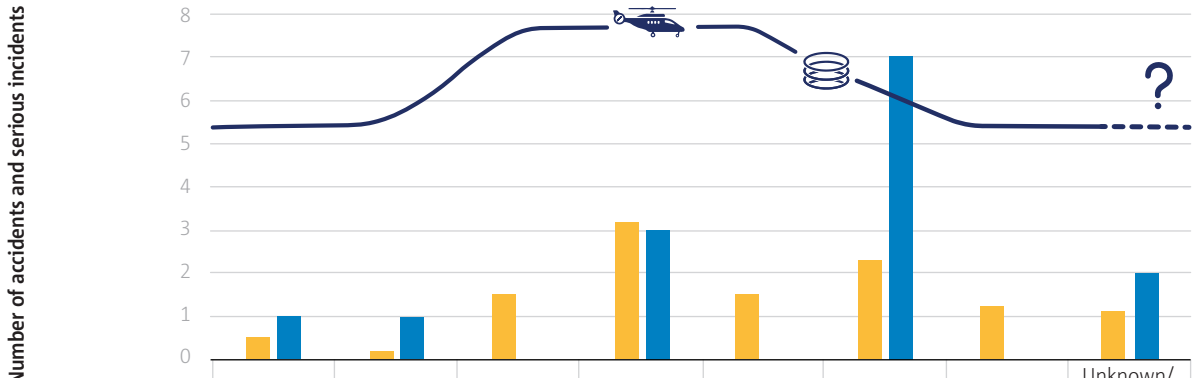


MAC: Airprox/ACAS alert/loss of separation/(near) midair collisions; CTOL: Collision with obstacle(s) during take-off and landing; UNK: Unknown or undetermined; LOC-I: Loss of control – inflight; ARC: Abnormal runway contact; LALT: Low altitude operations; OTHR: Other; CFIT: Controlled flight into or toward terrain; F-POST: Fire/smoke (post-impact); SCF-NP: System/component failure or malfunction [non-powerplant]; SCF-PP: powerplant failure or malfunction; BIRD: Birdstrike; F-NI: Fire/smoke (non-impact); LOC-G: Loss of control – ground; MED: Medical

Figure 3.11 Numbers of occurrences by occurrence category involving CAT helicopters

Phase of flight

Figure 3.12 shows the distribution of accidents and serious incidents by flight phase. Over the decade 2012-2021, the en-route phase and landing phase are the most involved in accidents. The same applies in 2022, where ten occurrences out of 14 have their flight phase being en-route and landing.

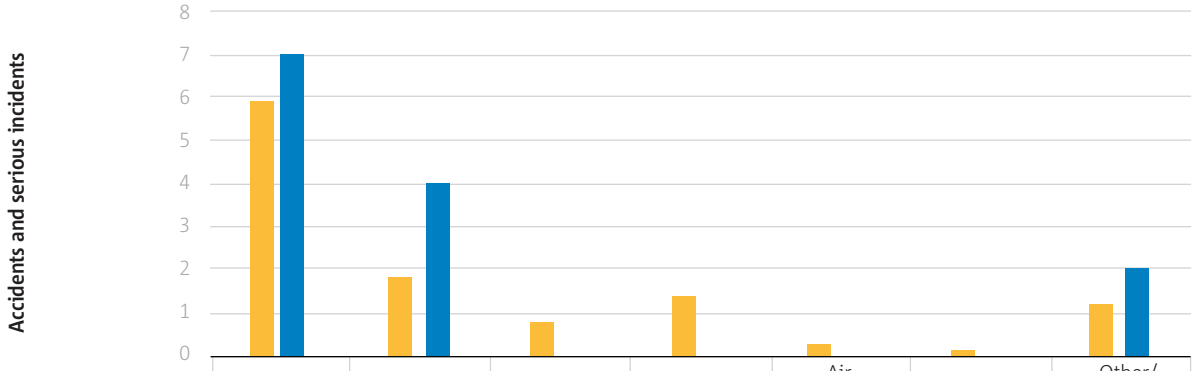


	Standing	Taxi	Take-off	En route	Approach	Landing	Tow	Unknown/ blank
Average 2012-2021	0.5	0.2	1.5	3.2	1.5	2.3	1.2	1.1
2022	1	1	0	3	0	7	0	2

Figure 3.12 Accidents and serious incidents by phase of flight involving CAT helicopters

Operation type

Figure 3.13 shows the numbers of accidents and serious incidents per type of operation. All four occurrences in 2022 involving air taxi operations have been fatal accidents, which is significantly above the average figures of the preceding decade for this type of operation. With seven occurrences (four accidents and three serious incidents) in 2022, the figures involving HEMS operations are still above the average figures of the preceding decade for this type of operation. HEMS is followed by air taxi, whereas the exact type of CAT operation is still unknow for two occurrences in 2022.



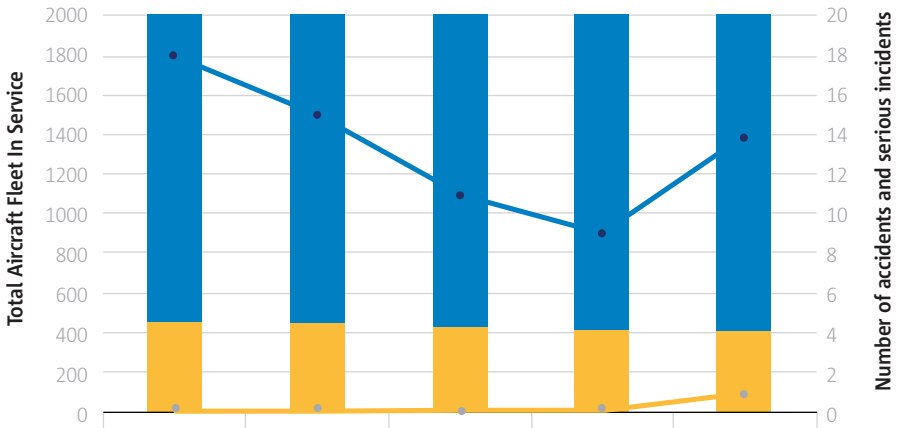
	HEMS	Air Taxi	Offshore	Sightseeing	Air Ambulance	Airline	Other/ unknown
Average 2012-2021	5.9	1.8	0.8	1.4	0.3	0.1	1.2
2022	7	4	0	0	0	0	2

Figure 3.13 Accidents and serious incidents by operation type involving CAT helicopters

Propulsion type

Figure 3.14 shows the distribution over the 5-year period of the EASA MS rotorcraft fleets in total by type of propulsion and with a trendline of accidents and serious incidents in the given period. The total fleet in service is shown in the primary vertical axis of the graph, whereas total number of accidents and serious incidents in each period is shown in the secondary vertical axis.

In 2022 one accident involved reciprocating engine helicopter and the rest of accidents and serious incidents in CAT helicopters operations involved turboshaft helicopters.



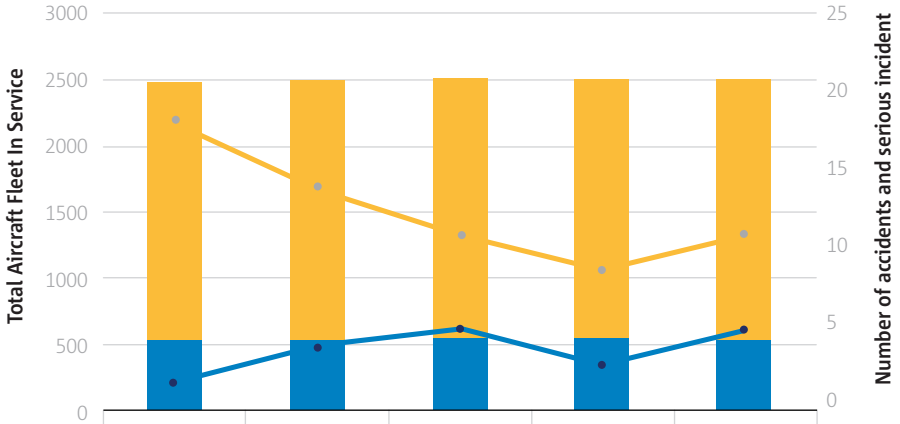
	2018	2019	2020	2021	2022
Turboshaft Total In Service	1912	1938	1951	1949	1949
Reciprocating Total In Service	452	449	429	416	409
Turboshaft Accidents and Serious incidents	18	15	11	9	13
Reciprocating Accidents and Serious incidents	0	0	0	0	1

Figure 3.14 Accidents and serious incidents by propulsion type involving CAT helicopters with the breakdown of propulsion type for the reported fleet

Helicopter certification specification (CS27/ CS29)

Figure 3.15 shows the distribution over the 5-year period of the EASA MS rotorcraft fleets in total by type of certification specification and with a trendline of accidents and serious incidents in the given period. The total fleet in service is shown in the primary vertical axis of the graph, whereas total number of accidents and serious incidents in each period is shown in the secondary vertical axis.

The relationship between certification and CAT operation requirements for transport category rotorcraft is known to be convoluted, of difficult interpretation. Based on this analysis, it can be observed that the CS 29 is more exposed than the CS 27 fleet.



	2018	2019	2020	2021	2022
CS 27 Total In Service	1929	1954	1957	1942	1945
CS 29 Total In Service	534	537	538	542	536
CS 27 Accidents and Serious incidents	16	10	6	6	6
CS 29 Accidents and Serious incidents	2	4	5	3	5

Figure 3.15 Accidents and serious incidents by certification specification (CS27/CS29) for CAT operations with the breakdown of aircraft certification type for the reported fleet

Safety risks for CAT helicopters

The safety risks for CAT helicopters are derived from accident and serious incident data from the EASA occurrence repository and the ECR, covering the period 2018-2022 (67 occurrences).

The relative comparison between KRAs for this domain is highlighted in Figure 3.16. KRAs and occurrence categories (refer to Figure 3.11) have different purposes. While occurrence categories describe actual factors and outcomes of an occurrence, KRAs describe the potential outcome of an occurrence. The KRA is defined by the most likely type of accident that an occurrence could have escalated to. Unlike occurrence categories, where multiple categories may be assigned to a single occurrence, there can only be one KRA per occurrence. The KRA is one element of the ERCS. This scheme is applied when determining the safety risk score of an occurrence and is further detailed in the ASR introduction.

The absolute numbers show that airborne collision is the top key risk area in terms of aggregated risk, whereas obstacle collision in flight shows similar risk, both in terms of the numbers of occurrences and aggregated risk. This statistic is a strong reminder of the dangers of airborne collision, highlighting the importance of taking the necessary precautions to avoid such a catastrophic event. It serves as a warning to pilots and other aircraft operators to be extra vigilant when flying in the vicinity of other aircraft. Furthermore, it emphasizes the need for improved safety protocols and regulations to reduce the risk of aircraft collisions.

In 2022 a total of three occurrences were attributed to the KRA airborne collision, of which one was a fatal accident, and two were serious incidents of which one involved a large drone and a HEMS helicopter, and a conflict with a small aeroplane performing non-commercial operations.

Terrain collision and aircraft upset form the other main KRAs of the CAT helicopters domain. Due to the nature of their activity and the conditions they get flown in, such as flying at low altitudes and in challenging weather conditions, in order to reach patients in remote or inaccessible areas, CAT helicopters are exposed to operational and environmental threats.

The KRA other injuries includes the occurrence scenarios that do not fit into other KRAs, but which can still cause actual or potential injury. That KRA includes injuries due to turbulence encounters, hoist operations, and ground operators' injuries, particularly persons being injured on the ground from falling loads, or from any part falling from an aircraft in flight.

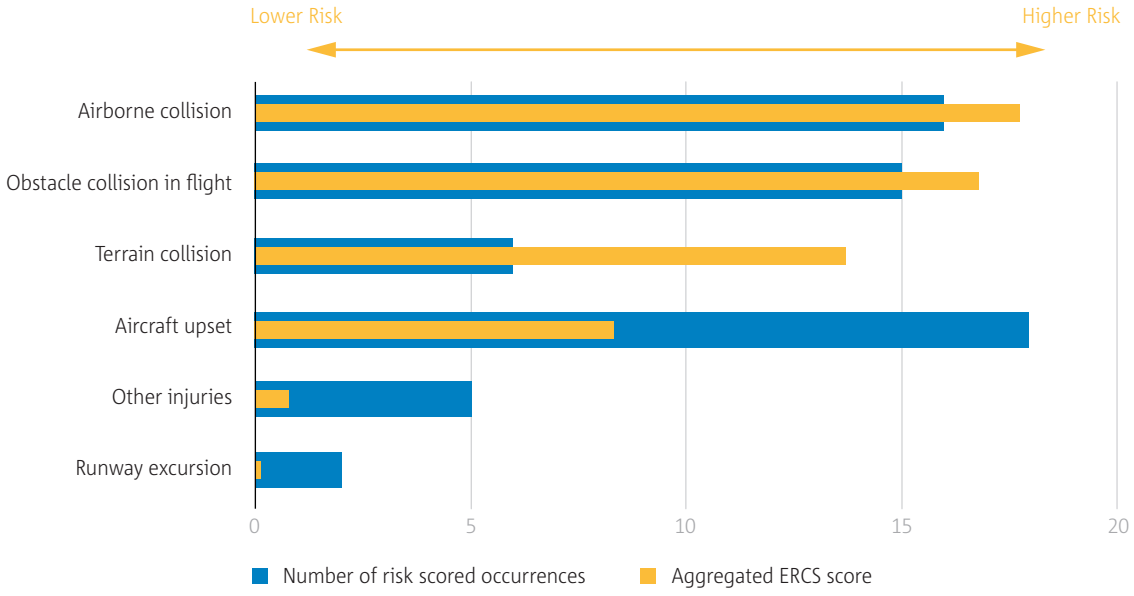


Figure 3.16 KRAs by aggregated ERCS score and number of risk-scored occurrences, involving CAT helicopters

3.3 SPO helicopters

This section covers the main safety statistics for EASA certified or validated helicopters performing SPO with an EASA MS as state of operator or state of registry. SPO are defined as any operation other than CAT where the aircraft is used for specialised activities such as: agriculture, construction, photography, surveying, observation and patrol, aerial advertisement.

Key statistics

The key statistics for this domain are in Table 3.5 and Table 3.6, which include a comparison of the number of fatal and non-fatal accidents and serious incidents for the last year and the previous 10-year period . It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

The number of accidents in 2022 was lower than the average of the preceding 10-year period, whereas the number of serious incidents slightly increased compared to the average for the same period. The numbers of fatalities and serious injuries are also below the average figures of the preceding decade.

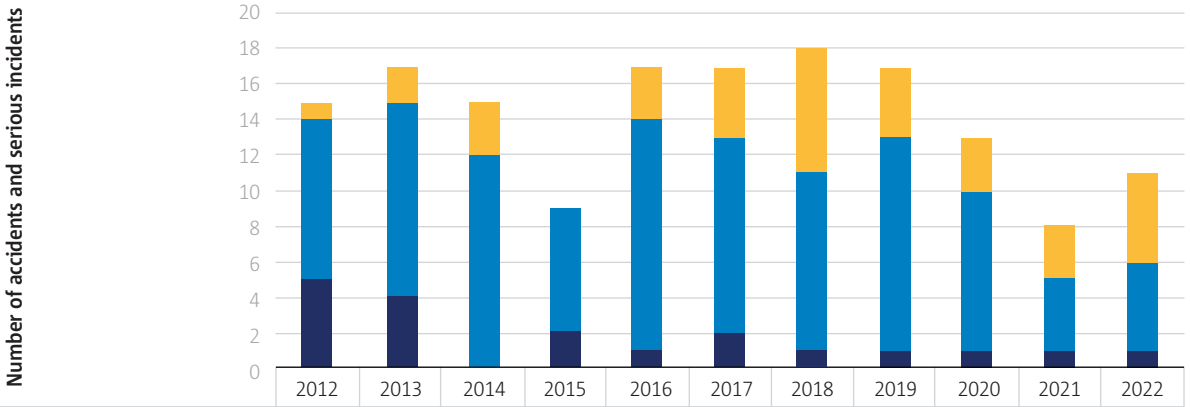
Table 3.5 Key statistics for SPO helicopters

	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**18**	**1**	↓
Non-fatal accidents	**98**	**5**	↓
Serious incidents	**30**	**5**	↑

Table 3.6 Fatalities and serious injuries involving SPO helicopters

	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**29**	**38**
Yearly max number over 2012-2021	**11**	**8**
Yearly min number over 2012-2021	**0**	**1**
Total number in 2022	**1**	**4**

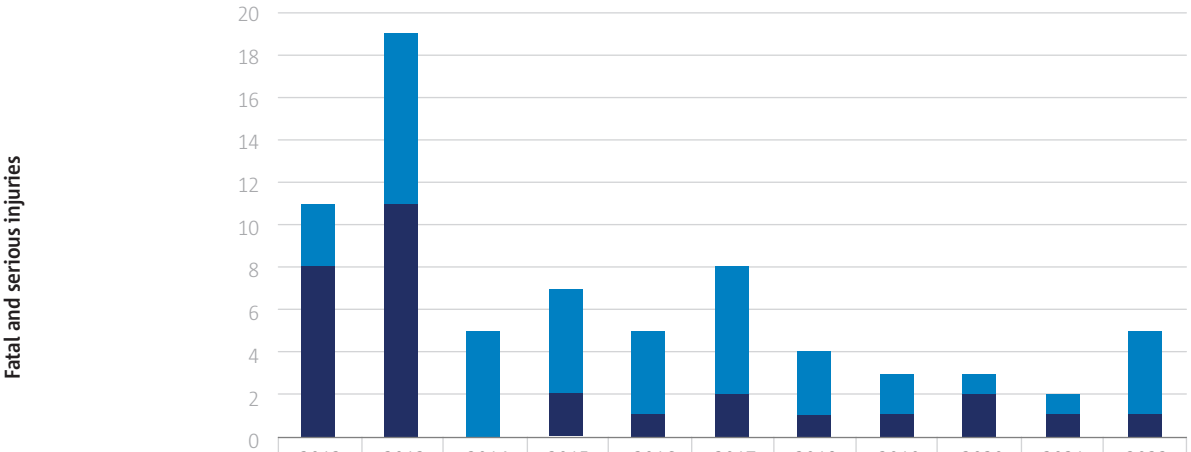
The numbers of accidents and serious incidents per year is shown in Figure 3.17. The total number of occurrences in 2022 had a slight upward trend in comparison to 2021, but still below the average for the same period. However, one fatal accident still occurred in 2022, as for the three preceding years. The fatal accident occurred during a sling load lifting operation when the main rotor hit the lower cable of a high voltage power line.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incident	1	2	3	0	3	4	7	4	3	3	5
Non-fatal accident	9	11	12	7	13	11	10	12	9	4	5
Fatal accident	5	4	0	2	1	2	1	1	1	1	1

Figure 3.17 Fatal accidents, non-fatal accidents and serious incidents per year involving SPO helicopters

The numbers of fatalities and serious injuries per year are shown in Figure 3.18. With one fatality and four serious injuries, the figures for 2022 are below the average observed since 2012.

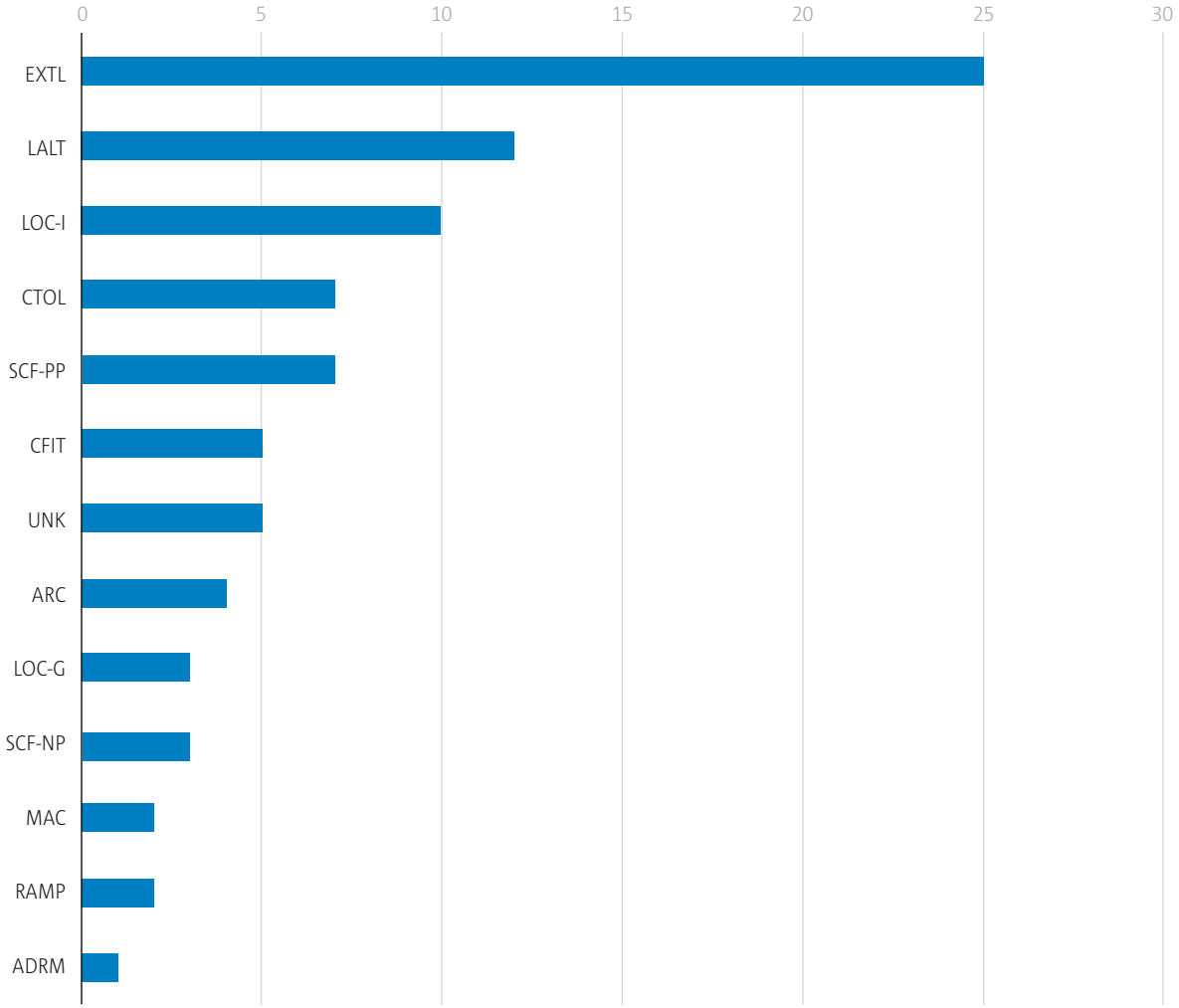


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	3	8	5	5	4	6	3	2	1	1	4
Fatalities	8	11	0	2	1	2	1	1	2	1	1

Figure 3.18 Fatal and serious injuries per year involving SPO helicopters

Occurrence categories

Figure 3.19 outlines the top 13 categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the ICAO ADREP taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed.

