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Foreword

by the Executive Director

The aviation industry has been under relentless pressure since early 2020, when the outbreak of the COVID pandemic plunged the sector into crisis almost overnight. The recovery from that initial shock has come in waves and proved extremely challenging.

By summer 2022, we had hoped that finally the worst impact of COVID was behind us, with only residual safety risks remaining from the severe slowdown in operations. On the technical and maintenance side, the side-effects of not using aircraft for extended periods requires constant vigilance. On the human side, the reduced flying time of pilots over an extended period increases the potential for safety lapses: it is important that this risk is mitigated. These are issues on which EASA offered extensive guidance in 2021.

However new challenges and shocks to the system have arisen in recent months due to the unanticipated surge in demand for air travel, with traffic in Europe now back up to around 85% of 2019 levels. This recovery has been severely challenged by the unavailability of qualified and experienced staff at various key stages in the passenger process, particularly at the airport. The resultant problems and delays can create stress and fatigue for air personnel, including pilots. We are monitoring this situation closely.

Other significant world events, in particular the Russian invasion of Ukraine, have imposed operational strains due to the resultant air space closures and the impact of the sanctions against Russia. The broader macroeconomic impact of all of this – supply chain issues, commodities shortages and therefore also inflation – is also taking its toll on the industry. These pressures are set to continue.

At the same time, the industry also needs to reinvent itself to meet the demands of society for a more environmentally friendly aviation. EASA is developing an aviation environmental labelling programme and is supporting the certification of fossil fuel alternatives, storage cell technologies and advancing urban mobility solutions. The European Aviation Environmental Report 2022 will be published in September and its recommendations will help further the efforts of the industry to become greener.

While the system has benefited enormously from digitalisation, the potential disruptive effects of cybersecurity attacks require our constant attention and awareness. To further strengthen European aviation against cybersecurity threats, EASA has actively supported the development of the regulatory framework that will introduce an information-security safety management system (iSMS) as an organisational requirement.

At EASA, our role is preventative – we consistently take measures in advance to keep the sector's safety record as high as possible. As part of this, we are developing an Integrated Risk Management concept that will help European Aviation overcome the full spectrum of challenges stemming from environmental, health and wellbeing concerns, and security and conflict zone management.

So far, despite all the challenges we have faced and are facing, the EASA system has once again shown itself to be resilient, safe, and effective. Such a positive outcome rests not only on the formal framework but also on the diligence and dedication of aviation and aviation-related staff.

Safety involves all of us. It is a joint activity that we can only realise together. I thank all stakeholders for their continued support and their recognition of the importance of ensuring that safety remains our top priority.

Patrick Ky

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Introduction

EASA would like to welcome you to the 2022 edition of the EASA Annual Safety Review (ASR)[1]. The review has been published since 2005 and is now in its 17th year. The analysis presented in this review provides the data-driven input that supports the European Safety Management Process (SRM) and hence the European Plan for Aviation Safety (EPAS).

The Annual Safety Review 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. This analysis drives the development of safety data portfolios, which as prioritised using the experience of EASA Member States and Industry so as to connect the data with the current and future priorities of the Agency and the safety priorities contained in the EPAS.

Data portfolios are provided for each of the aviation domains presented in this edition and build upon the work of previous years. They show the safety issues that have been identified in occurrence data and are cross referenced with the key risk areas (or main accident outcomes) to which they contribute. The ASR analysis focuses on aviation safety risks based on occurrence data. This work is a part of the ongoing SRM and, in particular, it benefits from the valuable input from the Network of Analysts[2] (NoA) and Collaborative Analysis Groups (CAGs).

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.

2 See Article 14(2) of REGULATION (EU) No 376/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 3 April 2014 on the reporting, analysis and follow-up of occurrences in civil aviation.

How the safety review is produced

Information sources

The EASA Annual Safety Review is produced by the Agency's Safety Intelligence and Performance Department, within the Strategy & Safety Management Directorate . 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. 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 also 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 Annual Safety Review may differ from safety reports prepared by other organisations and regulators. This is due to differences in collection methods, in the definitions of the data collected, and the subsequent analysis. 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.

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 occurrence-risk classification at the national and EASA levels. As a result, the European Risk Classification Scheme (ERCS) was developed, which measures 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[3] published in 2020 and later a Commission Implementing Regulation[4], published in 2021. The application of the ERCS is mandatory as of January 1, 2023.

Within the ERCS, the matrix's rows consider what the severity would have been if the occurrence being scored had escalated into a fatal accident. This is done by considering both the size of the aircraft involved and the worst likely type of accident outcome.

Secondly, the columns measure the probability, by looking at how close the occurrence was to that fatal accident outcome, based on a weighted barrier model.