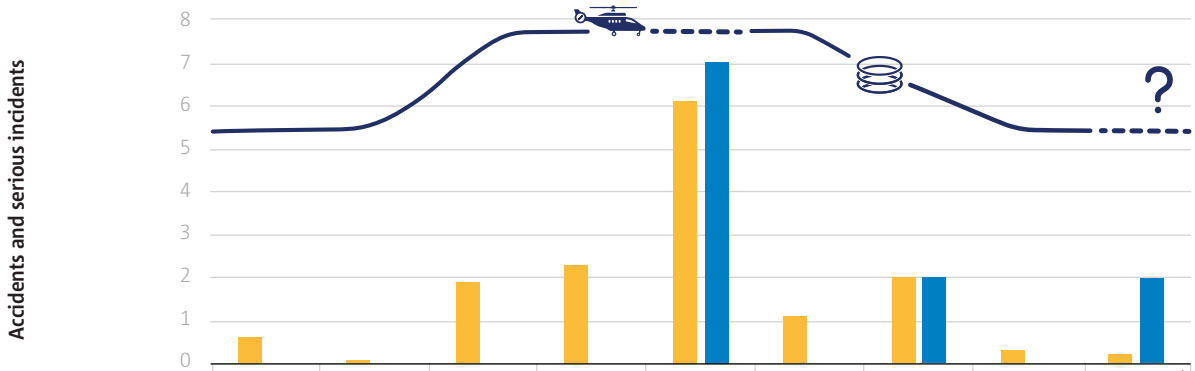


EXTL: External load related occurrences; LALT: Low altitude operations; LOC-I: Loss of control – inflight; CTOL: Collision with obstacle(s) during take-off and landing; SCF-PP: powerplant failure or malfunction; CFIT: Controlled flight into or toward terrain; UNK: Unknown or undetermined; ARC: Abnormal runway contact; LOC-G: Loss of control – ground; MAC: Airprox/ACAS alert/loss of separation/(near) midair collisions; RAMP: Ground Handling; SCF-NP: System/component failure or malfunction [non-powerplant]; ADRM: Aerodrome

Figure 3.19 Numbers of occurrences by occurrence category involving SPO helicopters

Phase of flight

Figure 3.20 shows the breakdown of accidents and serious incidents by flight phase. As with the average of the preceding 10-year period, the highest number of accidents and serious incidents in 2022 happened during manoeuvring phases which is expected for helicopters performing specialised operations, as the risk undertaken is the highest when performing the activities, such as long lifting devices, power line operations or constructing a large mast.

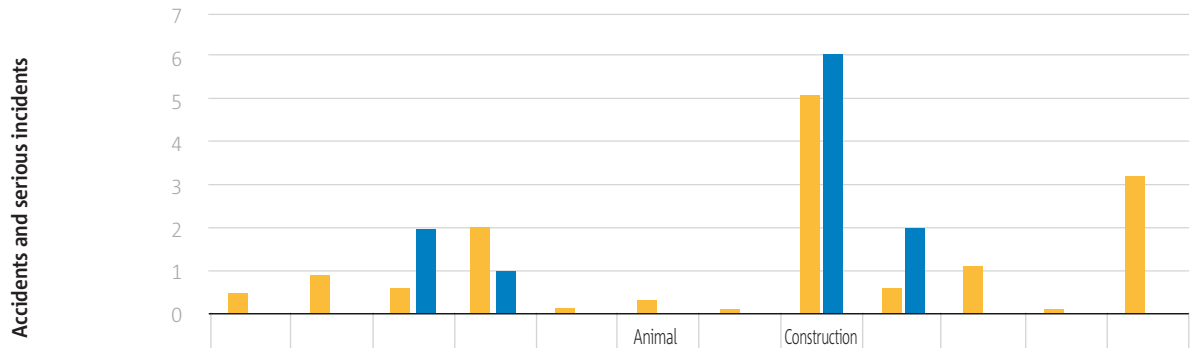


	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Tow	Unknown/ blank
Average 2012-2021	0.6	0.1	1.9	2.3	6.1	1.1	2	0.3	0.2
2022	0	0	0	0	7	0	2	0	2

Figure 3.20 Accidents and serious incidents by phase of flight involving SPO helicopters

Operation type

Figure 3.21 shows the numbers of accidents and serious incidents per type of operation. In 2022, construction and sling-load operations were, once again, by far the most affected. The other identified operation types involved in an occurrence in 2022 were logging and agricultural operations.

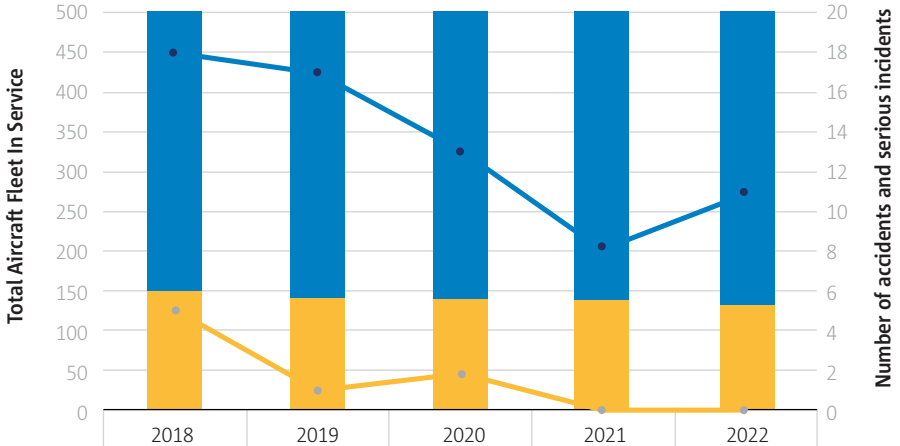


	Aerial observation	Aerial patrol	Aerial survey	Agricultural	Airshow /race	Animal herding/ mustering	Calibration	Construction sling/ load	Logging	Photography	Towing	Other/ unknown
Average 2012-2021	0.5	0.9	0.6	2	0.1	0.3	0.1	5.1	0.6	0.1	0.1	3.2
2022	0	0	2	1	0	0	0	6	2	0	0	0

Figure 3.21 Accidents and serious incidents by operation type involving SPO helicopters

Propulsion type

Figure 3.22 shows the distribution over the 5-year period of the EASA MS rotorcraft fleets in total by type of propulsion and with a trendline of accidents and serious incidents in the given period. The total fleet in service is shown in the primary vertical axis of the graph, whereas total number of accidents and serious incidents in each period is shown in the secondary vertical axis.

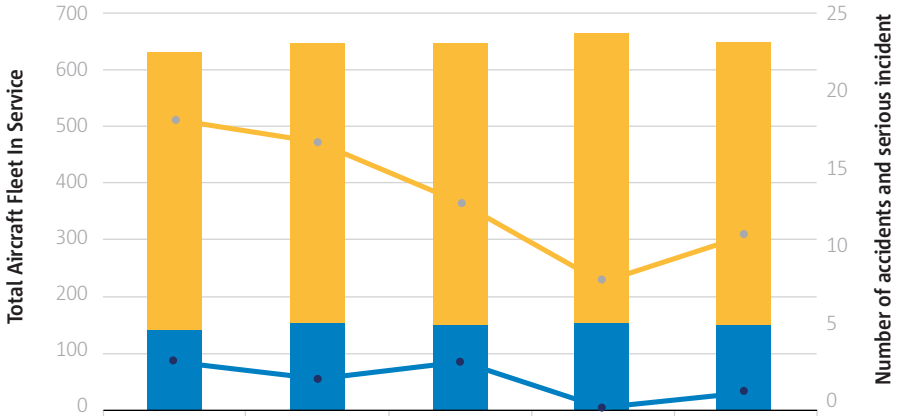


	2018	2019	2020	2021	2022
Turboshaft Total In Service	438	452	455	475	456
Reciprocating Total In Service	150	142	141	137	132
Turboshaft Accidents and Serious incidents	13	16	11	8	11
Reciprocating Accidents and Serious incidents	5	1	2	0	0

Figure 3.22 Accidents and serious incidents by propulsion type involving SPO helicopters with the breakdown of propulsion type for the reported fleet

Helicopter certification specification (CS27/ CS29)

Figure 3.23 shows the distribution over the 5-year period of the EASA MS rotorcraft fleets in total by type of certification specification, Certification Specifications for Small Rotorcraft (CS-27) and the Certification Specifications for Large Rotorcraft (CS-29), with a trendline of accidents and serious incidents in the given period. The total fleet in service is shown in the primary vertical axis of the graph, whereas total number of accidents and serious incidents in each period is shown in the secondary vertical axis.



	2018	2019	2020	2021	2022
CS 27 Total In Service	490	495	497	513	498
CS 29 Total In Service	140	151	150	152	150
CS 27 Accidents and Serious incidents	15	15	10	8	10
CS 29 Accidents and Serious incidents	3	2	3	0	1

Figure 3.23 Accidents and serious incidents by certification specification (CS27/CS29) for SPO with the breakdown of aircraft certification type for the reported fleet

Safety risks for SPO helicopters

The safety risks for SPO helicopters are derived from accident and serious incident data from the EASA occurrence repository and the ECR, covering the period 2018-2022 (74 occurrences).

The relative comparison between KRAs for this domain is highlighted in Figure 3.24. KRAs and occurrence categories (refer to Figure 3.19) have different purposes. While occurrence categories describe actual factors and outcomes of an occurrence, KRAs describe the potential outcome of an occurrence. The KRA is defined by the most likely type of accident that an occurrence could have escalated to. Unlike occurrence categories, where multiple categories may be assigned to a single occurrence, there can only be one KRA per occurrence. The KRA is one element of the ERCS. This scheme is applied when determining the safety risk score of an occurrence and is further detailed in the ASR introduction.

When it comes to KRA, aircraft upset or LOC in flight is most risky, both in terms of numbers of occurrences and aggregated risk, which is not surprising given the conditions and the common environmental factors that come with this type of operation. Helicopter pilots navigate the most harrowing environments known to flight, where recovery has no margin for delayed and untrained human reaction. Aircraft upset or LOC can occur in all phases of the flight. Most of the aircraft upset KRA is often caused by inadvertent entry into instrument meteorological conditions, such as flying into clouds/fog/degraded visual conditions.

Over the 5-year period analysed, four out of the five fatal accidents involving SPO helicopters were aircraft upsets in flight.

The KRA other injuries includes occurrences that do not fit in other KRAs, but which can still cause actual or potential injury. That KRA includes occurrences due to turbulence encounters, hoist operations, ground operator injuries, particularly persons being injured on the ground from falling loads, or from any part falling from an aircraft in flight.

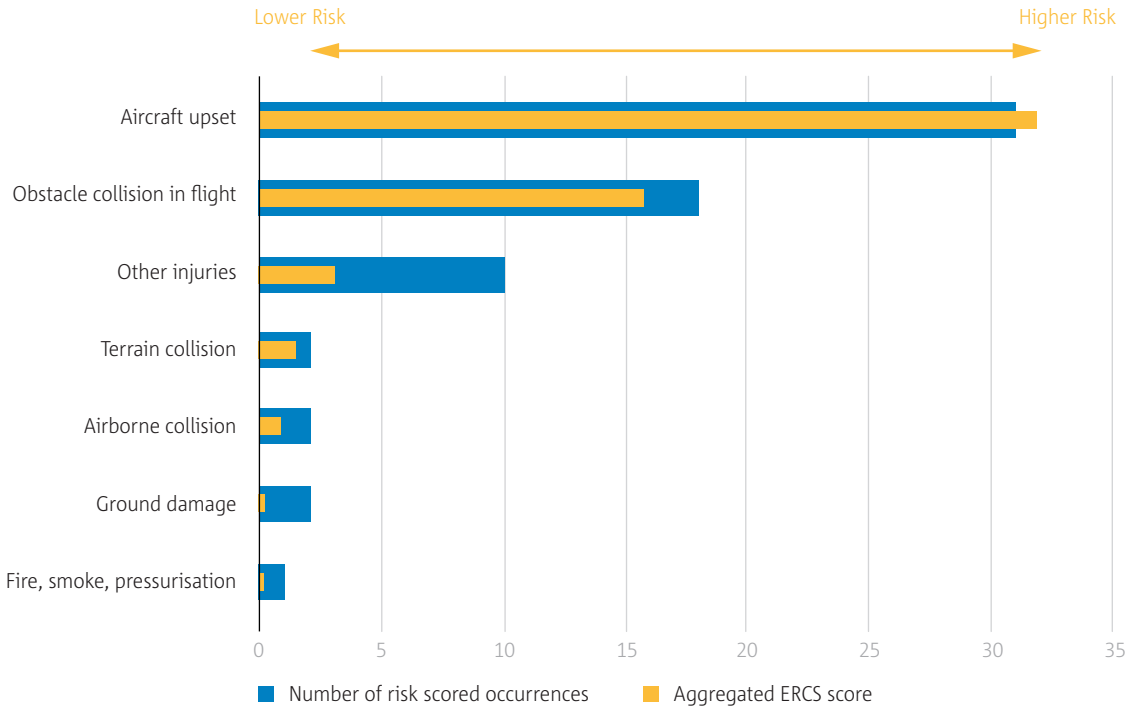


Figure 3.24 KRAs by aggregated ERCS score and number of risk-scored occurrences, involving SPO helicopters

3.4 Non-commercial operations helicopters

This section covers the main safety statistics for EASA certified or validated helicopters performing non-commercial operations with an EASA MS as state of operator or state of registry. The type of flying included in this section are mainly flight training, test flights, leisure flights and ferry flights.

Key statistics

The key statistics for this domain are in Table 3.7 and Table 3.8, which include a comparison of the number of fatal and non-fatal accidents and serious incidents for the last year and the previous 10-year period. It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

Whereas the number of fatal accidents and serious incidents in 2022 was lower compared with the average of the preceding decade, the number of non-fatal accidents was similar to the 10-year period. The number of fatalities and serious injuries in 2022 are below the average of the preceding 10 years.

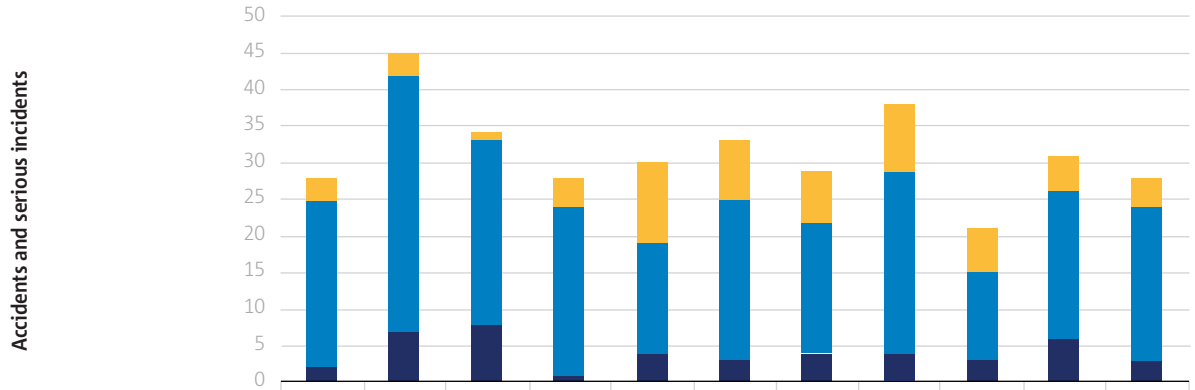
Table 3.7 Key statistics for non-commercial operations helicopters

	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**42**	**3**	↓
Non-fatal accidents	**218**	**21**	=
Serious incidents	**57**	**4**	↓

Table 3.8 Fatalities and serious injuries involving non-commercial operations helicopters

	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**90**	**46**
Yearly max number over 2012-2021	**20**	**11**
Yearly min number over 2012-2021	**1**	**0**
Total number in 2022	**4**	**4**

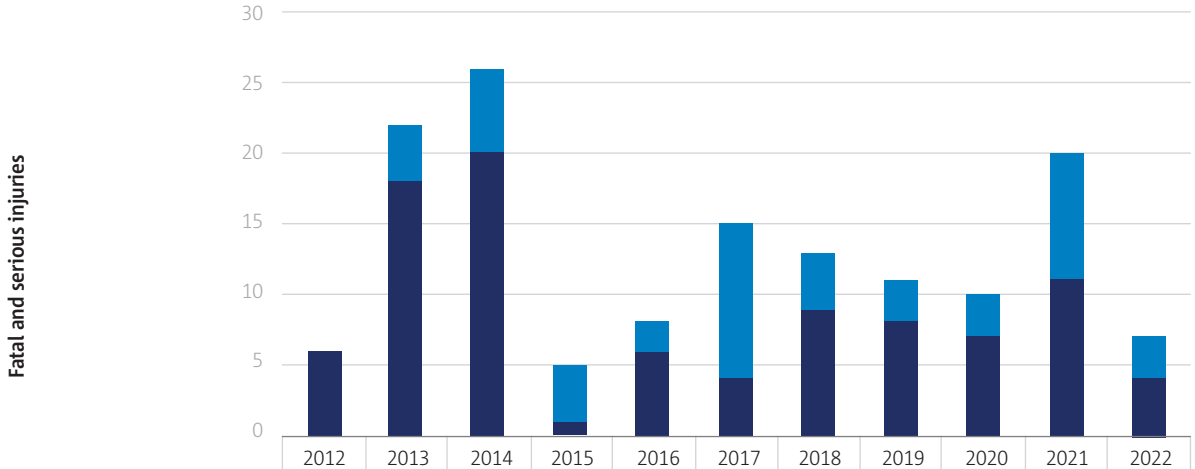
The numbers of accidents and serious incidents per year is shown in Figure 3.25. After the year 2020 which resulted in the lowest figures observed since 2011, the number of accidents slightly increased in 2021 and then stabilised in 2022. In comparison with 2021 where we had the highest number of fatal accidents, in 2022 the number is below the average figures of the preceding decade. An increasing trend can be observed for non-fatal accidents.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incident	3	3	1	4	11	8	7	9	6	5	4
Non-fatal accident	23	35	25	23	15	22	18	25	12	20	21
Fatal accident	2	7	8	1	4	3	4	4	3	6	3

Figure 3.25 Fatal accidents, non-fatal accidents and serious incidents per year involving non-commercial operations helicopters

The numbers of fatalities and serious injuries per year are shown in Figure 3.26. The number of fatalities in 2022 shows a significant drop, whereas the number of serious injuries is similar to the period 2018-2020 but not to 2021.

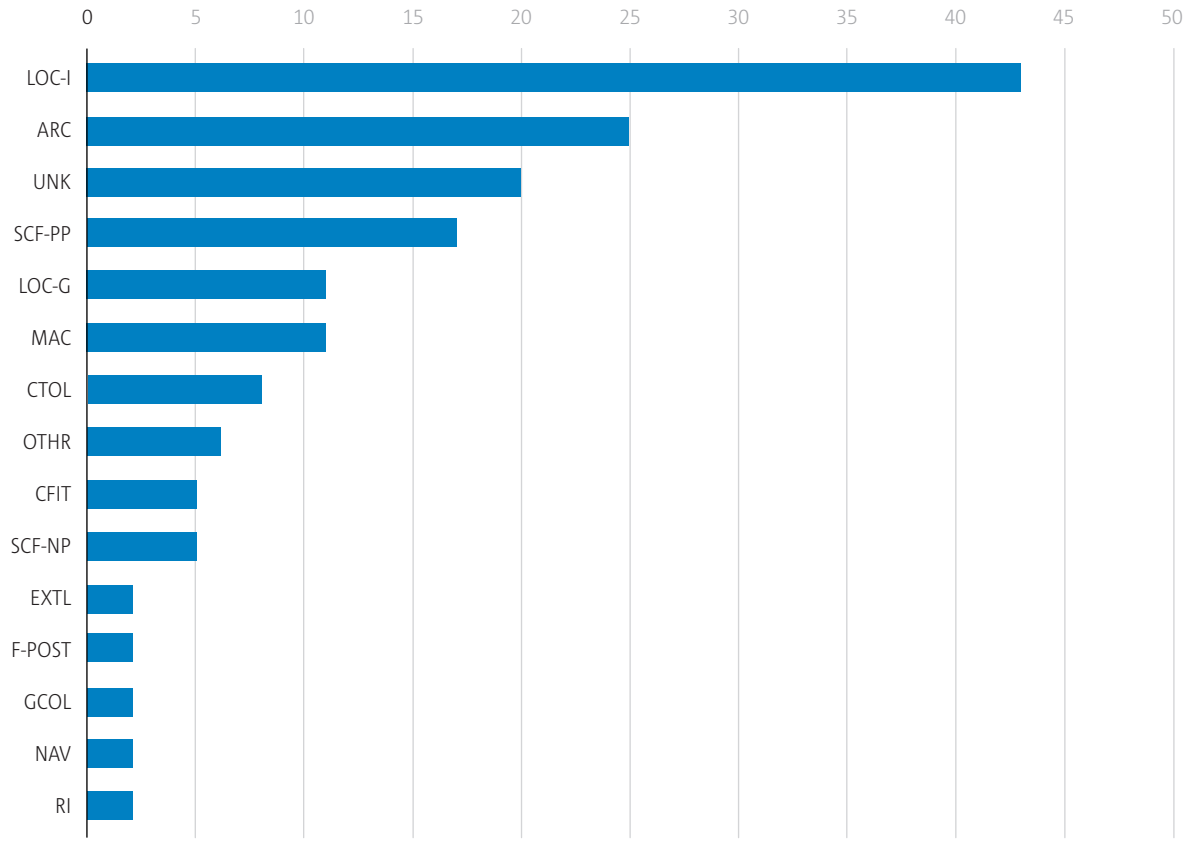


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	0	4	6	4	2	11	4	3	3	9	3
Fatalities	6	18	20	1	6	4	9	8	7	11	4

Figure 3.26 Fatal and serious injuries per year involving non-commercial operations helicopters

Occurrence categories

Figure 3.27 outlines the top 15 categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the ICAO ADREP taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed.

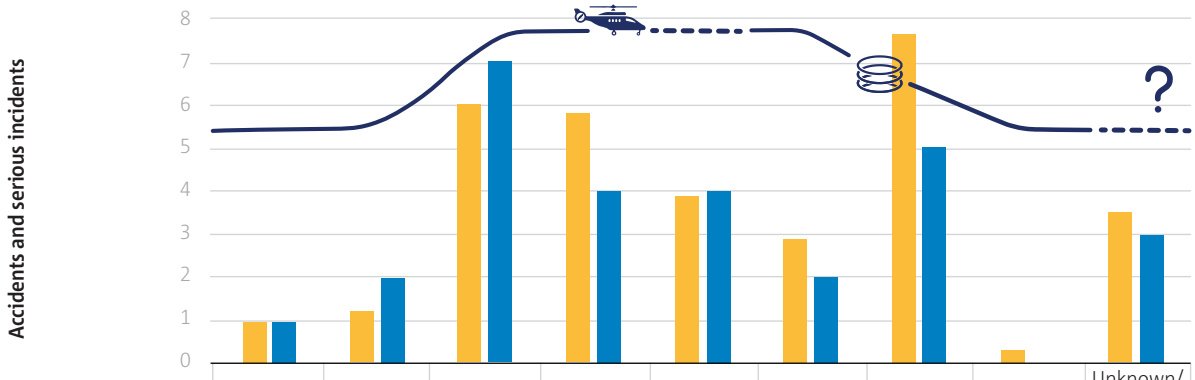


LOC-I: Loss of control – inflight; ARC: Abnormal runway contact; UNK: Unknown or undetermined; SCF-PP: powerplant failure or malfunction; LOC-G: Loss of control – ground; MAC: Airprox/ACAS alert/loss of separation/(near) midair collisions; CTOL: Collision with obstacle(s) during take-off and landing; OTHR: Other; CFIT: Controlled flight into or toward terrain; SCF-NP: System/component failure or malfunction [non-powerplant]; EXTL: External load related occurrences; F-POST: Fire/smoke (post-impact); GCOL: Ground Collision; NAV: Navigation error; RI: Runway incursion - vehicle, aircraft or person

Figure 3.27 Numbers of occurrences by occurrence category involving non-commercial operations helicopters

Phase of flight

Figure 3.28 shows the distribution of accidents and serious incidents by flight phase. Among the occurrences in 2022 for which the flight phase was identified, take-off and landing phases were the most frequent, which is also the case for the 10-year average figures. However, it should be noticed that for three occurrences of 2022, the flight phase could not be identified from the data collected so far.

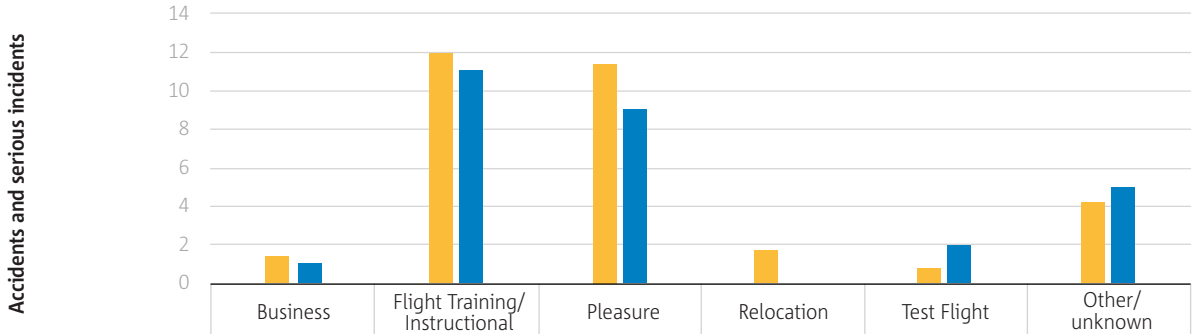


	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Tow	Unknown/ blank
Average 2012-2021	1	1.2	6	5.8	3.9	2.9	7.6	0.3	3.5
2022	1	2	7	4	4	2	5	0	3

Figure 3.28 Accidents and serious incidents by phase of flight involving non-commercial operations helicopters

Operation type

Figure 3.29 shows the numbers of accidents and serious incidents per type of operation. In 2022, as in the previous decade, the highest number of occurrences for which the type of operation was identified were in pleasure flights and flight training/instructional operations. This is to be expected that flight instruction is still one of the riskiest environments. Most of the helicopters used in this sector are small and equipped with one engine. It should be highlighted that the exact nature of the operation is unknown at this stage for 5 occurrences.



	Business	Flight Training/ Instructional	Pleasure	Relocation	Test Flight	Other/ unknown
Average 2012-2021	1.4	11.9	11.4	1.7	0.7	4.2
2022	1	11	9	0	2	5

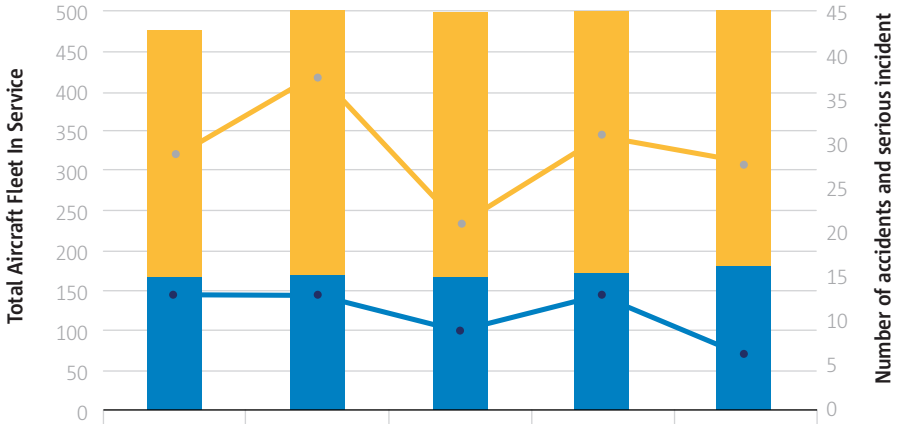
Figure 3.29 Accidents and serious incidents by operation type involving non-commercial operations helicopters

Propulsion type

Figure 3.30 shows the distribution over the 5-year period of the EASA MS rotorcraft fleets in total by type of propulsion and with a trendline of accidents and serious incidents in the given period.

The total fleet in service is shown in the primary vertical axis of the graph, whereas total number of accidents and serious incidents in each period is shown in the secondary vertical axis.

In 2022, the figures for turboshaft helicopters decreased in absolute numbers, but there is an increase in reciprocating helicopters.

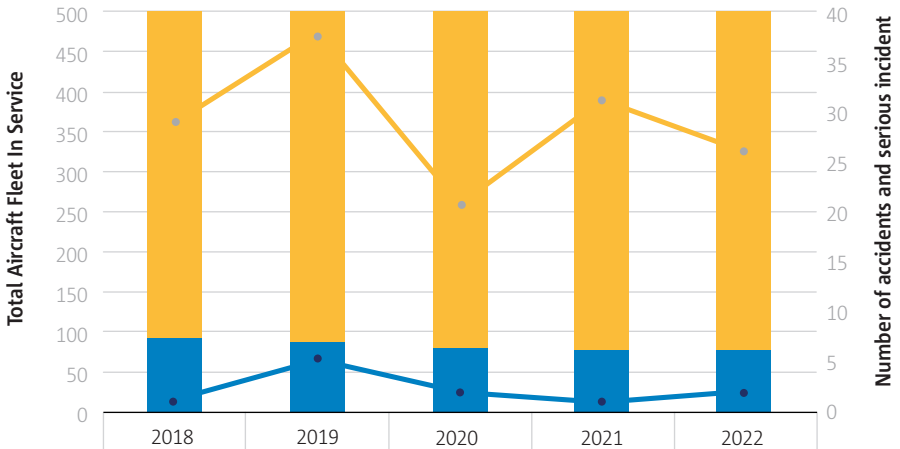


	2018	2019	2020	2021	2022
Reciprocating Total In Service	311	374	336	343	339
Turboshaft Total In Service	166	169	165	171	180
Reciprocating Accidents and Serious incidents	16	25	12	18	22
Turboshaft Accidents and Serious incidents	13	13	9	13	6

Figure 3.30 Accidents and serious incidents by propulsion type involving non-commercial operations helicopters with the breakdown of propulsion type for the reported fleet

Helicopter certification specification (CS27/CS29)

Figure 3.31 shows the distribution over the 5-year period of the EASA MS rotorcraft fleets in total by type of certification specification, Certification Specifications for Small Rotorcraft (CS-27) and the Certification Specifications for Large Rotorcraft (CS-29), with a trendline of accidents and serious incidents in the given period. The total fleet in service is shown in the primary vertical axis of the graph, whereas total number of accidents and serious incidents in each period is shown in the secondary vertical axis.



	2018	2019	2020	2021	2022
CS 27 Total In Service	539	561	562	574	581
CS 29 Total In Service	92	88	80	77	77
CS 27 Accidents and Serious incidents	28	33	19	30	24
CS 29 Accidents and Serious incidents	1	5	2	1	2

Figure 3.31 Accidents and serious incidents by certification specification (CS27/CS29) for non-commercial operations with the breakdown of aircraft certification type for the reported fleet

Safety risks for non-commercial operations helicopters

The safety risks for non-commercial operations helicopters are derived from accident and serious incident data from the EASA occurrence repository and the ECR, covering the period 2018-2022 (198 occurrences).

The relative comparison between KRAs for this domain is highlighted in Figure 3.32. KRAs and occurrence categories (refer to Figure 3.27) have different purposes. While occurrence categories describe actual factors and outcomes of an occurrence, KRAs describe the potential outcome of an occurrence. The KRA is defined by the most likely type of accident that an occurrence could have escalated to. Unlike occurrence categories, where multiple categories may be assigned to a single occurrence, there can only be one KRA per occurrence. The KRA is one element of the ERCS. This scheme is applied when determining the safety risk score of an occurrence and is further detailed in the ASR introduction.

The data reviewed on the accidents and serious incidents involving non-commercial operated helicopters shows that aircraft upset is by far the top KRA, both in terms of numbers of occurrences and aggregated risk. This is to be expected considering that it is a crucial part of pilot training and learning how to recover from an upset that can prevent more serious LOC incidents. On top of this, the flight envelope that they are being exposed presents more risk as well (e.g., engine off landings, practice forced landings, advanced autorotations).

Over the 5-year period analysed, 10 out of the 20 fatal accidents involving non-commercial operations helicopters were aircraft upset in flight.

This KRA is followed by obstacle collision in flight and terrain collision. Due to the nature of their operations, helicopters tend to commonly fly at low altitudes, and this places them at high risk of striking various types of obstacles or high-level terrain.

Figure 3.32 below gives a visual representation of KRAs by aggregated ERCS score and absolute numbers.

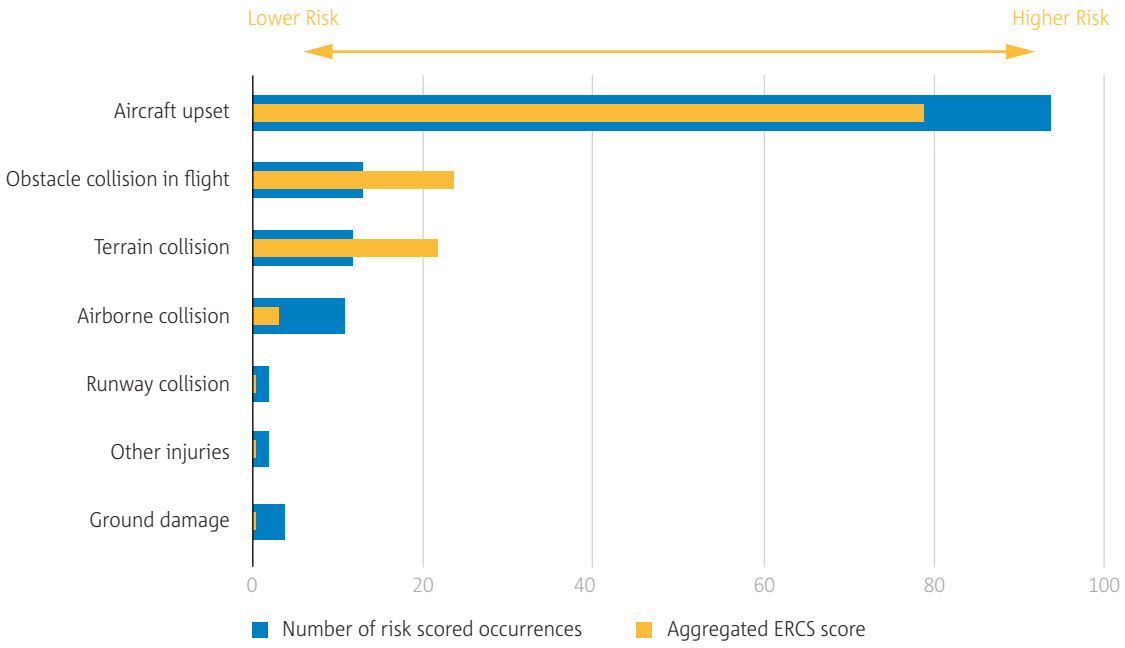


Figure 3.32 KRAs by aggregated ERCS score and number of risk-scored occurrences, involving non-commercial operations helicopters

Chapter 4
Balloons

The scope of this chapter covers hot air balloon operations where the state of registry is an EASA MS. The data presented is based on the accidents and serious incidents collected by the Agency under Regulation (EU) 996/2010 on accident and serious incident investigation and Regulation (EU) 376/2014 on occurrence reporting, and through actively searching for those events from other official sources.

The chapter provides in the core document the key statistics, the occurrence categories, and the safety risks at key risk aera level for balloon operations. It is the second time the European Common Repository (ECR) will be used as the data source for the key statistics and occurrence categories. Advanced statistics are then provided per aviation domain in domain-specific appendices, giving an overview of the contributors to the safety risks identified in the core document for these types of operations at the European level. These advanced statistics are solely derived from occurrence data, and use the EASA database that contains more relevant information for its purpose.

The list of fatal accidents associated with the scope of this chapter is provided in Appendix 1 of this document.

The advanced statistics associated with the scope of this chapter are provided in Appendix 4 of this document.

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Key Statistics

The key statistics for this domain are in Table 4.1 and Table 4.2 and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the last year and the previous 10-year period. It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

Table 4.1 shows a comparison between the 10-year average vs. 2022. This indicates that the number of fatal accidents and the number of serious incidents is decreasing compared to the 10-year average. Non-fatal accidents, however, are a bit higher than the 10-year average.

Table 4.2 presents the number of fatalities and serious injuries for 2022 vs. the 10-year average. The number of fatalities has decreased in 2022 compared to the 10-year average and the number of serious injuries in 2022 is close to even when compared to the 10-year average.

A better understanding of the level of balloon safety in EASA Member States could be achieved if exposure data showing the number of flights was collected at regulatory level. EASA encourages all national authorities to collect, aggregate and share such data for the benefit of all.

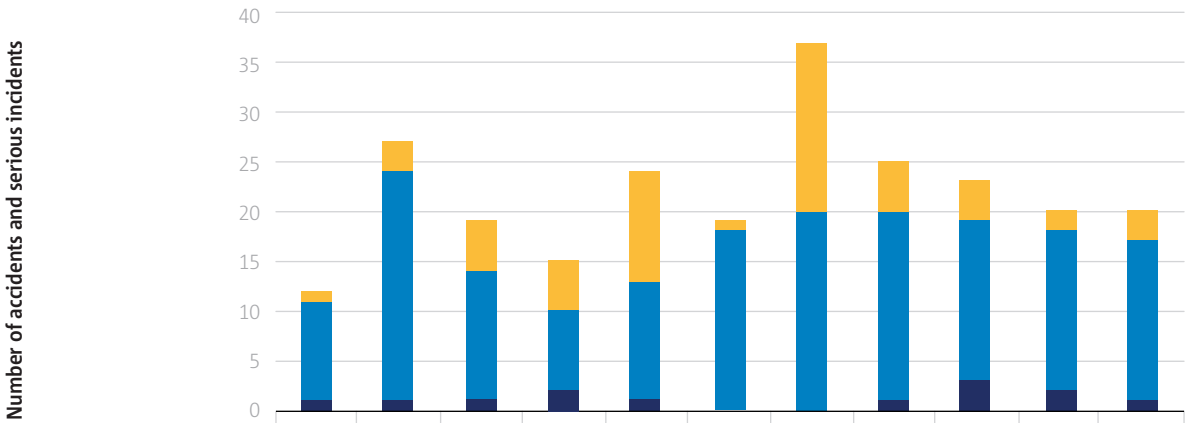
Table 4.1 Key statistics for balloons

	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**12**	**1**	↓
Non-fatal accidents	**155**	**16**	↑
Serious incidents	**54**	**3**	↓

Table 4.2 Fatalities and serious injuries involving balloons

	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**15**	**178**
Yearly max number over 2012-2021	**4**	**24**
Yearly min number over 2012-2021	**0**	**10**
Total number in 2022	**1**	**17**

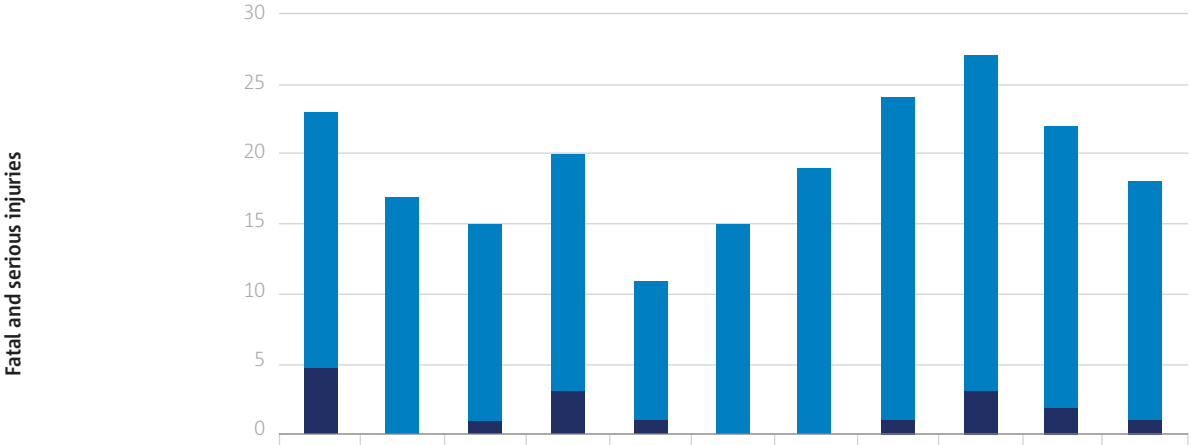
Figure 4.1 plots the number of fatal accidents, non-fatal accidents, and serious incidents from 2012 until 2022. Last year was overall very similar to 2021, with fewer fatal accidents. A slight downward trend in the total figures can also be observed since 2018.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	1	3	5	5	11	1	17	5	4	2	3
Non-fatal accidents	10	23	13	8	12	18	20	19	16	16	16
Fatal accidents	1	1	1	2	1	0	0	1	2	2	1

Figure 4.1 Fatal accidents, non-fatal accidents and serious incidents per year involving balloons

Figure 4.2 shows the number of fatalities and serious injuries in a similar downward trend as Figure 4.1. Last year 2022 can be compared to 2013 and 2015 in terms of serious injuries.



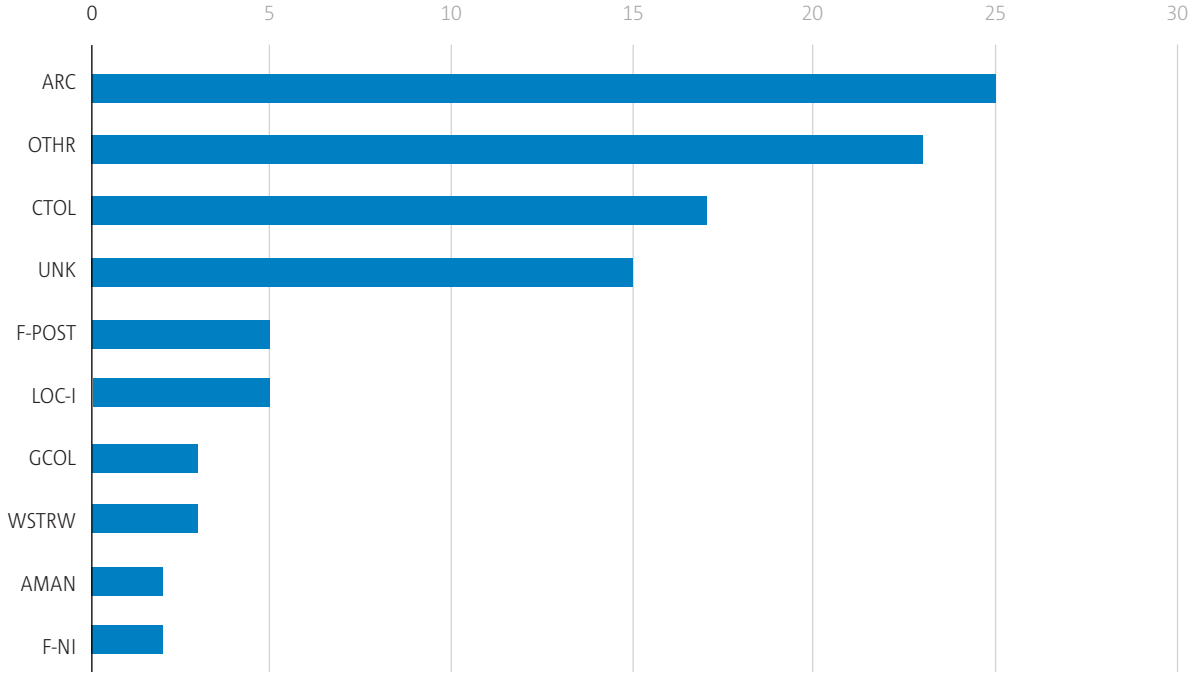
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	19	17	14	17	10	15	19	23	24	20	17
Fatalities	4	0	1	3	1	0	0	1	3	2	1

Figure 4.2 Fatalities and serious injuries involving balloons

Occurrence categories

Figure 4.3 outlines the top 10 categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the ICAO Accident Incident Data Reporting (ADREP) taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed. Categories are of different nature, e.g., operational such as abrupt manoeuvre (AMAN), environmental such as windshear or thunderstorm (WSTRW), technical such as system/ component failure or malfunction [non-powerplant] (SCF-NP), consequential such as fire/ smoke resulting from impact (F-POST), etc. Multiple categories may therefore be assigned to a single occurrence. For example, if an engine failure occurred, and loss of control followed, the occurrence would be coded in both categories, i.e., SCF-PP: powerplant failure or malfunction and LOC-I: loss of control in flight. The sum of the number of occurrences per category may therefore be greater than the total number of occurrences that realised in the period.

For the period 2018-2022 figures show that abnormal runway contact is the most common cause of injuries. This means that hard landings are causing injuries, mostly to passengers, resulting in bone fractures or torn ligaments. The collision with obstacle(s) during take-off or landing occurrence category includes collisions with powerlines, buildings or other structures.