3 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

4 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

EASA began using the method in 2017 and has categorised all the accidents and serious incidents in the Annual Safety Review, including those occurring before 2017. The ERCS is useful because the classification of 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 of the latter would be classified as an accident. It is clear that in terms of risk, the serious incident in this example would be of a higher risk than the accident. The combination of probability and severity would significantly differ. An analysis using ERCS-applied occurrence data provides an overview of the risks for each domain that were present during the analysed period. However, it does not predict the future risks, which will change because of changing circumstances and the remedial effects of safety mitigating actions.

Exclusion of United Kingdom Occurrence Data

Although some non-EU Member States are EASA Member States (Iceland, Norway, Switzerland and Lichtenstein), the United Kingdom of Great Britain and Northern Ireland (UK) left both the European Union and the EASA regulatory system at the end of 2020. In order that the data of 2021 can be compared to the preceding ten years on an equal basis, occurrence data originating from the UK is no longer included in the Annual Safety Review.

Chapter overview

This document is split into eight chapters, each of which covers one particular operational domain within the European aviation system. The different domains cover the areas for which a specific data portfolio has been developed. The scope of each domain chapter and corresponding data portfolio, is the EASA MS, either as the state of operator or the state of registry. For the aerodromes and ground handling and ATM/ANS chapters, this scope is the EASA MS as state of occurrence. Please note that as the United Kingdom is no longer an EASA MS and thus is not included in the scope of the ASR, either for this year or in the data of preceding years, the figures presented differ more significantly than usual when compared with previous editions.

The chapters of this review 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 domains. It helps to identify which domains are likely to need the greatest focus in the EPAS.

Chapter 2 – Aeroplanes

- **Commercial air transport aeroplanes:** This covers all commercial air transport airline (passenger and cargo operators) operations involving aeroplanes, as well as non-commercially operated complex aircraft flown for business operations. The airline and business operations involving complex aircraft are covered under the same data portfolio due to the strong commonalities in their safety issues and key risk areas.
- **Specialised operations:** This covers all aerial work/Part SPO operations involving aeroplanes and involves a wide range of different operational activities including aerial advertising, aerial patrol, agricultural, air shows, parachuting and glider towing.
- **Non-commercial operations**: The chapter covers all non-commercial operations involving 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, with the exception of 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

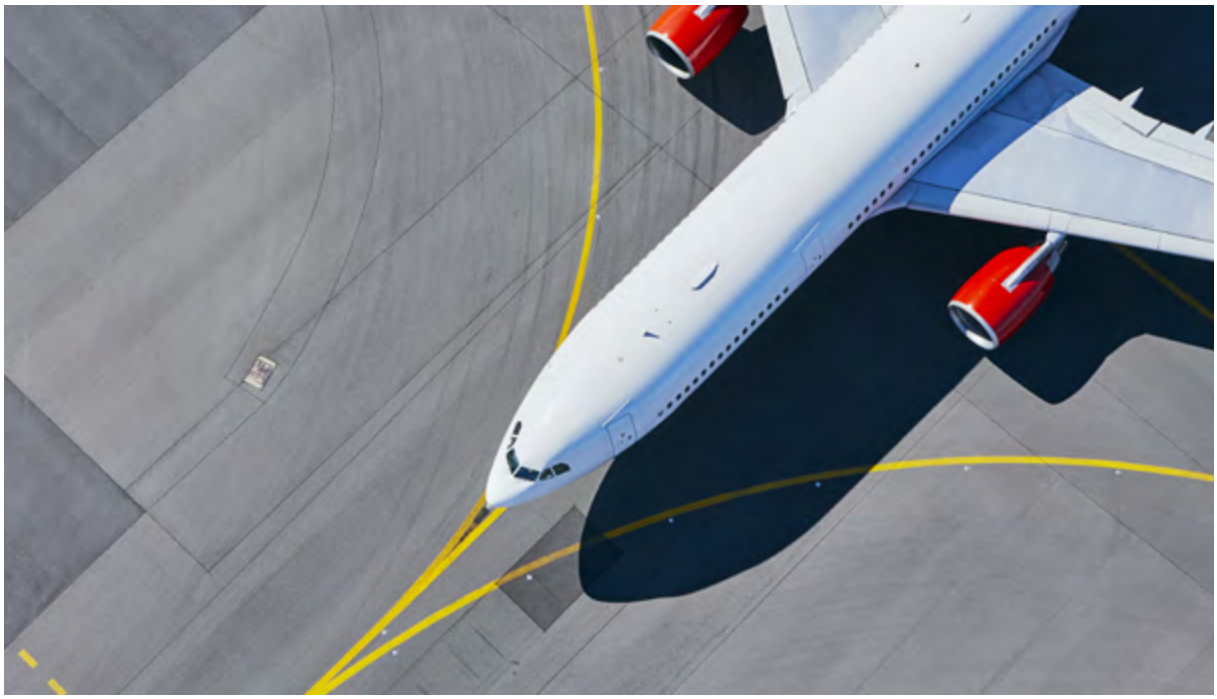
This chapter covers air traffic management and air navigation services (ATM/ANS) occurrences within the EASA MS. Therefore, the scope of the chapter is EASA MS as state of occurrence.