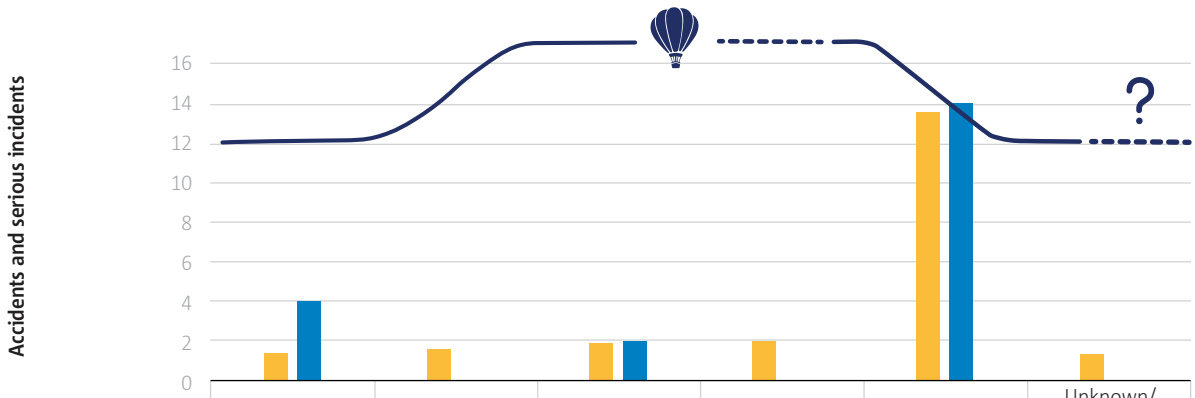


ARC: Abnormal runway contact; OTHR: Other; CTOL: Collision with obstacle(s) during take-off and landing; UNK: Unknown or undetermined; F-POST: Fire/ smoke (post-impact); LOC-I: Loss of control - inflight; GCOL: Ground Collision; WSTRW: Windshear or thunderstorm; AMAN: Abrupt maneuvre; F-NI: Fire/ smoke (non-impact)

Figure 4.3 Numbers of occurrences by occurrence category involving balloons

Phase of flight

Most balloon accidents and serious incidents occur during the landing phase of the flight, as shown in Figure 4.4. It can also be observed that the number of recorded landing accidents and serious incidents is almost at the 10-year average. There is an increase in accidents and serious incidents during the standing flight phase, whilst for take-off and manoeuvring phases these numbers are decreasing. For balloons, the flight phase standing covers the period where the balloon is filled with hot air, but the basket is still heavy.

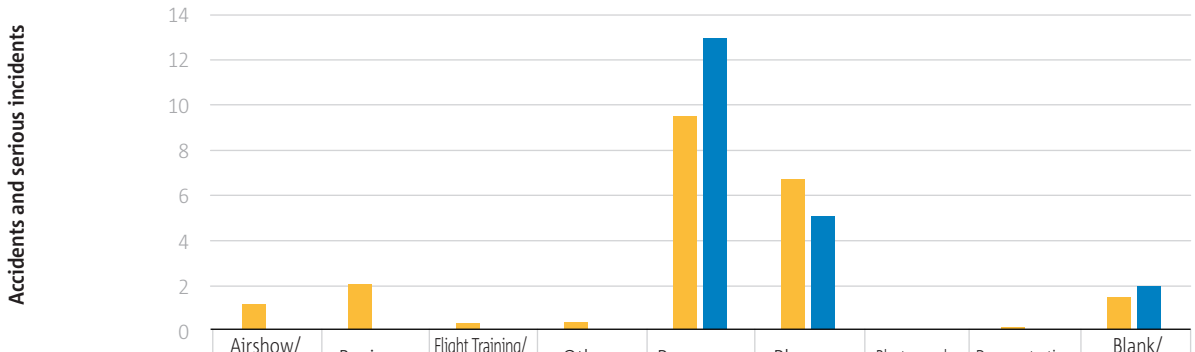


	Standing	Take-off	En route	Manoevring	Landing	Unknown/ Blank
Average 2012-2021	1.4	1.6	1.9	2	13.6	1.3
2022	4	0	2	0	14	0

Figure 4.4 Accidents and serious incidents involving balloons, by phase of flight

Operation type

Most balloon accidents and serious incidents are related to passenger and pleasure flights, as shown in Figure 4.5. Note that activities such as competitions and record flights are considered to be part of the airshow/ race category. Passenger accidents have slightly increased in 2022 compared with the 10-year average but there is a fairly stable and low number of accidents and serious incidents in all other categories.



	Airshow/ race	Business	Flight Training/ Instructional	Other	Passenger	Pleasure	Photography	Demonstration	Blank/ Unknown
Average 2012-2021	1.2	2.1	0.3	0.4	9.5	6.7	0.1	0.2	1.5
2022	0	0	0	0	13	5	0	0	2

Figure 4.5 Accidents and serious incidents involving balloons, by operation type

Safety risks for balloons

The safety risks for balloons are derived from accident and serious incident data from the EASA occurrence repository and the European Central Repository, covering the period 2018-2022 (125 occurrences).

The key risk areas for Balloons are shown in Figure 4.6. Key risk areas and occurrence categories (refer to Figure 4.3) have different purposes. While occurrence categories describe actual factors and outcomes of an occurrence, key risk areas describe the potential outcome of an occurrence. The key risk area is defined by the most likely type of accident that an occurrence could have escalated to. Unlike occurrence categories, where multiple categories may be assigned to a single occurrence, there can only be one key risk area per occurrence. The key risk area is one element of the European Risk Classification Scheme (ERCS). This scheme is applied when determining the safety risk score of an occurrence and is further detailed in the ASR introduction.

The main key risk area in ballooning is obstacle collision in flight. With 21 occurrences over the last five years, the data shows that powerline collisions or collisions with trees and buildings are the main issues.

The balloon landings key risk area includes hard landings causing serious injuries to the passengers but no damage to the basket or other components. However, the landing is firm enough to cause injuries which could be avoided by better preparation of the passengers for the imminent touchdown. The use of the aircraft upset key risk area is a bit controversial in the context of ballooning. There have been, however, some accidents where the pilot falls out of the basket during a hard landing due to the lack of or not used restraints, or is unable to board the balloon when taking off. Hence, the balloon becomes uncontrolled and therefore it can be substantiated that the balloon, as an aircraft, is upset.

The other injuries key risk area is a low-risk area but one which has a significant number 31 of occurrences attached to it. These include injuries from the inflation of the balloon until the passengers have exited the balloon basket, and do not fall into any other KRA. In 2022 a fatal accident occurred when a passenger rolled over and was killed by a vehicle during an uncontrolled take off of a balloon.

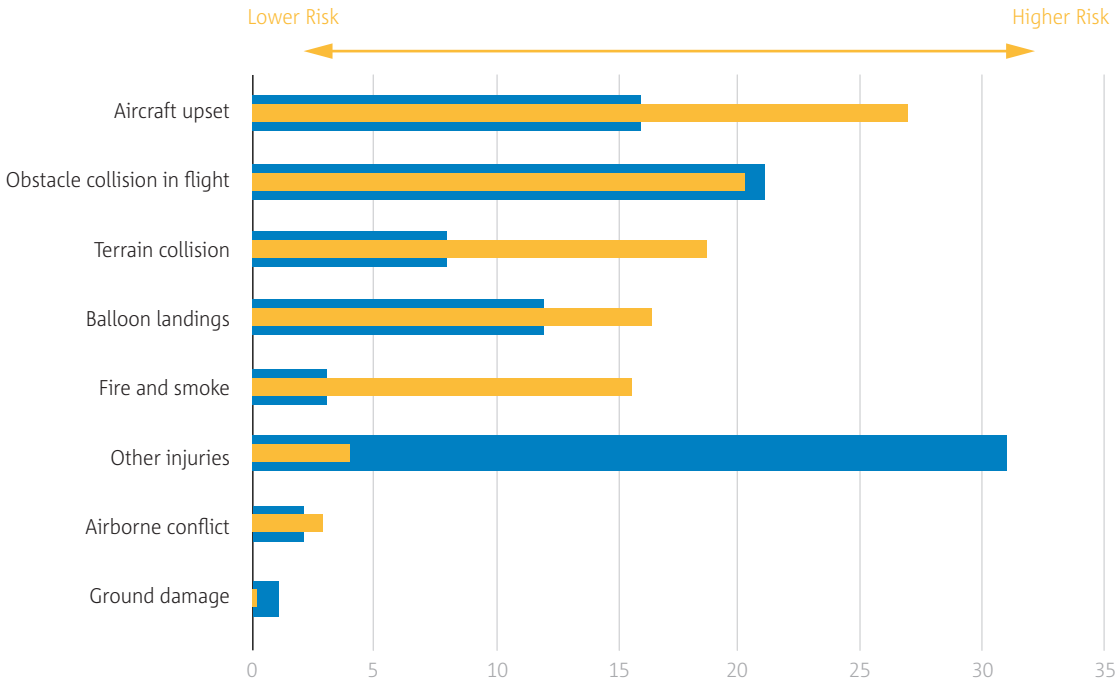


Figure 4.6 Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving balloons

Chapter 5
Sailplanes

This chapter covers sailplane operations where the state of registry of the aircraft is an EASA Member State. The data presented are based on the accidents and serious incidents collected by the Agency under Regulation (EU) 996/2010 on accident and serious incident investigation and Regulation (EU) 376/2014 on occurrence reporting, and through actively searching for those events from other official sources.

The chapter provides in the core document the key statistics, the occurrence categories, and the safety risks at key risk aera level for sailplanes. The European Common Repository (ECR) and the EASA database are used as the data sources for the key statistics. Advanced statistics are then provided per aviation domain in domain specific appendices, giving an overview of the contributors to the safety risks identified in the core document for these types of operations at the European level. These advanced statistics are solely derived from occurrence data and use the EASA occurrence database that contains more relevant information for its purpose. Updated accident rates for sailplanes are not available this year due to missing utilisation data. It is therefore worth stressing the importance of collecting exposure data to provide a proper oversight visibility on the domain.

Sailplane operations are a unique aviation domain, largely due to how gliding is performed. Unlike other domains where aircraft are powered by engines, sailplane operations depend on teamwork and safe towing into the air, using an aircraft or a winch, for the flight to commence. This added operational complexity has fostered a collaborative team spirit and cohesive atmosphere for safety within the gliding community. The dataset used in this chapter contains both non-powered and powered sailplanes but excludes ultralight sailplanes. The gliding community, with the leadership of the European Gliding Union (EGU), has been actively involved in shaping the EU rules on Sailplane Air Operations (OPS) and Flight Crew Licensing (FCL) rules, and in providing EASA with valuable input and insight into sailplane operations.

The list of fatal accidents associated with the scope of this chapter is provided in Appendix 1 of this document.

The advanced statistics associated with the scope of this chapter are provided in Appendix 5 of this document.

Key statistics

The key statistics for this domain are in Table 5.1 and Table 5.2 and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the last year and the previous 10-year period. It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe. Table 5.1 shows an upward trend in number of fatal accidents and serious incidents but a downward trend in the number of non-fatal accidents, compared to the 10-year average. Table 5.2 lays out the figures on number of fatalities and serious injuries. In 2022 there were 32 fatalities which is higher than the maximum value for the preceding 10 years. Compared to the 10-year average, the number of fatalities were increased by 66% and the number of serious injuries were close to 50% fewer.

Table 5.1 Key statistics for sailplanes

	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	204	27	↑
Non-fatal accidents	1522	122	↓
Serious incidents	259	33	↑

Table 5.2 Fatalities and serious injuries involving sailplanes

	Number of fatalities	Number of serious injuries
Total number over 2012-2021	212	306
Yearly max number over 2012-2021	31	45
Yearly min number over 2012-2021	15	20
Total number in 2022	32	15

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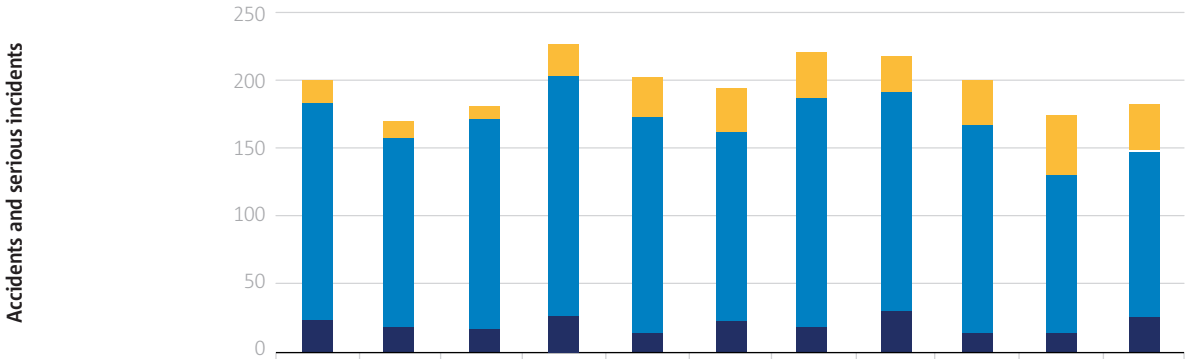
Figure 5.1 provides an overview of both fatal and non-fatal accidents and serious incidents from 2012 to 2022. The figure shows a stable trend over the period. However, last year the number of fatal accidents increased to similar figure as in 2019.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	15	12	9	23	29	33	33	27	34	44	33
Non-fatal accidents	160	139	154	177	158	139	168	160	152	115	122
Fatal accidents	24	19	17	26	15	23	19	31	15	15	27

Figure 5.1 Fatal and non-fatal accidents and serious incidents per year involving sailplanes

Figure 5.2 shows a monthly comparison between the years 2020 to 2022. The figure clearly shows a jump in the number of accidents in May 2020. 2021 shows more even, and a little lower spike in June and July. In comparison to 2022, the number of accidents is more evenly spread between months while in 2020 the main spike is from May till the end of August.

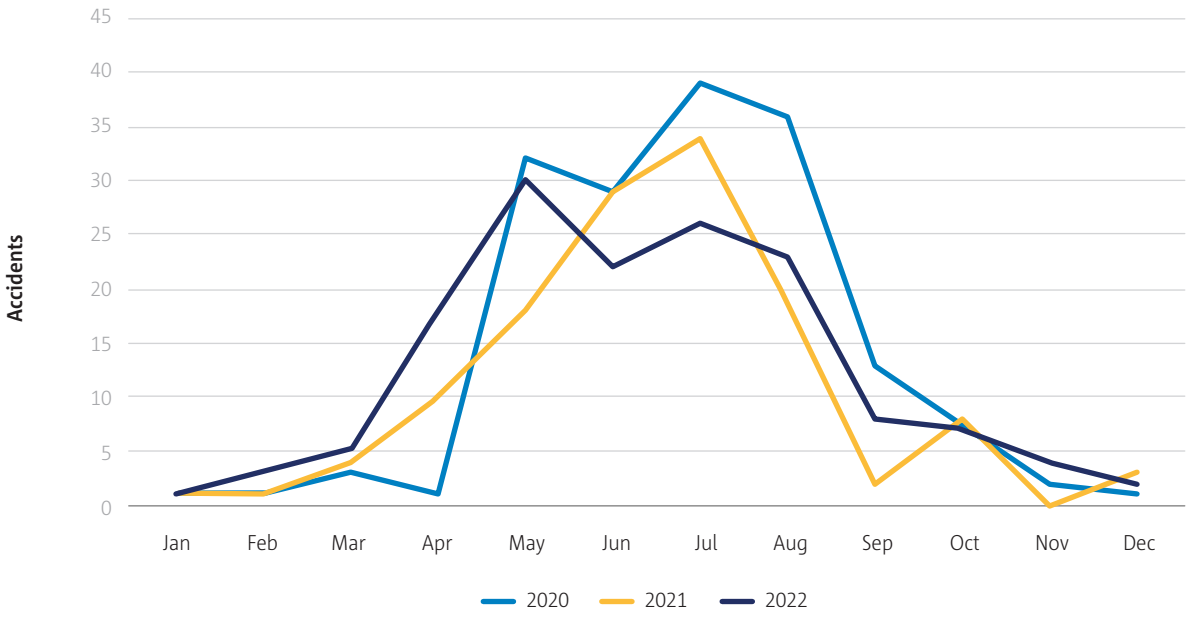
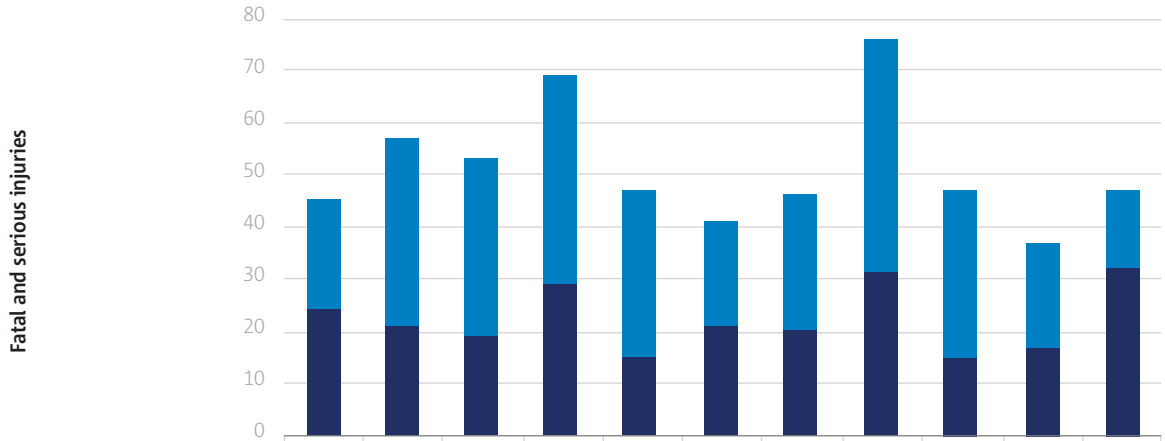


Figure 5.2 Comparison of number of accidents involving sailplanes per month for 2020-2022

Figure 5.3 shows an even trend in number of fatalities and serious injuries over the period, except for 2019 that was unusually high compared to other years within the period. Last year records the highest number of fatalities compared to the previous 10 years. There was one more fatality in 2022 compared to 2019, however, serious injuries in 2019 were significantly more frequent than in 2022. The figure also shows that the number of reported serious injuries are the lowest since 2012.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	21	36	34	40	32	20	26	45	32	20	15
Fatalities	24	21	19	29	15	21	20	31	15	17	32

Figure 5.3 Fatal and serious injuries per year involving sailplanes

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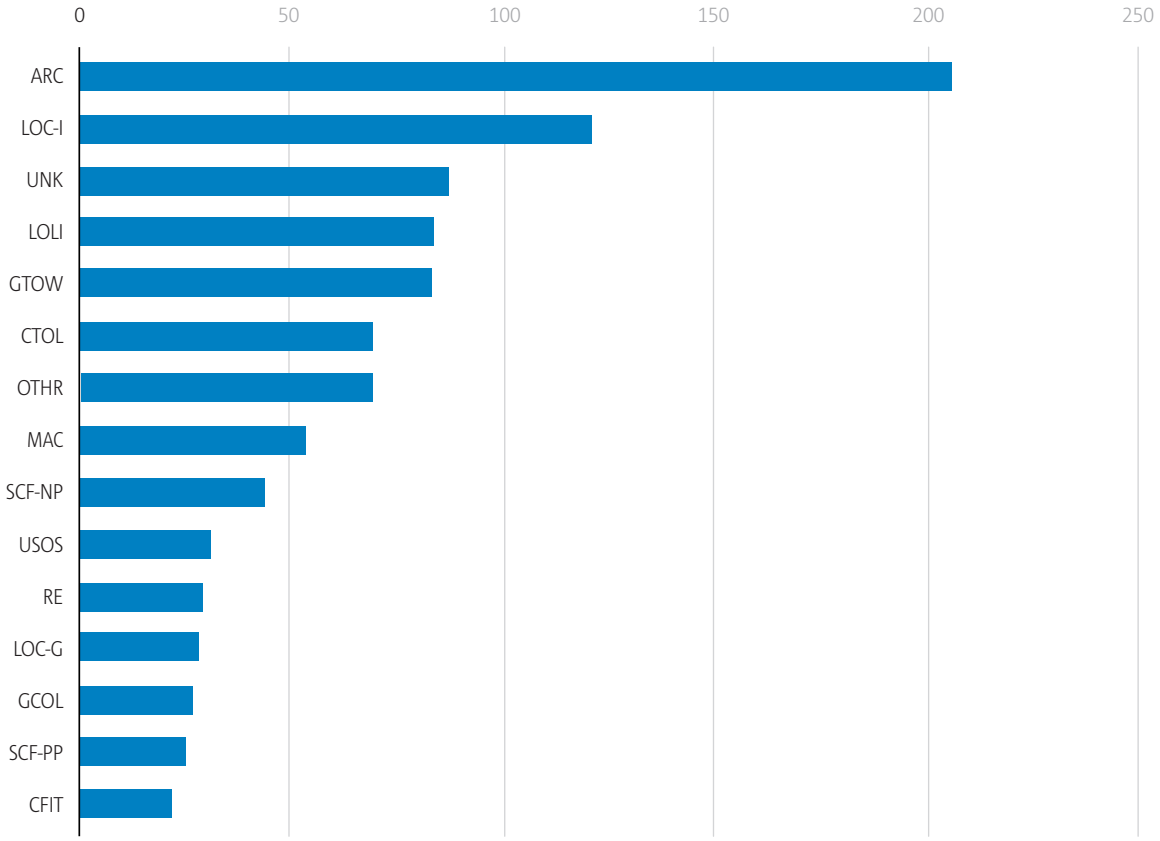
Occurrence categories

Figure 5.4 outlines the top 15 categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the Commercial Aviation Safety Team (CAST)/ ICAO Common Taxonomy Team (CICTT) taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed. Categories are of different nature, e.g., operational such as low altitude operations (LALT), environmental such as turbulence encounter (TURB), technical such as system/ component failure or malfunction [non-powerplant] (SCF-NP), consequential such as fire/ smoke resulting from impact (F-POST), etc. Multiple categories may therefore be assigned to a single occurrence. For example, if an engine failure occurred, and loss of control followed, the occurrence would be coded in both categories, i.e., SCF-PP: powerplant failure or malfunction and LOC-I: loss of control in flight. The sum of the numbers of occurrences per category may therefore be greater that the total number of occurrences that occurred in the period.

For the period 2018-2022, the main occurrence categories are abnormal runway contact – which in many cases leads to damage due to collision with objects in the outfield landing area, and loss of control. Loss of lifting conditions is often a precursor to abnormal runway contact (ARC). Such occurrences include off-field landings.



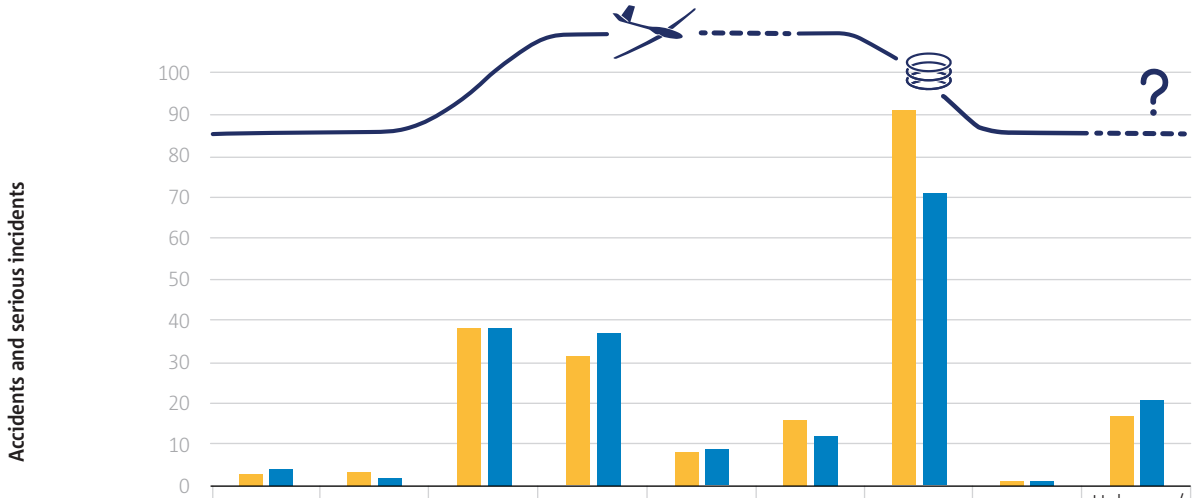
ARC: Abnormal runway contact; LOC-I: Loss of control - inflight; UNK: Unknown or undetermined; LOLI: Loss of lifting conditions en-route; GTOW: Glider towing related events; CTOL: Collision with obstacle(s) during take-off and landing; OTHR: Other; MAC: Airprox/ ACAS alert/ loss of separation/ (near) mid-air collisions; SCF-NP: System/component failure or malfunction [non-powerplant]; USOS: Undershoot/ overshoot; RE: Runway excursion; LOC-G: Loss of control - ground; GCOL: Ground Collision; SCF-PP: powerplant failure or malfunction; CFIT: Controlled flight into or toward terrain

Figure 5.4 Numbers of occurrences by occurrence category involving sailplanes

Phase of flight

The nature of gliding creates a different set of challenges for sailplane pilots compared to flights using motorised aircraft. This includes both a different means of take-off and the need for the sailplane pilot to frequently plan for possible landing areas during the flight. Figure 5.5 provides an overview of the accidents and serious incidents per phase of flight.

Most sailplane accidents occur during the landing phase of the flight. The landings occur both as airfield landings and off-field landings. The off-field landings rely on a good eye for the landscape topography in order to select a landing spot that is flat and clear of obstacles for a successful landing. It is during these landings where the sailplanes suffer damage, but the risk of injuries is low. Airfield landing accidents are mostly caused by under and overshoot landings where windstrength and direction plays a big role. Most common accidents during take-off are due to various mishaps while using a winch. The dataset includes towing occurrences where the occurrence involves a glider. Sailplane towing is addressed in the SPO Aeroplanes chapter.

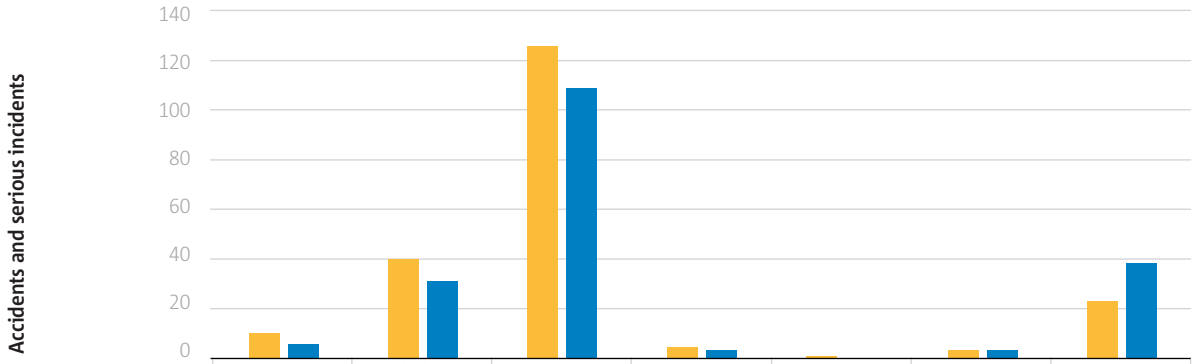


	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Tow	Unknown/ blank
Average 2012-2021	2.7	3.2	38.4	31.3	8.5	16	91	1	16.8
2022	4	2	38	17	9	12	71	1	21

Figure 5.5 Accidents and serious incidents by phase of flight involving sailplanes

Operation type

Most sailplane accidents and serious incidents occurred during leisure/private flights. Accidents during flight training come next but in 2022 there was a significant reduction of both leisure/private flights and flight training accidents compared to the 10-year average. It should be noted that many of the unknown/blank phases of flight have not been categorised due to a lack of information as these accidents are still being investigated by the national safety investigation authorities.



	Airshow/race	Flight Training/ Instructional	Pleasure	Towing	Test Flight	Other	Blank/ Unknown
Average 2012-2021	10.4	40.2	126.1	4.2	0.9	2.8	23
2022	6	31	109	3	0	3	38

Figure 5.6 Accidents and serious incidents by operation type involving sailplanes

Safety risks for sailplanes

The key risk areas for sailplanes are shown in Figure 5.7. Key risk areas and occurrence categories (refer to Figure 5.4 have different purposes. While occurrence categories describe actual factors and outcomes of an occurrence, key risk areas describe the potential outcome of an occurrence. The key risk area is defined by the most likely type of accident that an occurrence could have escalated to. Unlike occurrence categories, where multiple categories may be assigned to a single occurrence, there can only be one key risk area per occurrence. The key risk area is one element of the European Risk Classification Scheme (ERCS). This scheme is applied when determining the safety risk score of an occurrence and is further detailed in the ASR introduction.

It can be stated that aircraft upset was the most likely type of accident to which accidents and serious incidents escalated/ could have escalated for the period 2018-2022 (152 occurrences out of 342). Aircraft upset also presented the highest safety risk in the domain. While 79 occurrences escalated to/ could have escalated to excursion, the safety risk was lower than the safety risks associated with terrain collision, airborne collision, and obstacle collision in flight. This is due to both airfield landing occurrences as well as off-field landings that are resulting in structural damage to the sailplane but with minimal risk for the persons on board. With only 35 occurrences out of 342, terrain collision presented however the second highest safety risk for the domain.

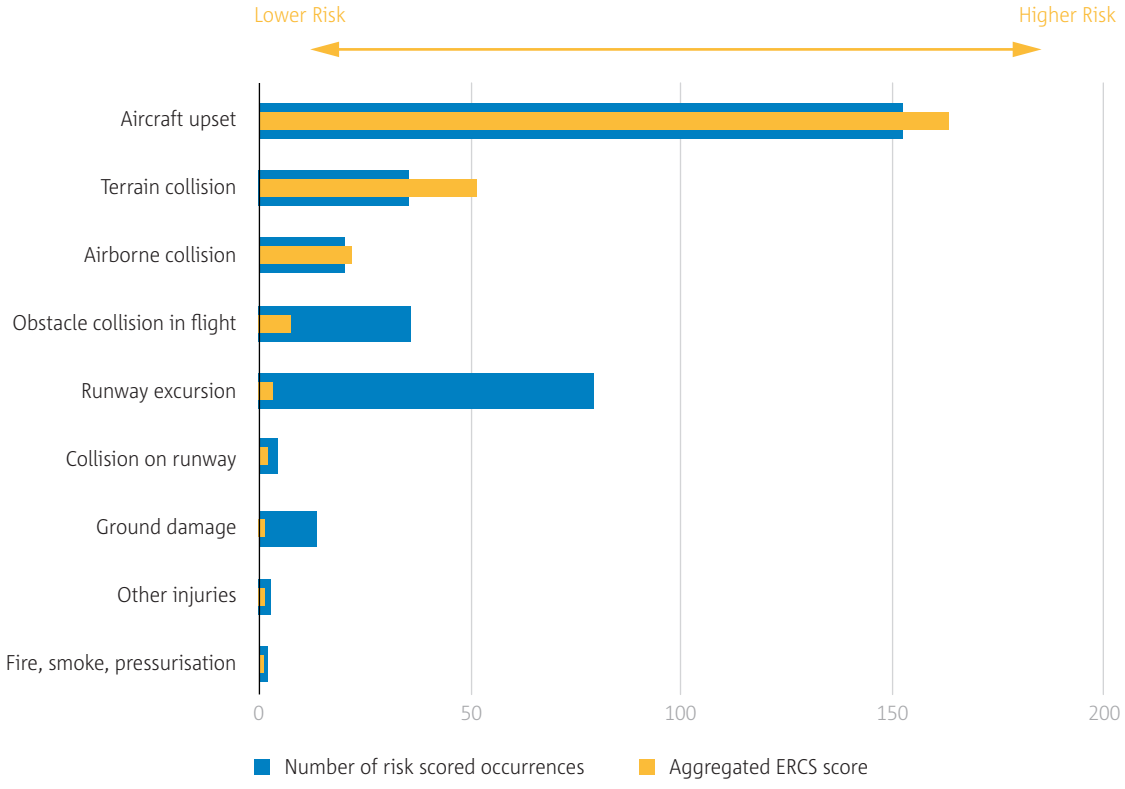


Figure 5.7 Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving sailplanes

Chapter 6
Aerodromes and ground handling

This chapter covers aerodrome and groundhandling operations in EASA MS. The data presented is based on the accidents and serious incidents collected by the Agency under Regulation (EU) 996/2010 on accident and serious incident investigation and Regulation (EU) 376/2014 on occurrence reporting and analysis, and through the active search of those events from other official sources.

The accidents and serious incidents considered in this chapter are the following:

- Runway excursions and runway incursions related to aerodrome operations and the aerodrome infrastructure;
- Occurrences happening on the apron and on the taxiway, including occurrences related to groundhandling operations;
- Occurrences with the aircraft being airborne, in the case where the aerodrome operations, infrastructure or groundhandling operations may have been contributors to these occurrences.

Accidents relating to occupational health and safety, with no element of aviation safety, are not included.

The accidents and serious incidents considered in this chapter are the ones which occurred at aerodromes that are located in the EASA MS. This means that the data includes not only aerodromes that fall under the scope of the EASA Basic Regulation due to the infrastructure provided at the aerodrome or due to the number of passengers and number of movements but also includes aerodromes that fall under the scope of national regulations.

The key statistics, occurrence categories and safety risks at key risk area level for the aerodromes and groundhandling domain are presented in this document. Advanced statistics are then provided per aviation domain in domain specific appendices, giving an overview of the contributors to the safety risks identified in this document at the European level. The advanced statistics are solely derived from occurrence data from the EASA occurrence repository and the European Central Repository (ECR).

The list of fatal accidents associated with the scope of this domain is provided in Appendix 1 of this document.

The advanced statistics associated with the scope of this chapter are provided in Appendix 6 of this document.

Key Statistics

The key statistics for this domain are shown in Table 6.1 and Table 6.2. The numbers of accidents and serious incidents in 2022 were lower than the average of the preceding decade. In 2022, there were no fatal accidents related to aerodrome and groundhandling in EASA MS. However, accidents causing serious injuries still occurred in 2022 with numbers close to the average of the preceding decade.

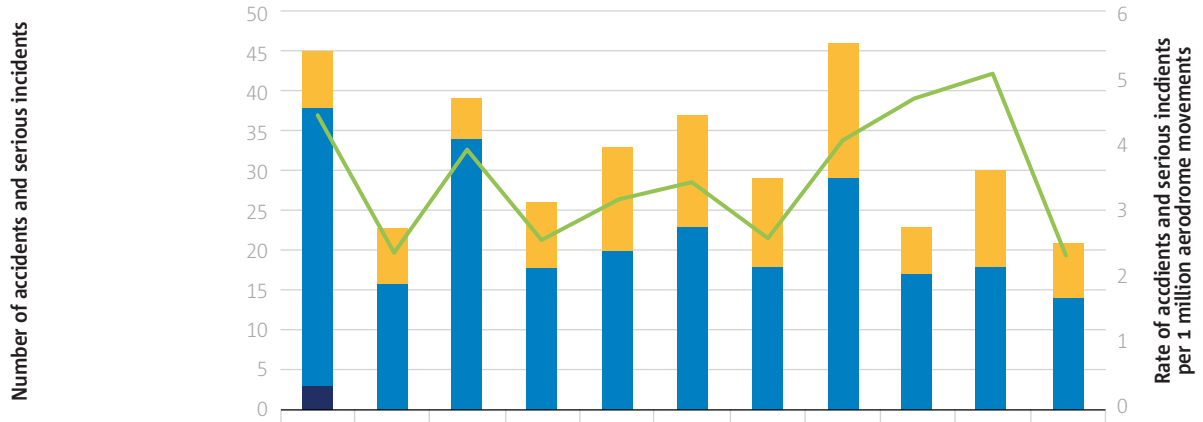
Table 6.1 Key statistics for aerodromes and groundhandling

	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**3**	**0**	↓
Non-fatal accidents	**228**	**14**	↓
Serious incidents	**100**	**7**	↓

Table 6.2 Fatalities and serious injuries for aerodromes and groundhandling

	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**5**	**21**
Yearly max number over 2012-2021	**5**	**5**
Yearly min number over 2012-2021	**0**	**0**
Total number in 2022	**0**	**3**

Figure 6.1 shows the number of accidents and serious incidents per year, as well as the rate of these occurrences per 1 million aerodrome movements in EASA MS. Whereas the aerodrome traffic in EASA MS significantly recovered in 2022 after two years of low activity, the numbers of accidents and serious incidents for that year is one of the lowest observed over the time scope analysed. After three years of increase with a peak in 2021, the rate of such occurrence has decreased in 2022 down to 2.3 accidents and serious incidents per million aerodrome movements. Such a trend should be interpreted for more than one year and EASA will continue to monitor the rate in the next years to determine whether this is a tangible trend.

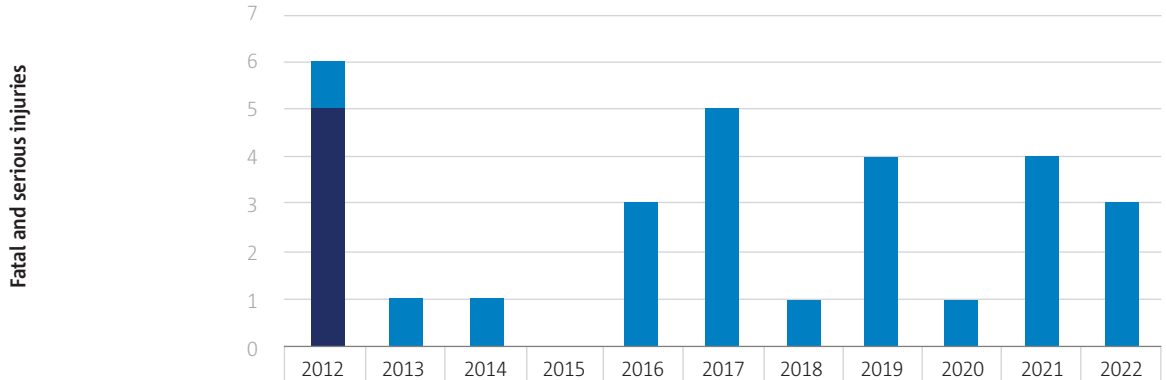


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	7	7	5	8	13	14	11	17	6	12	7
Non-fatal accidents	35	16	34	18	20	23	18	29	17	18	14
Fatal accidents	3	0	0	0	0	0	0	0	0	0	0
Accident +Serious incident Rate	4.5	2.3	3.9	2.6	3.2	3.4	2.6	4.1	4.7	5.1	2.3

Figure 6.1 Numbers of fatal accidents, non-fatal accidents and serious incidents involving aerodromes and groundhandling, and rates per million aerodrome movements

The number of fatalities and serious injuries per year is shown in Figure 6.2. There were three serious injuries in 2022.

The accidents causing these serious injuries were one taxiway excursion of a helicopter injuring the pilot, and two falls of passengers during disembarkation of a commercial air transport flight.



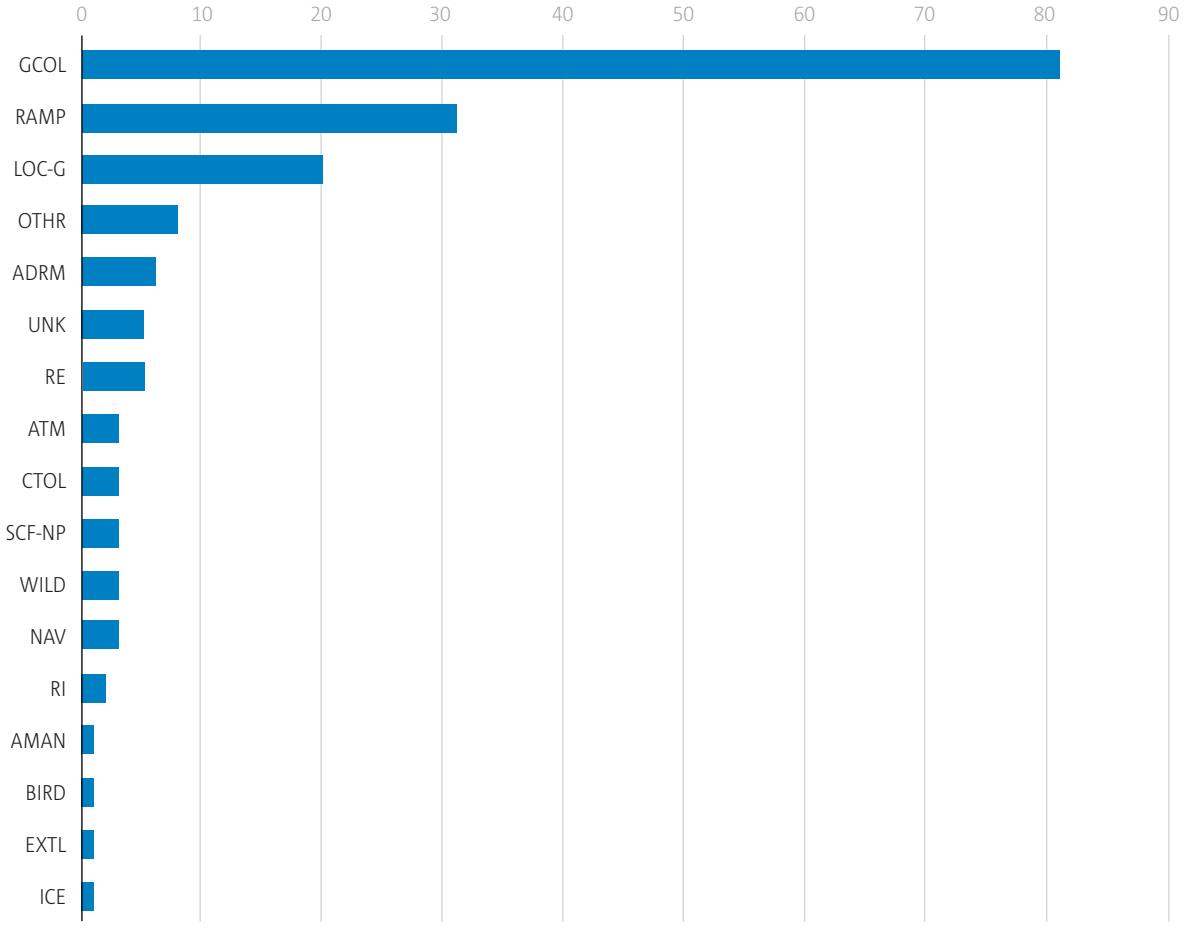
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	1	1	1	0	3	5	1	4	1	4	3
Fatalities	5	0	0	0	0	0	0	0	0	0	0

Figure 6.2 Fatal and serious injuries per year involving aerodromes and groundhandling

Occurrence categories

Figure 6.3 outlines the occurrence categories assigned to the serious incidents and accidents in the past five years. Occurrences are categorised using the ICAO Accident Incident Data Reporting (ADREP) taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed. Categories are of different natures, e.g., operational such as low altitude operations (LALT), environmental such as turbulence encounter (TURB), technical such as system/ component failure or malfunction [non-powerplant] (SCF-NP), consequential such as fire/ smoke resulting from impact (F-POST), etc. Multiple categories may therefore be assigned to a single occurrence. For example, if an engine failure occurred, and loss of control followed, the occurrence would be coded in both categories, i.e., SCF-PP: powerplant failure or malfunction and LOC-I: loss of control in flight. The sum of the number of occurrences per category may therefore be greater than the total number of occurrences that realised in the period.

For the period 2018-2022, ground collisions are by far the most frequent type of accident or serious incident, followed by ramp/groundhandling occurrences. A more detailed categorisation of the type of event is depicted in Appendix 6 of this document.



GCOL: Ground Collision; RAMP: Ground Handling; LOC-G: Loss of control – ground; OTHR: Other; ADRM: Aerodrome; UNK: Unknown or undetermined; RE: Runway excursion; ATM: ATM/CNS; CTOL: Collision with obstacle(s) during take-off and landing; SCF-NP: System/component failure or malfunction [non-powerplant]; WILD: Collision Wildlife; NAV: Navigation error; RI: Runway incursion - vehicle, aircraft or person; AMAN: Abrupt maneuvre; BIRD: Birdstrike; EXTL: External load related occurrences; ICE: Icing

Figure 6.3 Numbers of occurrences by occurrence category involving aerodromes and groundhandling

Number of EASA MS certified aerodromes

Regulation (EU) 2018/1139 (the EASA Basic Regulation), establishes which aerodromes fall under the scope of the European aviation safety rules and should therefore be certified in accordance with these rules. Regulation (EU) 139/2014, the Aerodromes Regulation (EASA ADR), lays down the detailed requirements for the certification and operation of those aerodromes located in the EASA Member States.

As of 31 December 2022, 541 aerodromes are within the scope of the Basic Regulation, of which, 398 have been certified, 17 have not been certified yet, and 126 have been granted an exemption in accordance with Article 2(1)(e) and Article 2(7) of the EASA Basic Regulation, due to low traffic volumes. Figure 6.4 shows the number of aerodromes per EASA MS that are certified in accordance with the European aviation safety rules or that are exempted due to low traffic volumes 13. It should be noted that although groundhandling services are regulated through the EASA Basic Regulation, the delegated acts laying down the detailed rules for the operation and oversight of groundhandling services are yet to be adopted. These acts are being developed within EASA rulemaking task RMT.0728.

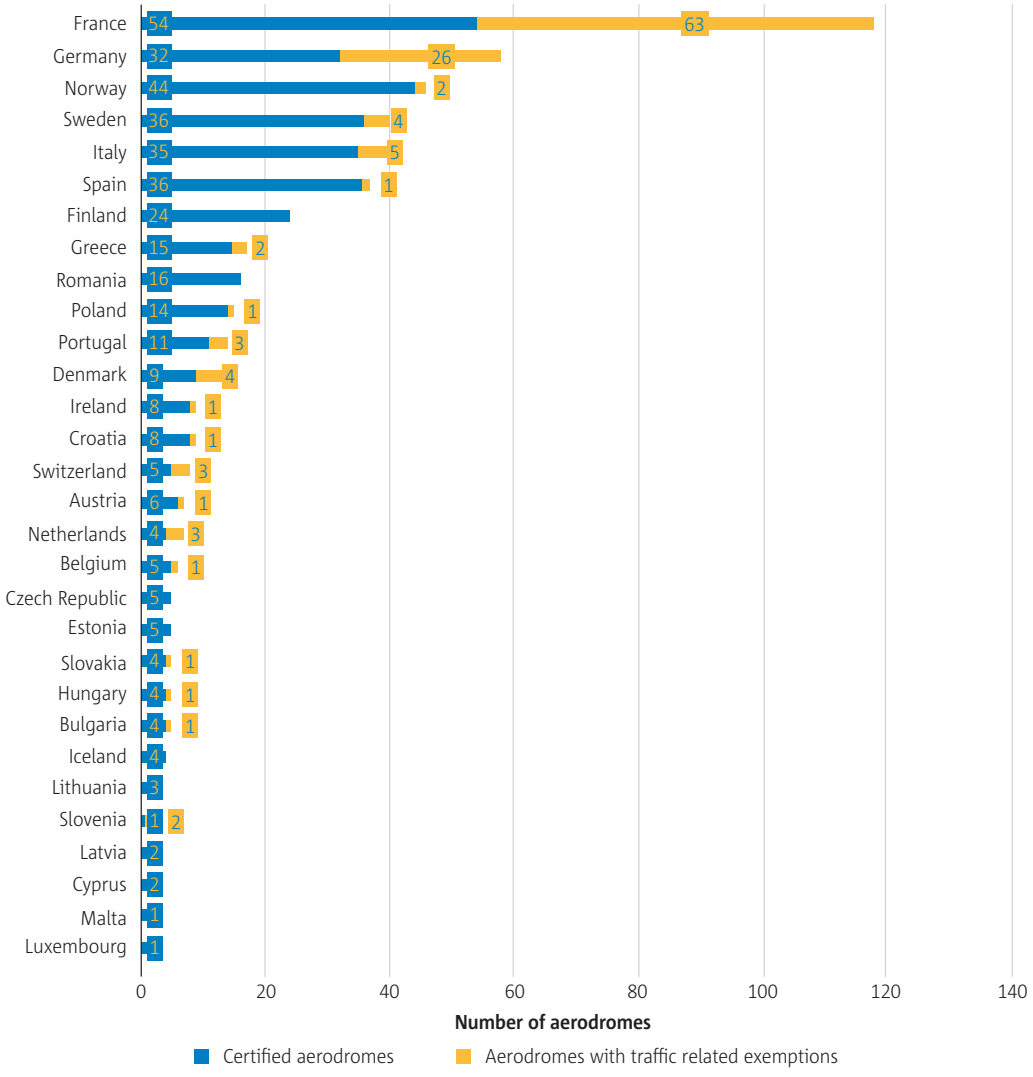


Figure 6.4 Aerodromes within the scope of Regulation (EU) 139/2014 (EASA ADR) by EASA Member State

13 A detailed list of aerodromes falling under EU rules and those exempted or excluded can be accessed via the EASA website under the following link: https://www.easa.europa.eu/en/datasets/aerodromes-falling-scope-regulation-eu-20181139

Safety risks for aerodromes and groundhandling

The safety risks for aerodromes and groundhandling are derived from accident and serious incident data from the EASA occurrence repository, covering the period 2018-2022 (149 occurrences).

The key risk areas for aerodrome and groundhandling are shown in Figure 6.5. Key risk areas and occurrence categories (refer to Figure 6.3) have different purposes. While occurrence categories describe actual factors and outcomes of an occurrence, key risk areas describe the potential outcome of an occurrence. The key risk area is defined by the most likely type of accident that an occurrence could have escalated to. Unlike occurrence categories, where multiple categories may be assigned to a single occurrence, there can only be one key risk area per occurrence. The key risk area is one element of the European Risk Classification Scheme (ERCS). This scheme is applied when determining the safety risk score of an occurrence and is further detailed in the ASR introduction.

It can be stated that ground damage was the most likely type of accident to which accidents and serious incidents escalated/could have escalated for the period 2018-2022 (105 occurrences out of 149). Ground damage also presented the highest cumulated safety risk in the domain (yellow bar). It can be noted that collision on runway, with only 6 occurrences which escalated to/could have escalated to such outcome, has the second highest cumulated safety risk.

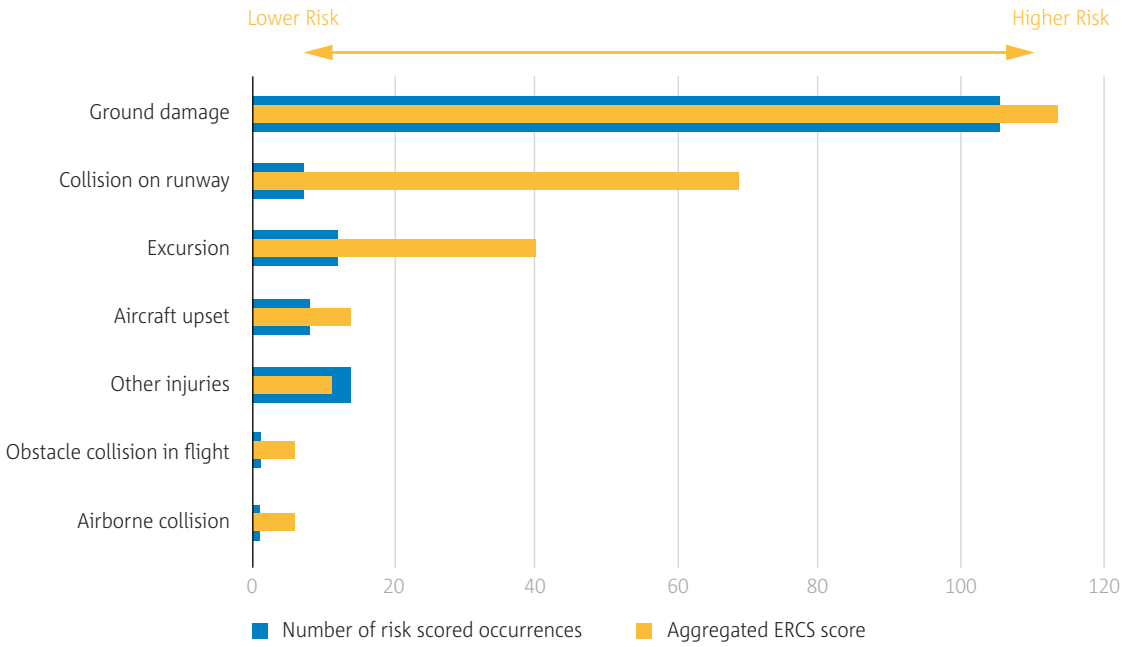


Figure 6.5 Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving aerodromes and groundhandling

Chapter 7
ATM/ANS

This chapter covers accidents and serious incidents related to the provision of Air Traffic Management or Air Navigation Services (ATM/ANS) in EASA MS. The data are based on the accidents and serious incidents collected by EASA under ICAO Annex 13 and Regulation (EU) 996/2010 on accident and serious incident investigation and Regulation (EU) 376/2014 on occurrence reporting, analysis and follow-up.

Accidents and serious incidents in this chapter involve at least one CAT aircraft, either fixed-wing aeroplanes with a maximum take-off mass of at least 2250 kg, or small (CS-27) or large (CS-29) helicopters, which occurred in an EASA MS.

Accidents and serious incidents reviewed in this chapter comprise occurrences where the provision of services by the ATM/ANS was, directly or indirectly, a contributing factor in the occurrence or played a role in aggravating the occurrence encountered by the aircraft.

Additionally, a subpart of this chapter deals with occurrences where UAS were involved. This part is added in the ATM/ANS chapter as those occurrences concern-controlled airspace and are mainly reported by the crew of CAT aeroplanes or ATM/ANS operators.

The chapter introduces the key statistics and occurrence categories on ATM/ANS occurrences and concludes with the safety risks at KRA level from a data perspective. Advanced statistics are then provided, per aviation domain, in domain-specific appendices, giving an overview of the contributors to the safety risks identified in the core document. The advanced statistics are solely derived from occurrence data from the EASA occurrence repository and the ECR.

The list of fatal accidents associated with the scope of this chapter is provided in Appendix 1 of this document.

The advanced statistics associated with ATM/ANS are provided in Appendix 7 of this report.

Key statistics

The key statistics for this domain are in Table 7.1. They include a comparison of the number of fatal and non-fatal accidents and serious incidents for the last year and the previous 10-year period.

No fatal accidents in 2022 and the preceding period 2012-2021, where ATM/ANS was a contributing factor (ATM involved or ATM indirectly involved) were recorded. As in 2020 and 2021 also no non-fatal accidents were reported in the year 2022. In the last decade, seven non-fatal accidents with ATM contribution were recorded.

Table 7.1 Key statistics for ATM/ANS contribution accidents and serious incidents

	Total number of occurrences per occurrence class over 2012-2021	Number of occurrences per occurrence class in 2022	Comparison 2022 vs yearly average of 2012-2021 per occurrence class
Fatal accidents	**0**	**0**	=
Non-fatal accidents	**7**	**0**	↓
Serious incidents	**116**	**6**	↓

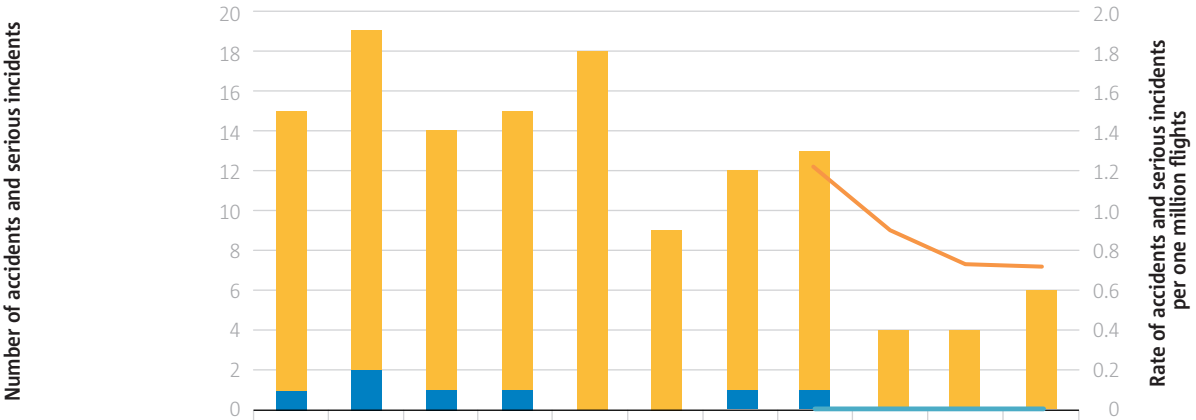
Table 7.2 includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

As shown in Table 7.2, no fatalities with ATM/ANS contribution were recorded in 2022. Only three serious injuries with ATM contribution (directly or indirectly involved) were recorded during the last decade.

Table 7.2 Number of fatalities and serious injuries involving ATM/ANS contribution

	Number of fatalities	Number of serious injuries
Total number over 2012-2021	**0**	**3**
Yearly max number over 2012-2021	**0**	**2**
Yearly min number over 2012-2021	**0**	**0**
Total number in 2022	**0**	**0**

Figure 7.1 shows the number of accidents and serious incidents for 2012 – 2022 and the number of accident and serious incident rates per one million flights for 2019-2022. In the past decade, no fatal accidents with ATM contributions were recorded. The rate of serious incidents with ATM/ANS contribution, as seen in Figure 7.1, decreased in 2020 and 2021 compared to 2019, however an increase from four to six serious incidents was recorded in 2022. During the last three years, fewer serious incidents were recorded than in the years before (2012-2019)

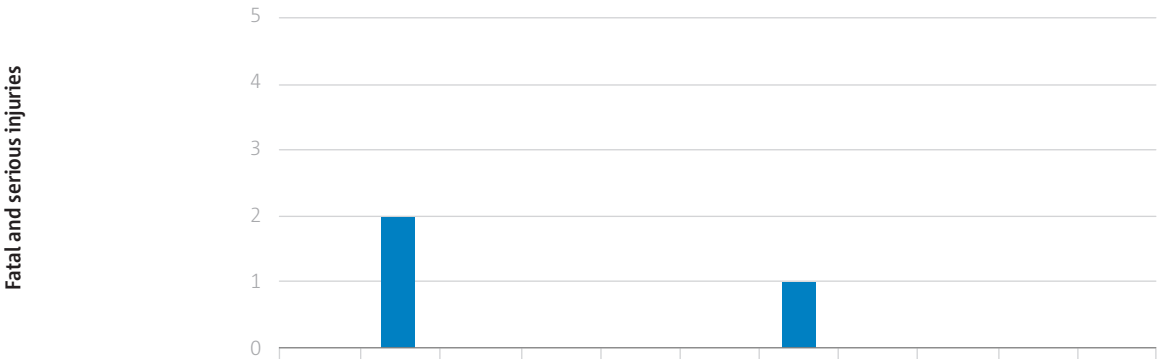


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious incidents	14	17	13	14	18	9	11	12	4	4	6
Non-fatal accidents	1	2	1	1	0	0	1	1	0	0	0
Fatal accidents	0	0	0	0	0	0	0	0	0	0	0
Accident rate								-	-	-	-
Serious incident rate								1.2	0.9	0.7	0.7

Figure 7.1 Number of accidents and serious incidents per year and serious incidents and accidents rate per one million flights

Figure 7.1 indicates the accident and serious incident rate per one million flights. The reference data chosen for the rate calculation are traffic data (IFR flights) without UK, therefore only 2019-2022 are considered for the accident and incident rate calculation. While the absolute number of serious incidents increased in 2022 compared to 2020 and 2021, the serious incident rate continues to decline since 2019. The accident rate has been on a stable decline over the last four years.

The number of fatalities and serious injuries per year are shown in Figure 7.2. The number of fatalities is highly dependent on the size of the aircraft involved in the accident and therefore the statistics do not follow a clear pattern. In 2022, there were no occurrences with ATM/ANS contributions that resulted in fatalities. In 2018 there was one occurrence and in 2013 there were two occurrences with serious injuries were reported.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Serious Injuries	0	2	0	0	0	0	1	0	0	0	0
Fatalities	0	0	0	0	0	0	0	0	0	0	0

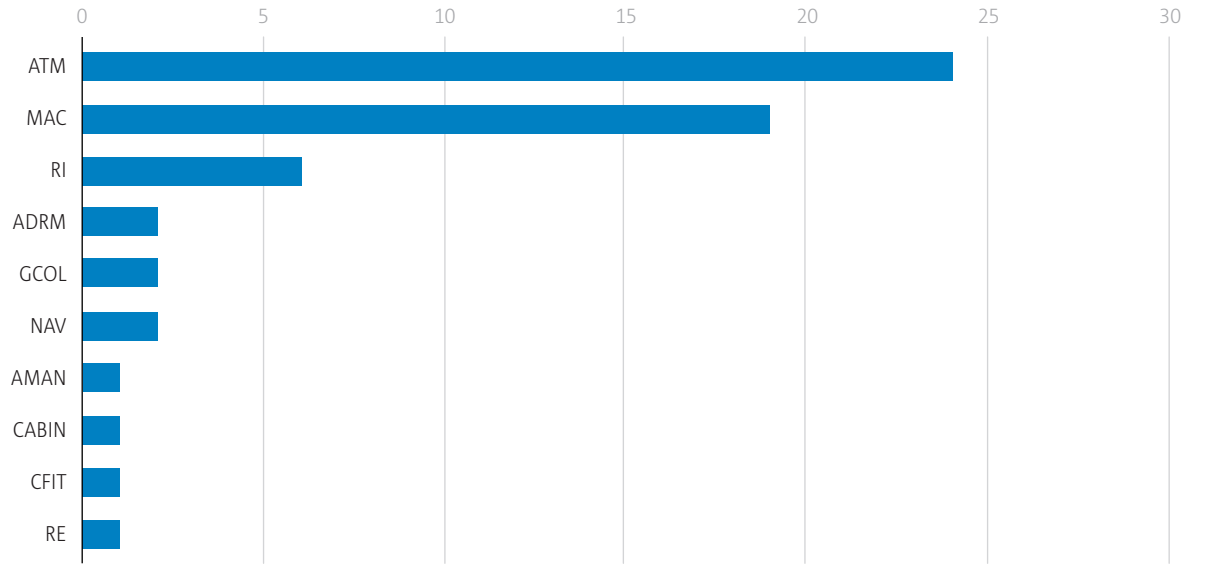
Figure 7.2 Fatalities and serious injuries per year involving ATM/ANS contribution

Occurrence categories

Figure 7.3 outlines the top 10 categories assigned to the serious incidents and accidents in the past five years.

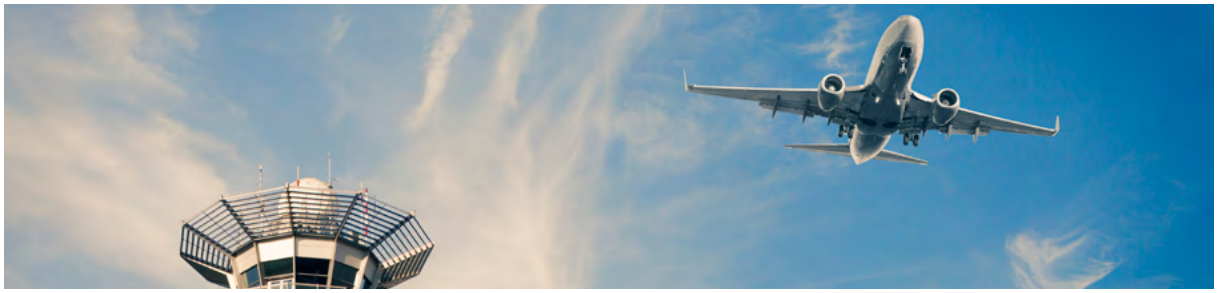
Occurrences are categorised using the ICAO ADREP taxonomy for occurrence categories, developed for supporting common coding of the main elements of an occurrence that should be investigated, recorded, and analysed. Categories are of different natures, e.g., operational such as low altitude operations (LALT), environmental such as turbulence encounter (TURB), technical such as system/ component failure or malfunction [non-powerplant] (SCF-NP), consequential such as fire/ smoke resulting from impact (F-POST), etc. Multiple categories may therefore be assigned to a single occurrence. For example, if an engine failure occurred, and loss of control followed, the occurrence would be coded in both categories, i.e., SCF-PP: powerplant failure or malfunction and LOC-I: loss of control in flight.

For the period 2018-2022, there were 39 serious incidents and accidents with ATM/ANS contributions. The occurrence category ATM: ATM/CNS was assigned to 24 serious incidents and accidents. The occurrence categories MAC: Airprox/ ACAS alert/ loss of separation/ (near) mid-air collisions was assigned to 19 serious incidents and accidents and RI: runway incursion – vehicle, aircraft or person was assigned to six serious incidents and accidents. The occurrence categories ADRM: Aerodrome, GCOL: Ground collision and NAV: Navigation error were assigned to two occurrences each, the occurrence categories AMAN: Abrupt manoeuvre, CABIN: Cabin safety events and CFIT: Controlled flight into or toward terrain and RE: Runway excursion were assigned to one occurrence each.



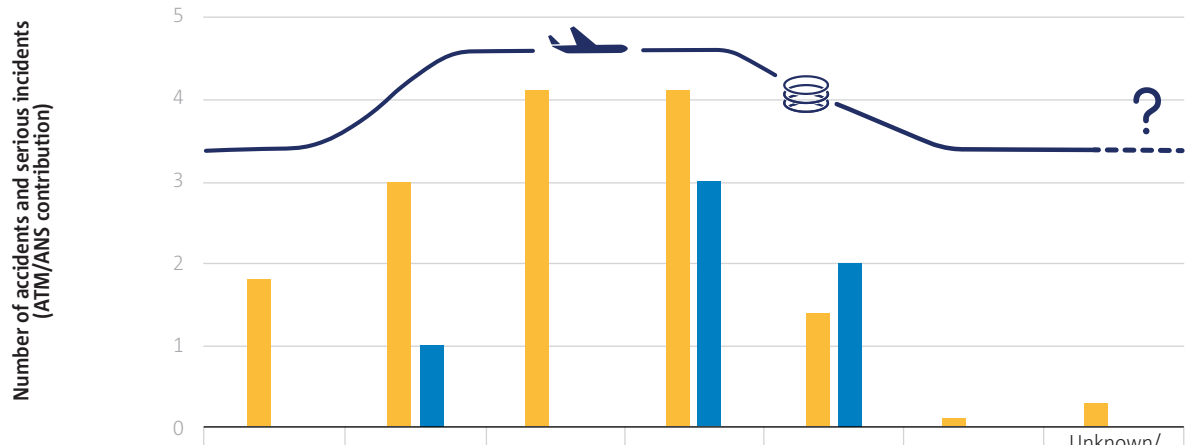
ATM: ATM/CNS; MAC: Airprox/ACAS alert/loss of separation/(near) mid-air collisions; RI: Runway incursion – vehicle, aircraft or person; ADRM: Aerodrome; GCOL: Ground Collision; NAV: Navigation error; AMAN: Abrupt manoeuvre; CABIN: Cabin safety events; CFIT: Controlled flight into or toward terrain; RE: Runway excursion

Figure 7.3 Numbers of occurrences by occurrence categories involving ATM/ ANS contribution



Phase of flight

The majority of accidents and serious incidents in 2022 with ATM/ANS contribution took place during the approach and landing phases, followed by the take-off phase, as shown in Figure 7.4. While for 2012-2021, looking at the average of occurrences, en-route was the most affected flight phase, no occurrences were recorded in 2022 for this flight phase, as opposed to the occurrences in the approach and landing flight phases.



	Taxi	Take-off	En route	Approach	Landing	Tow	Unknown/ blank
Average 2012-2021	1.8	3.0	4.1	4.1	1.4	0.1	0.3
2022	0	1	0	3	2	0	0

Figure 7.4 Accidents and serious incidents by phase of flight involving ATM/ ANS contribution

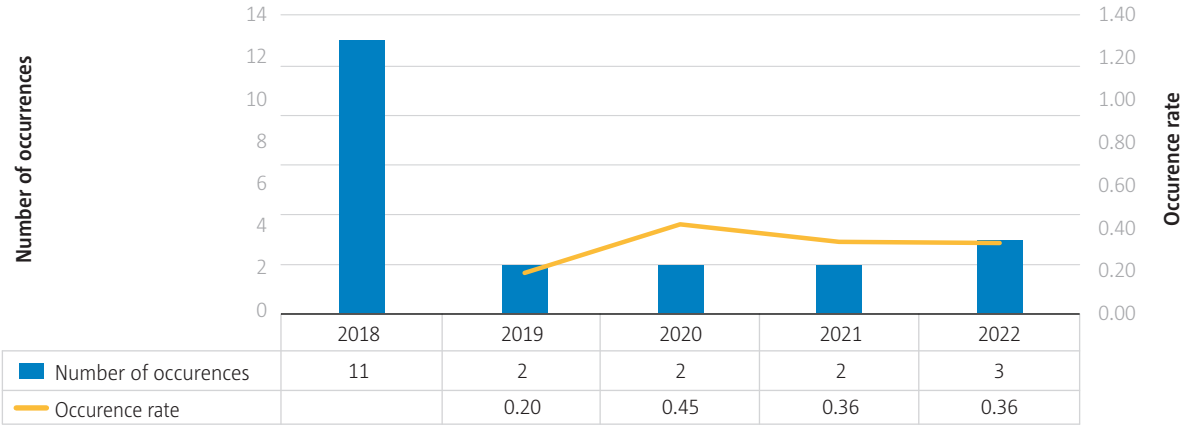
Airborne collisions and near collisions involving unmanned aircraft

This subchapter is added into the ATM/ANS chapter as it lists occurrences involving unmanned aircraft occurring in controlled airspace.

The potential for an airborne collision between a UAS and other aircraft is an area of growing safety concern, due to the increasing accessibility of UAS.

It is important to note that UAS-related reports are mainly provided by the CAT aeroplanes and ATM/ANS domains. As soon as reports from UAS operators become more common, the safety issues relating to this type of aircraft will become more apparent.

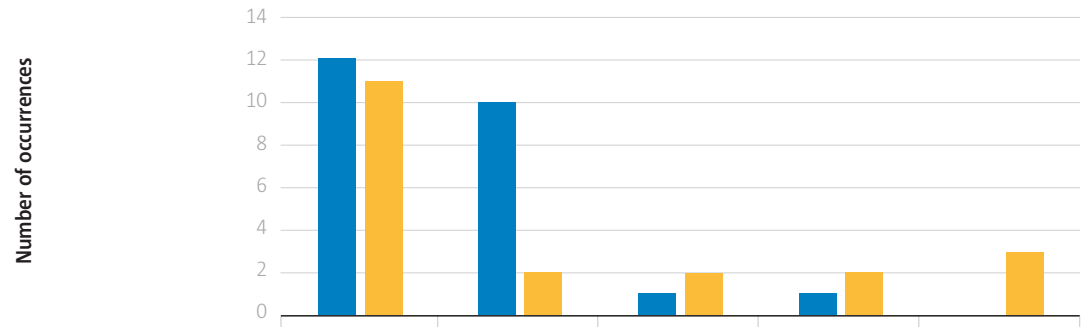
Figure 7.5 shows the number of occurrences and the occurrence rate which is calculated by taking the number of IFR flights in the MS area and the number of UAS occurrences into account. In this chapter, a UAS occurrence refers to accidents and serious incidents where at least one manned fixed-wing or rotary aircraft was involved, and the event resulted in an airborne collision or near airborne collision with a UAS. A slight increase from two to three occurrences was recorded in 2022.



	2018	2019	2020	2021	2022
Number of occurences	11	2	2	2	3
Occurence rate		0.20	0.45	0.36	0.36

Figure 7.5 Number and rate of UAS collisions with manned aircraft and near collisions rate

Figure 7.6 compares UAS and manned aircraft involved in airborne collisions and near collisions. Since 2018 the number of accidents and serious incidents involving UAS decreased and kept low in 2019, 2020, and 2021 and had a slight increase in 2022, while no occurrence with manned aircraft of this event type was recorded in 2022.



	2018	2019	2020	2021	2022
Manned aircraft	12	10	1	1	0
UAS	11	2	2	2	3

Figure 7.6 Airborne collisions and near collisions, involving UAS and manned aircraft

Safety risks for ATM/ANS

The safety risks for ATM/ANS are derived from accidents and serious incident data from the EASA occurrence repository and the ECR, covering the 5-year period (2018-2022).

The KRAs for ATM/ANS are shown in Figure 7.7.

KRAs and occurrence categories (refer to Figure 7.3) have different purposes. While occurrence categories describe actual factors and outcomes of an occurrence, KRAs describe the potential outcome of an occurrence. The KRA is defined by the most likely type of accident that an occurrence could have escalated to. Unlike occurrence categories, where multiple categories may be assigned to a single occurrence, there can only be one KRA per occurrence. The KRA is one element of the ERCS. This scheme is applied when determining the safety risk score of an occurrence and is further detailed in the ASR introduction.

It can be stated that the occurrences with the KRA collision on runway had the highest risk score. 16 out of 39 occurrences were reported with this KRA. The occurrences with the second highest risk score are occurrences with the KRA airborne collision. 18 out of 39 occurrences were reported with this KRA. One occurrence each with the KRAs terrain collision, ground damage, other injuries, aircraft upset and runway excursion were reported with a low safety risk.

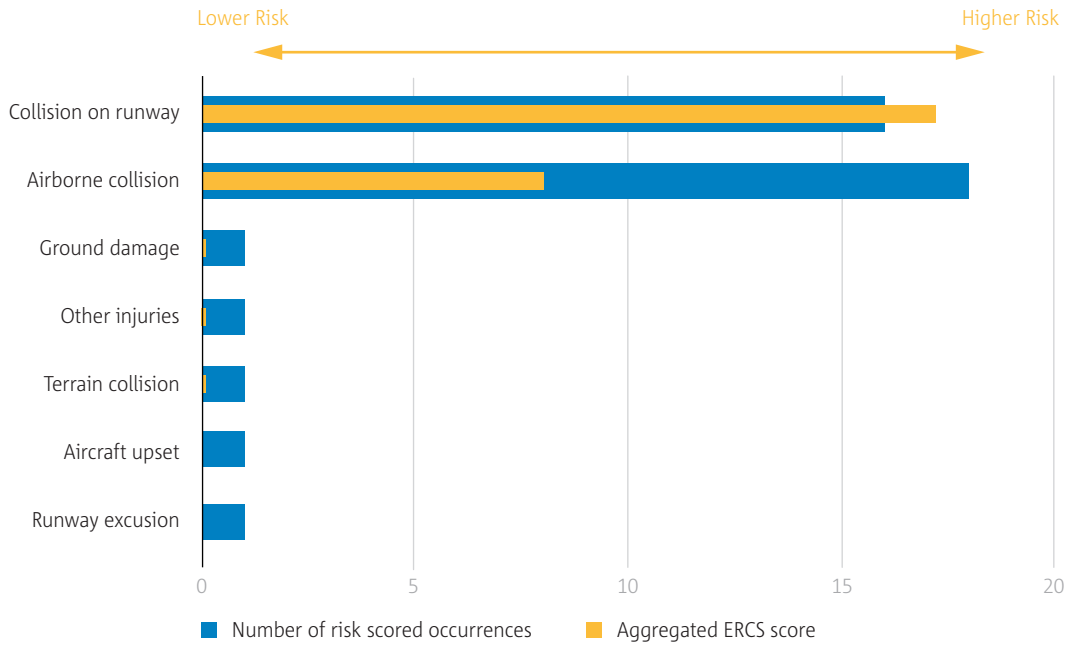


Figure 7.7 Key risk areas by aggregated ERCS score and number of risk-scored ATM/ANS occurrences

The top KRAs in the ATM/ANS domain are airborne collision and runway collision, reflecting the role of ATM/ANS in guiding and separating aircraft.

The top KRAs the ATM/ANS domain are defined as:

- **Collision on runway.** This includes all occurrences involving actual or potential runway collisions between an aircraft and another aircraft, vehicle or person that occur on the runway of an aerodrome or other designated landing area. This includes occurrences involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and take-off of aircraft. It does not include occurrences involving wildlife on the runway.

A slight majority nine out of 16 of occurrences in the ASR 2023 with the KRA collision on runway occurred during the take-off phase.

- **Airborne collision.** This includes occurrences involving actual or potential airborne collisions between aircraft, and occurrences involving an aircraft and other controllable airborne objects, such as drones, thereby excluding birds. Therefore, it includes all separation-related occurrences regardless of the cause. It does not include false TCAS/ACAS alerts caused by equipment malfunctions or loss of separation with at least one aircraft on the ground, which may be coded as runway or movement area collision if the occurrence meets the criteria.

  The occurrence with the highest ERCS score and the KRA airborne collision was an occurrence that happened at the transfer from one sector to the other. It has to be noted that no occurrence with the KRA airborne collision was reported in 2022.

Chapter 8
Occurrence reporting rates

This chapter intends to measure the volume of occurrence reports collected in the European Central Repository (ECR) under Regulation (EU) 376/2014 over the period 2016-2022 and to put the changing levels of occurrence reporting in perspective with changes to the level of aviation activity in Europe.

Occurrence reporting rates are important to monitor as they are an indicator of the changes to safety culture in Europe. A large number of reports can be regarded as a sign of a good safety culture. In this respect, whereas in the rest of the annual safety review a higher number of accidents and serious incidents may be viewed in as negative; in this chapter an increase in overall occurrence reporting, which include incidents, can be viewed as a positive development.

This chapter had initially been developed for the 2021 annual safety review by the safety performance indicators working group (SPI WG), under the Network of Aviation Safety Analysts (NoA), which is established under Article 14 of Regulation (EU) 376/2014.

For all figures in this chapter, the number of reports should be interpreted as the number of reports from distinct reporting entities. This means that for a single occurrence record, if more than one report is reported by the same reporting entity, as it would be the case if there were follow-up reports, the record will be counted as one. However, if there are reports from two different reporting entities about the same occurrence, then the record will be counted as two and so forth. The traffic data used in this chapter were provided by Eurocontrol. The extent of the data scope is 30 out of the 31 EASA MS, since Eurocontrol does not collect data for Iceland. The IFR traffic data used in this report includes both EU and Non-EU operators.

It should be highlighted that the figures shown in this chapter are highly dependent on the quality and completeness of the coding of the occurrences collected in the ECR, in particular on the attribute ‘Reporting Entity’.

In order to reach more accurate figures from which more solid interpretations can be built, it is important that reporting organisations and competent authorities continue their effort to improve the coding quality of occurrence records submitted under Regulation (EU) 376/2014.

8.1 Overall levels of occurrence reporting and levels of traffic

This section gives a high-level quantitative analysis of the total number of reports collected in the ECR over the period 2016-2022, in parallel with the evolution of the level of traffic in Europe.

Annual evolution over the period 2016-2022

The total number of reports collected in the ECR over the period 2016-2022 is shown in Figure 8.1, and the number of cumulated airport movements in Europe for the same time period is illustrated in Figure 8.2. Reporting rates were then calculated by normalising the volumes of reports with the airport movements, as shown in Figure 8.3.

After the entry into force of Regulation (EU) 376/2014 at the end of 2015, the number of reports in the ECR steadily increased from 2016 to 2019, with the figure for 2019 being 50% higher than for 2016. By contrast, the level of traffic in Europe increased at a slower pace, with +8% of airport movements in 2019 compared to 2016. The overall reporting rate, therefore, increased over this period from 15.6 to 21.6 reports per 1000 airport movements.

In 2020, the COVID-19 pandemic caused a drastic decrease in the level of traffic, which then recovered only partially in 2021. The total number of reports also dropped substantially in 2020, but this drop was less pronounced than the drop in traffic. Also, in 2021, the number of reports increased rapidly compared to 2020, reaching back to the volumes reported in 2017. Consequently, the overall reporting rate continued to increase significantly over 2020 and 2021, reaching 33.8 reports per 1000 airport movements, which is doubled compared to 2016.

The volumes of reports in 2022 were the highest observed since 2016, and 20% higher than in 2019. In terms of activity, 2022 saw the traffic continuing its recovery to reach 81% of the level of 2019. As a result, the reporting rate in 2022 remained almost at the highest level observed in 2021.

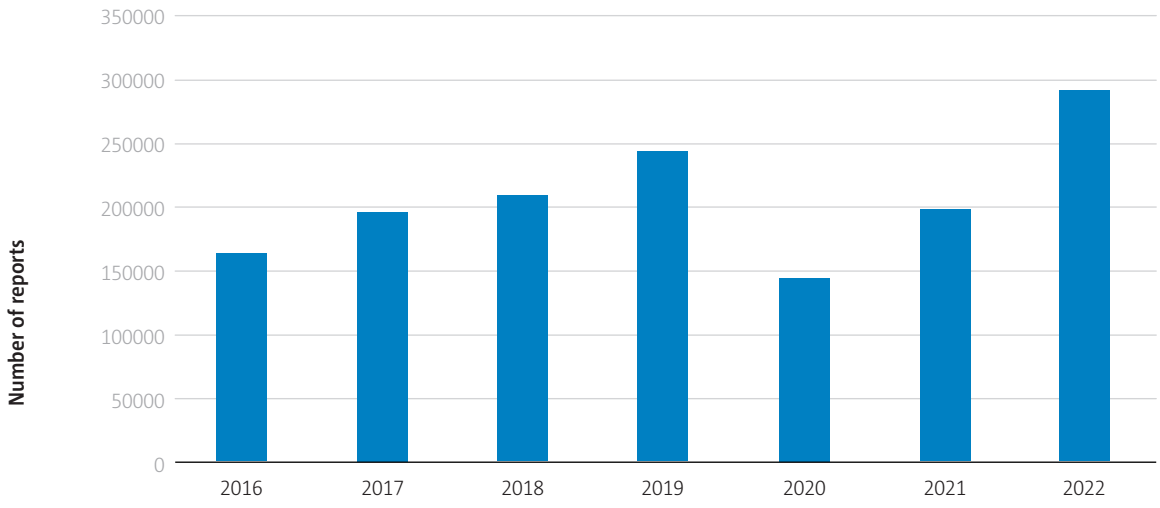


Figure 8.1 Number of reports collected in the European Central Repository (ECR) per year

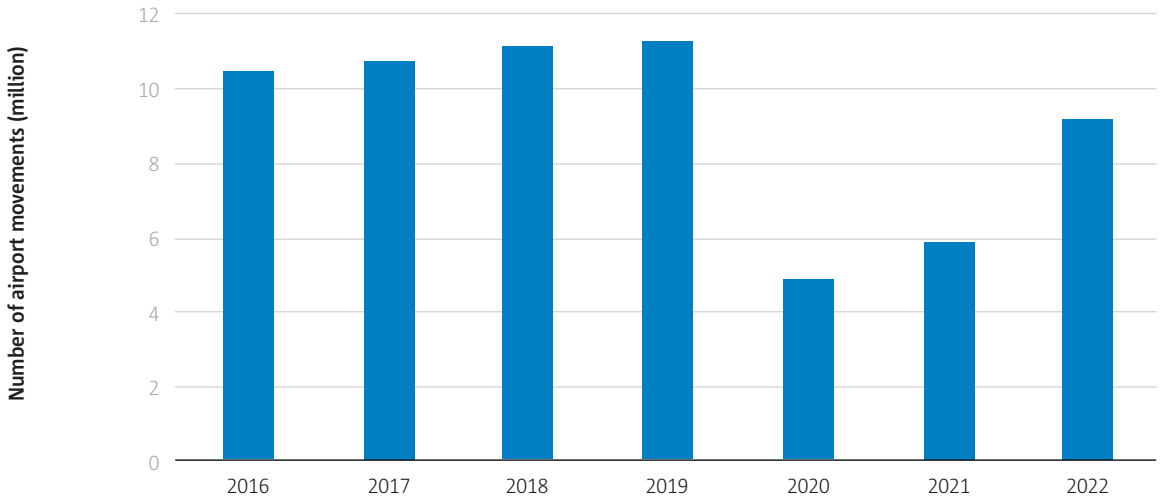


Figure 8.2 Number of airport movements per year, for all EASA MS (except Iceland)

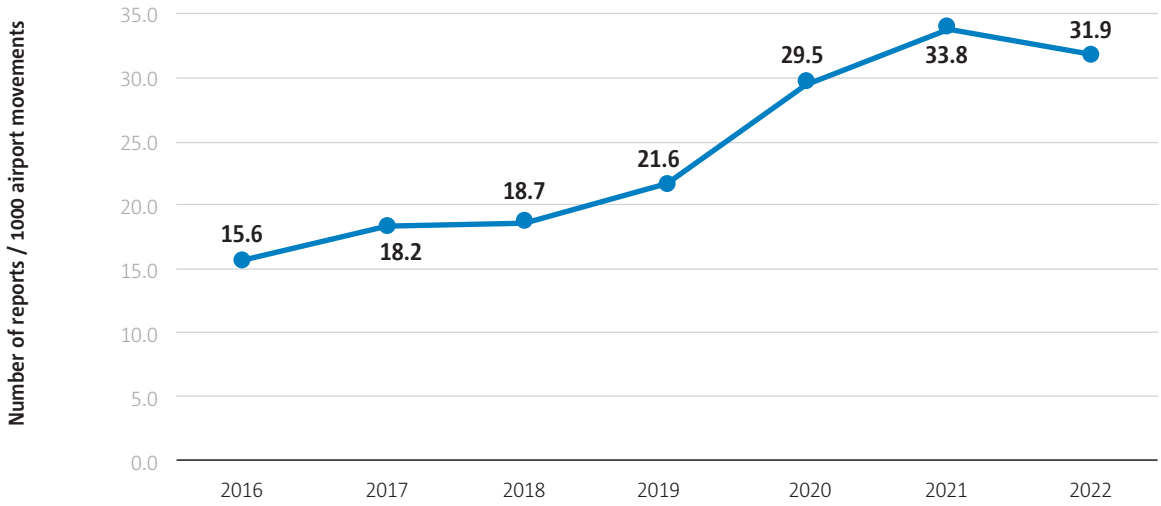


Figure 8.3 Reporting rate (number of reports/1000 airport movements) per year

Monthly variation for each year

Figure 8.4 shows the number of reports by month for each year over the period 2016-2022.

The steady increase in reporting levels is clearly visible from 2016 to 2019. 2020 shows a very different profile, with a substantial drop in the number of reports from March 2020, which coincides with the even more pronounced drop in traffic, as shown in Figure 8.5. In 2021, whereas the first months of the year showed a lower number of reports compared to the preceding years, the number of reports progressively caught up with the levels of 2019 and were even similar to 2019 for the last quarter of the year. This trend for reports in 2021 was not observed in the number of airport movements which stayed lower than the pre-pandemic levels despite a visible increase over the year. In 2022, the evolution of airport traffic got back to its more usual seasonal profile, which was still slightly below the pre-pandemic years. The number of reports all along 2022 was the highest observed.

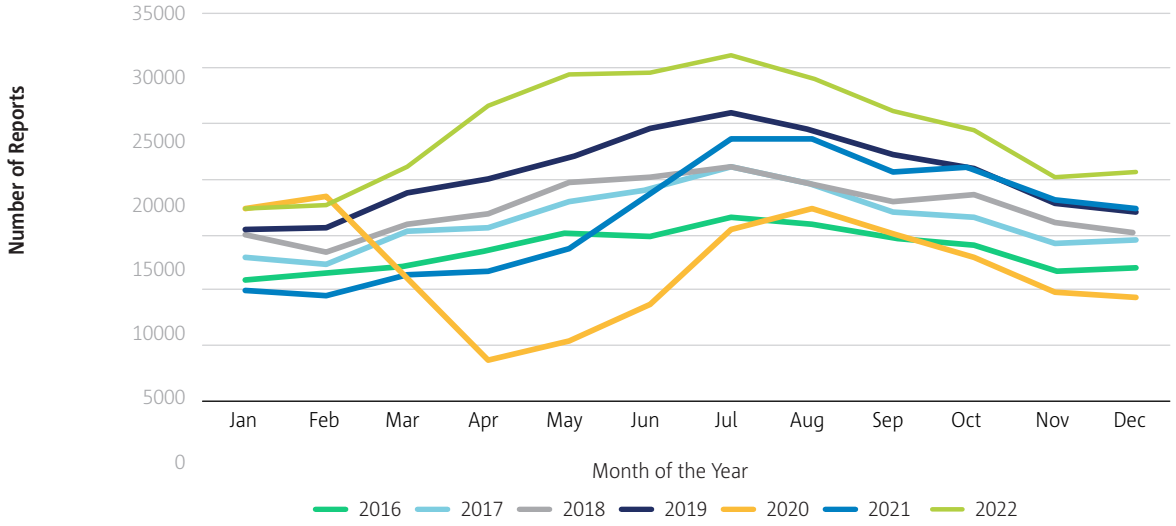


Figure 8.4 Number of reports collected in the ECR per month per year

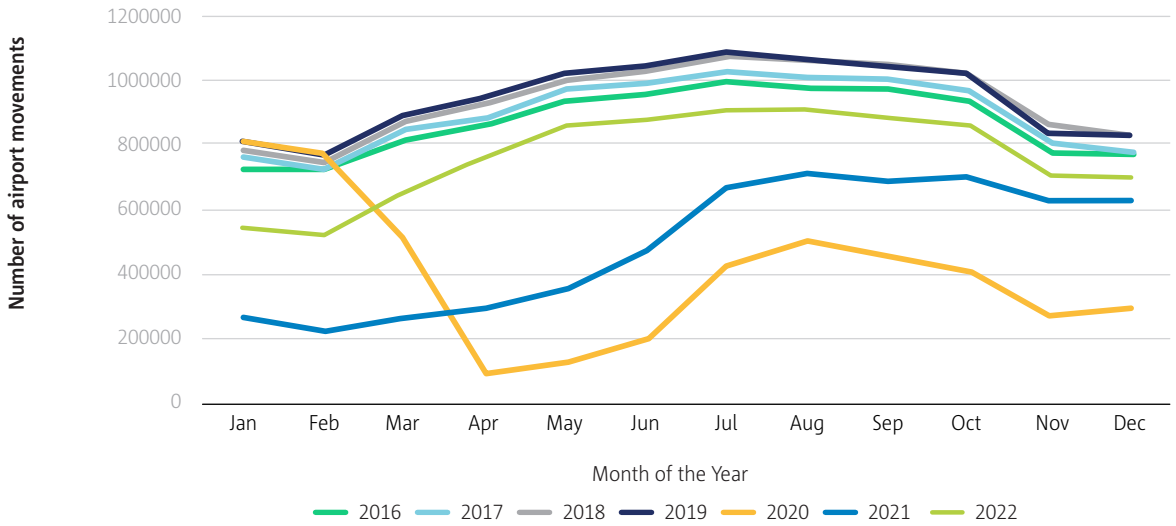


Figure 8.5 Number of airport movements per month per year, for all EASA MS (except Iceland)

8.2 Volumes of reporting for the main type of organisations

This section provides data split by the main type of reporting organisations, to better identify which organisations are the main contributors to safety occurrence reporting and evaluate how their relative contributions have evolved over the period 2016-2022.

Comparison of volume of reporting

In Figure 8.6, the total number of reports was split into five main categories of reporting organisations, using the ECR attribute 'Reporting Entity'. These five categories are as follows:

- Aircraft operators;
- Air navigation service providers (ANSPs);
- Aerodrome operators;
- Other types of reporting entities, such as design organisations, maintenance organisations, ground handling organisations, production organisations, individuals;
- Unknown: the reports for which the 'Reporting Entity' value was not completed.

For the three main types of organisations, following a progressive increase from 2016 to 2019, and lower numbers during 2020 and 2021, the number of reports in 2022 was the highest observed since 2016. In comparison to the last pre-pandemic year 2019, the number of reports in 2022 from aircraft operators is 28% higher, also 28% higher for ANSPs, and almost doubled (93% higher) for aerodrome operators.

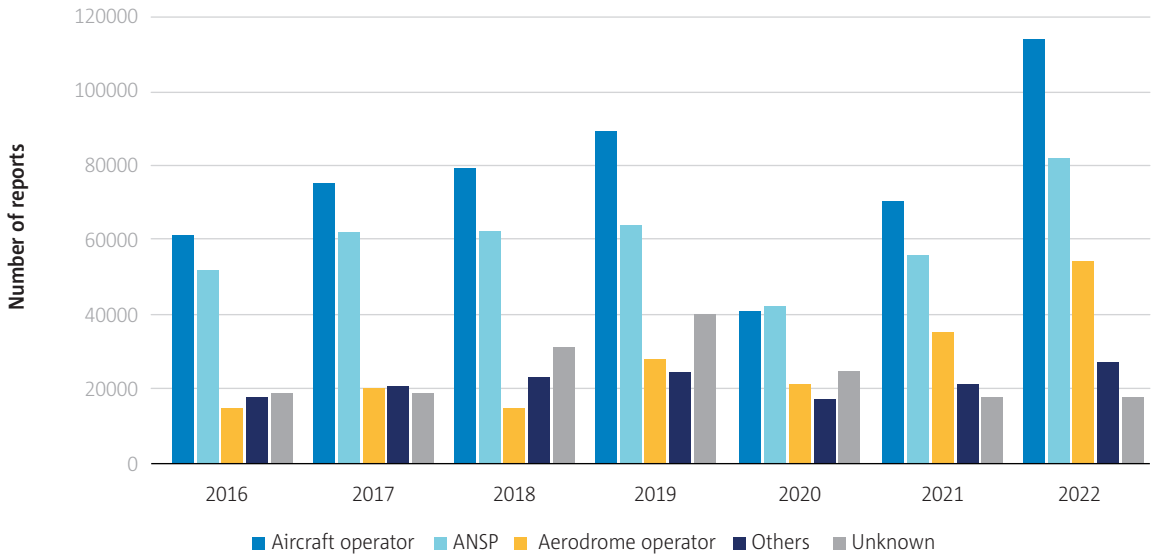


Figure 8.6 Number of reports collected in the ECR per type of reporting organisation

Figure 8.7 brings an additional perspective on the trend in occurrence reporting, by showing the relative proportion of reports for the five categories defined in Figure 8.6.

The proportion of reports from aircraft operators was relatively stable around 37 % of all reports over the period 2016-2022, except in 2020 where it decreased to 28%. For the ANSPs, the proportion of reports slightly decreased since 2016 to stabilise then around 28% of the total reports over the last three years. The proportion of aerodrome reports had a continuous increase since 2016, starting from 9% of the total reports in 2016 to reach 18% of the overall reports over the last two years.

It is important to highlight that the accuracy of the figures and trends described here are affected by the proportion of reports for which the type of reporting entity is unknown. The number of reports in the ECR with no reporting entity value represents between 12% and 17% of the overall reports for each year between 2016 and 2020. Over the last two years, this proportion was reduced to 6% of the overall reports, which is encouraging, but still a limiting factor in the interpretability of the ECR data.

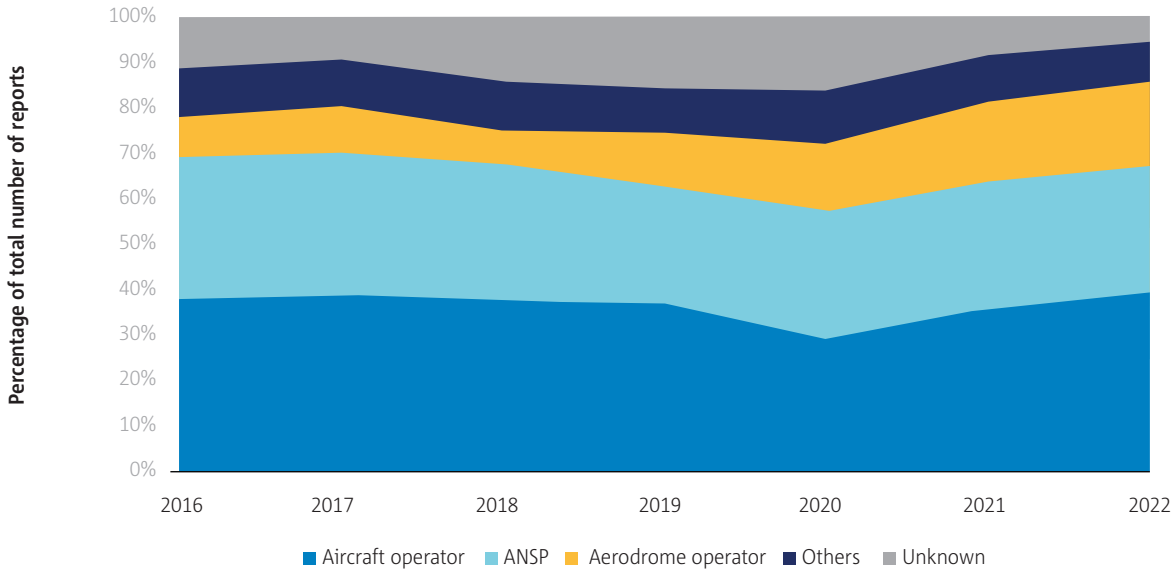


Figure 8.7 Proportion of reports (in % of the total number of reports) per type of reporting organisation

Chapter 9
Standardisation

As safety is the Agency's core business, Standardisation[14], aimed at achieving and maintaining a high and uniform level of safety within the EU, is one of its main tasks. EASA conducts standardisation activities to monitor the application by National Competent Authorities (NCAs) of the requirements of the Basic Regulation[15] and its Implementing Rules, as well as their uniform implementation, to enable that:

- Passengers can fly safely to, from and within the EU;
- The EU industry benefits from a level playing field;
- Certificates issued by NCAs are mutually recognised and trusted; and
- The European system is recognised by international partners.

Standardisation activities entail assessing the NCAs' ability to discharge their safety oversight responsibilities on a continuous basis (Continuous Monitoring Activities, CMA), as well as conducting standardisation inspections as necessary to directly verify the implementation of the rules. Such inspections are prioritised, planned and performed using a risk-based approach, based on the Agency's assessment of well-defined indicators.

This chapter summarises the standardisation activities conducted by EASA in 2022. After two years of partial shut-down of aviation and NCAs operating in 'exemption mode', 2022 was the first year of a strong recovery in terms of traffic. NCAs have been trying to catch up with the resurgence of their industry. However, retaining and recruiting qualified staff in competition with the also recruiting industry is a big challenge for many NCAs. This is also the root cause of several observations made in Standardisation in 2022.

During 2022, the Agency performed standardisation inspections and CMA in the following domains:

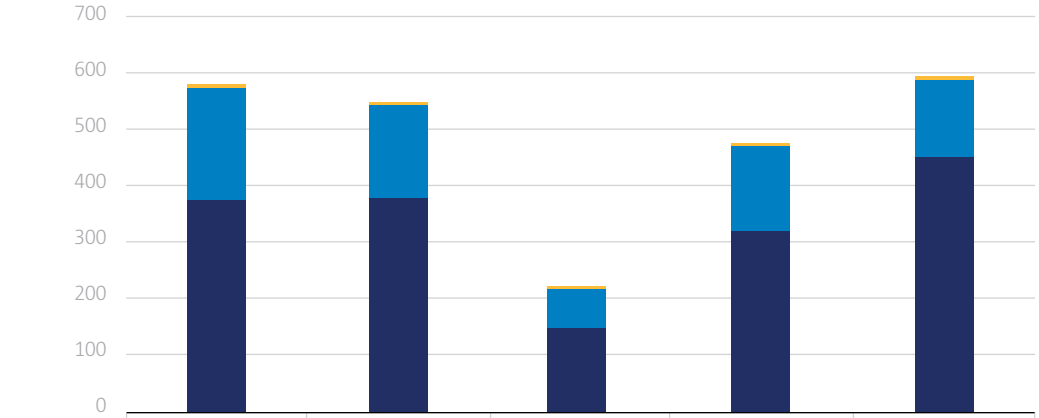
1. Systemic Enablers for Safety Management (SYS),
2. Aerodromes (ADR),
3. Airworthiness (Production and Maintenance) (AIR),
4. Air Traffic Management/Air Navigation Services (ATM/ANS),
5. Air Operations (OPS),
6. Ramp inspections (RAMP),
7. Aircrew - Licensing (FCL),
8. Aircrew - Medical (MED),
9. Aircrew - Flight Simulation Training Devices (FSTD), and
10. Unmanned Aircraft Systems (UAS).

The Agency continued the build-up of its standardisation activities in the UAS domain. Instead of following a traditional standardisation approach, focusing mainly on a cycle of on-site inspections of all MS, EASA decided to adopt a novel approach that is mainly based on dedicated surveys (horizontal Enhanced CMA (ECMA) activities) and regular webinars with sectorial focal points. These activities were complemented by one comprehensive on-site inspection and two implementation support visits. In addition, a new Technical Body (TeB), dedicated to the UAS domain, was established to better support the exchanges between EASA and EASA MS. Two sessions of this new TeB were held in 2022.

14 Commission Implementing Regulation (EU) No 628/2013 of 28 June 2013.

15 Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018.

In 2022 the Agency raised a total of 591 findings of non-conformity, as shown in Figure 9.1:



	2018	2019	2020	2021	2022
Class G	9	5	3	6	2
Class D	198	166	72	155	198
Class C	375	380	147	318	391

Figure 9.1 Number of findings by class and year

Class C findings (391 in 2022) raise mainly standardisation concerns, whereas class D findings (198 in 2022) also raise safety concerns, if not timely corrected, and class G findings (2 in 2022) represent immediate safety concerns (ISCs) requiring the concerned NCA to take immediate corrective actions.

Comparing 2022 and 2021 figures shows that the number of findings in 2022 have increased significantly reflecting the increase of standardisation activities in 2022. With more onsite visits compared to the preceding year, the number of findings increased in the majority of the domains. The biggest increase is found in the ATM/ANS domain mainly due to a targeted focus on Performance Based Navigation (PBN) implementation specifically undertaken on behalf of the European Commission and new regulatory requirements that the NCAs and undertakings are still becoming fully conversant with. This demonstrates the efficiency of the ECMA approach that enables to better evaluate the level of implementation of recent regulatory changes.

In terms of the ratio of findings per inspection, the average of 6.9 for 2022 indicates a need to maintain regular onsite inspections with an upwards trend over the last three years (6.3 in 2021 and 6.2 in 2020).

Class C

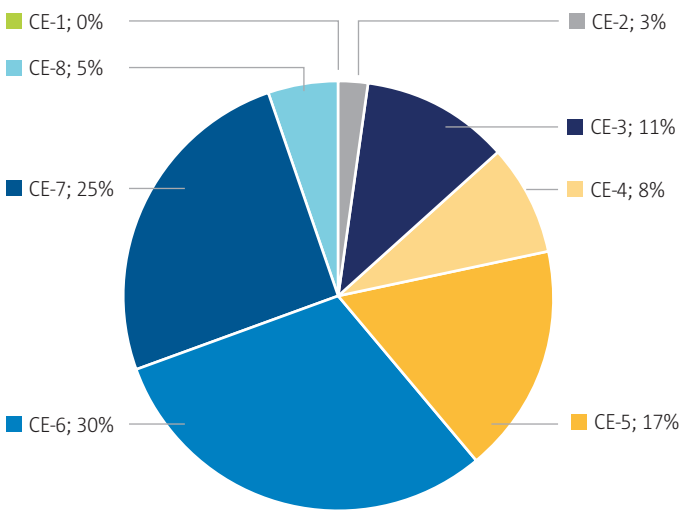


Figure 9.2 Distribution of Class C findings by Critical Element

Class D

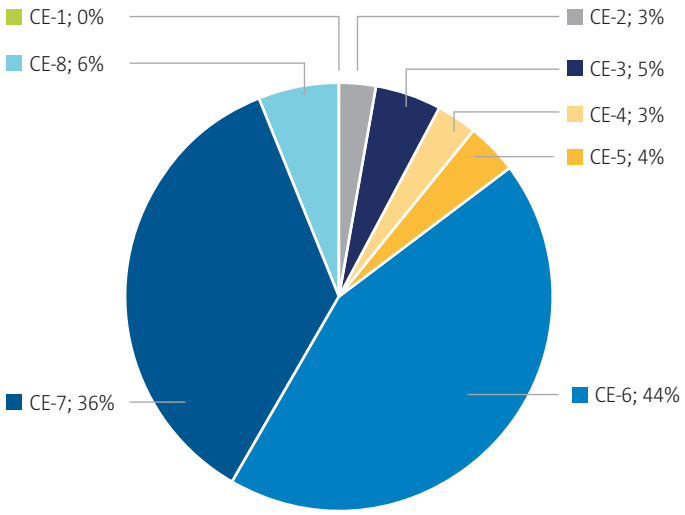


Figure 9.3 Distribution of Class D findings by Critical Element

Figure 9.2 and Figure 9.3 illustrate the distribution of class C and D findings raised in 2022 according to the eight Critical Elements (CEs) of a State's Safety Oversight System defined by the International Civil Aviation Organisation (ICAO) in its Doc 9734 "Safety Oversight Manual". The ICAO CEs are essentially the main constituents of a safety oversight system. They encompass the whole spectrum of civil aviation oversight activities, and their effective implementation is an indication of a State's capability in providing safety oversight. The eight CEs are:

CE-1 Primary aviation legislation;

CE-2 Specific operating regulations;

CE-3 State civil aviation system and safety oversight functions;

CE-4 Technical personnel qualification and training;

CE-5 Technical guidance, tools and the provision of safety-critical information;

CE-6 Licensing, certification, authorisation and approval obligations;

CE-7 Surveillance obligations;

CE-8 Resolution of safety concerns.

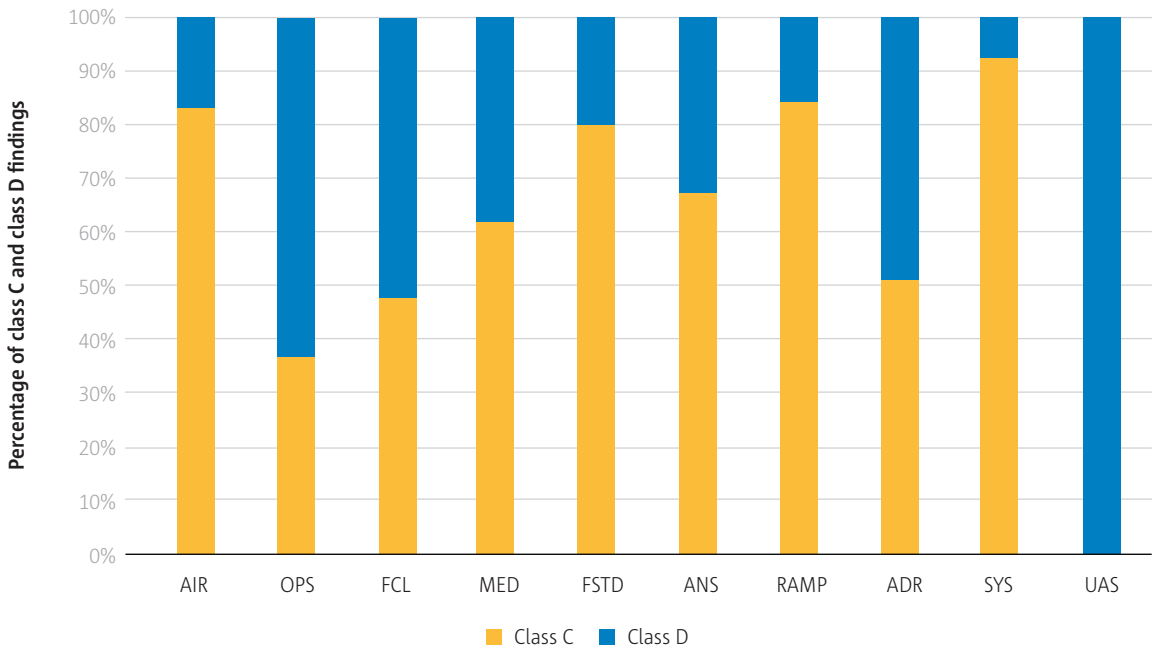
As in previous years, most class D findings (80%) relate to CE-6 (initial certification/ approval) and CE-7 (continued oversight/ surveillance). This confirms the continued safety impact of the inadequacy of certification and oversight processes that was already observed in the previous years; it represents a standing concern, and it is a focus area for standardisation inspections.

For class C findings, the main areas of concern are CE-6 and CE-5, followed by CE-3 and CE-7; combined, they account for 83% of all class C. Besides certification and oversight, the unavailability of proper procedures and tools (CE-5) and technical training and qualification of personnel, remain a source of standardisation concern.

In 2022 two ISCs were identified in the OPS domain. This is a decrease compared to six ISCs in 2021. All safety concerns were addressed immediately by the NCAs involved.

More generally, the key outcomes of standardisation activities in 2022 can be summarised as follows:

- **Lack of effective oversight.** As in previous years, most Class D findings (78%) relate to the NCAs' performance of certification and oversight tasks (ICAO Critical Elements CE-6 and CE-7), showing that such essential functions remain the most challenging. The severity of the issue varies across technical domains, the most critical being Air Operations, Flight Crew Licensing and Aerodromes, as can be seen in Figure 9.4. The inability of several NCAs to properly discharge their certification and oversight responsibilities in these domains is a concern, especially due to the size, scope and complexity of the aviation industry that some of them oversee.



AIR - Airworthiness; OPS - Air Operations; FCL - Aircrew Licencing; MED - Aircrew Medical; FSTD - Flight Simulation Training Devices; ANS - Air Traffic Management/Air Navigation Services; RAMP - Ramp inspections; SYS - Systemic Enablers for Safety Management; ADR - Aerodromes; UAS - Unmanned Aircraft Systems.

Figure 9.4 Ratio of class C and D findings per domain in 2022[16]

- **A growing gap in restoring the oversight function.** While the majority of NCAs have reached a suitable level of implementation and are able to correct their weaknesses in safety oversight, some MS show continued difficulties in restoring their safety oversight function.
- This is illustrated by safety-related findings (class D) that remain open and overdue at the end of each year. Among the MS experiencing the most difficulties, some have been improving over the last years, but others struggle to restore the situation for years now. Lastly, the ability to react in a timely manner to overdue findings is an issue in several MS.
- **Uneven progression of the overall maturity in States**. While some MS have started their journey to develop their maturity level years ago, others are still struggling to initiate their State Safety Programme (SSP), in particular regarding the coordination of all relevant state entities.
- **Management Systems**. As in previous years, the implementation of management systems at NCAs continues to be an area of concern. The manpower computation, which has improved globally, reflects the difficulty to recruit and maintain a sufficient amount of competent personnel. The competence of personnel and the turnover of qualified staff remains a global concern. NCAs face difficulties to properly implement recent changes in the applicable regulations and in change management in general, notably in NCAs who established a multimodal organisation, combining different modes of transport in a single authority, where the integrated management system struggles to address all the specificities of the aviation domain and its safety management.
- **Principal place of Business (PPoB)**. The correct determination of the principal place of business has improved in 2022 with best practices based on a European Commission Working Paper . The handling of PPoB issues has matured in some NCAs by increasing awareness and developing appropriate

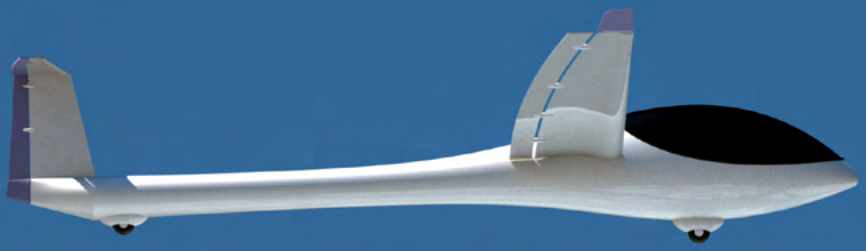
16 Note: this ratio is not yet statistically meaningful for the UAS domain, as only two findings were raised in 2021.

assessment tools. However, the increasing number of multinational companies keeps making the determination more complex with the risk that some companies might engage with several NCAs to "select" the optimal place for their approval with, potentially, challenges for the oversight that still needs to cope with the size and complexity of the industry.

- **European Economic Area (EEA) agreement-specific issues.** The delay in incorporating new EU regulations into Annex XIII to the EEA applicable to Norway and Iceland creates growing technical differences between the certification basis used by EU MS and non-EU EEA States which escapes the scope of Standardisation while benefiting from equal rights and obligations within the internal market.

The Agency will continue to focus its standardisation efforts by running an effective Continuous Monitoring Approach. The successful development of ECMA to remotely investigate areas of concern and trigger inspections, implementation support or even direct off-site findings has proven to be an efficient way to tailor the activities to the situation of each country. The maturity level assessed during the SYS inspections provides a new dimension related to safety management at state level.

EASA will monitor and report to the European Commission on the progress of issues mentioned above to resolve long-standing and overdue findings and help the MS in maintaining a robust safety oversight and the mutual recognition of certificates.



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Postal address
Postfach 10 12 53
50452 Cologne
Germany

Visiting address
European Union Aviation Safety Agency
Konrad-Adenauer-Ufer 3, D-50668
Köln, Germany

Tel. +49 221 89990-000
Mail safetypromotion@easa.europa.eu
Web **www.easa.europa.eu**