Chapter 8 – ECR reporting rates

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

Chapter 9 – Standardisation

This new chapter provides an overview of EASA's oversight of the Member State competent authorities for aviation safety. 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[5].



5 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 Annual Safety Review contains specific information, which is useful in understanding the analysis of that domain. The structure of each chapter, as described below, is as similar as possible, while providing the ability to compare information in each domain.

Key statistics: Every chapter begins with a set of key statistics. These figures 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. It also outlines the number of fatalities and serious injuries in the domain. In all cases, the figures for 2021 are followed by a comparison with the annual averages over the past 10 years. This helps to provide a reference on how this year's performance relates to historical trends. This information is also provided in a graphical format.

Domain specific analysis: As every domain 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.

Following on from the inclusion of data relating to human factors and human performance in the domain specific analysis for the aeroplane and sailplane domains in 2020, this analysis is now included in all domains. The term human factors describes human characteristics, abilities and limitations. The knowledge of human factors is used throughout the aviation industry to design systems, equipment and work in ways that support humans in performing at their best. Human performance refers to how people perform their tasks. HF and HP knowledge can also be used diagnostically following safety occurrences, to understand what went wrong, what went right and, more importantly, to understand how to prevent these occurrences from happening again.

Within the EASA occurrence data, human factors and human performance 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 human factors and human performance 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 detail on the type of HF or HP issues identified.

Safety risk analysis: The next part of the analysis, and the most important in each chapter, is the domain safety risk analysis. This section provides an overview of the relative risk level and frequency of each key risk area, as well as outlines the high-risk safety issues for the domain. Safety issues are safety deficiencies related to one or more hazards. They are the actual manifestation of a hazard or combination of several hazards in a specific context. A data portfolio is then provided, listing the domain's safety issues being cross-referenced with the key risk areas.

The data portfolio tables have 2 axes. Along the top, information is provided on the key risk areas, which are the most frequent accident outcomes or potential accident outcomes in that domain. In the context of a safety performance framework, the key risk areas are the Tier 2 safety performance indicators (SPIs) for the domain. The key risk areas are, in most cases, ordered on the basis of their risk levels and determined using the ERCS. On the left-hand axis of the portfolio are the safety issues, which relate to the causal and contributory factors to the key risk areas (accident outcomes). In terms of safety performance, these are the Tier 2+ SPIs. These are prioritised on the basis of their 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.

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 Member States. It sets out the strategic priorities, strategic enablers, main risks affecting the European aviation system, and the necessary actions to mitigate those risks to further improve aviation safety in Europe. The EPAS is a five-year plan, updated annually by EASA, with technical inputs from the EASA Advisory Bodies representing Member States and industry. The plan looks at aviation safety in a systemic manner. The safety priorities and corresponding mitigating actions are determined through the European safety risk management process. While the plan originates with the EASA Member States, it forms the basis of the Regional Aviation Safety Plan 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 Safety Risk Management Process

The main safety risks and corresponding mitigation actions feeding the EPAS are developed through the European safety risk management (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 it is performed through the analysis of occurrence data and other safety-related information and supporting information by the CAGs. These candidate safety issues are formally captured by the Agency and are then subject to a preliminary safety assessment. This assessment then informs the decision on whether a candidate safety issue should be formally included within the relevant safety risk portfolio or be subject to other actions. Advice is taken from the Network of Analysts (NoA) and CAGs. The output of this step in the process are the domain safety risk portfolios. Within the portfolios, both the key risk areas and safety issues are prioritised.

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

The timescales of the SRM process are as follows: The safety data of 2011 – 2020, compared with that of 2021 informs the Annual Safety Review published in 2022, which in turn informs the EPAS of 2023 and beyond.

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 Member States' operators to the number of global fatal accidents and fatalities. Figure 1 shows that the number of fatal accidents in recent years has stabilised, despite the reduction in air traffic caused by the COVID-19 pandemic in 2020 and 2021. As such, both regulators and the industry should remain highly vigilant to aviation safety risks.

Despite the stabilisation in the number of accidents, the number of fatalities in 2021 is the second lowest in the decade. This contrast is largely because over half of the fatal accidents in 2021 involved cargo operations, with fewer people onboard the aircraft.

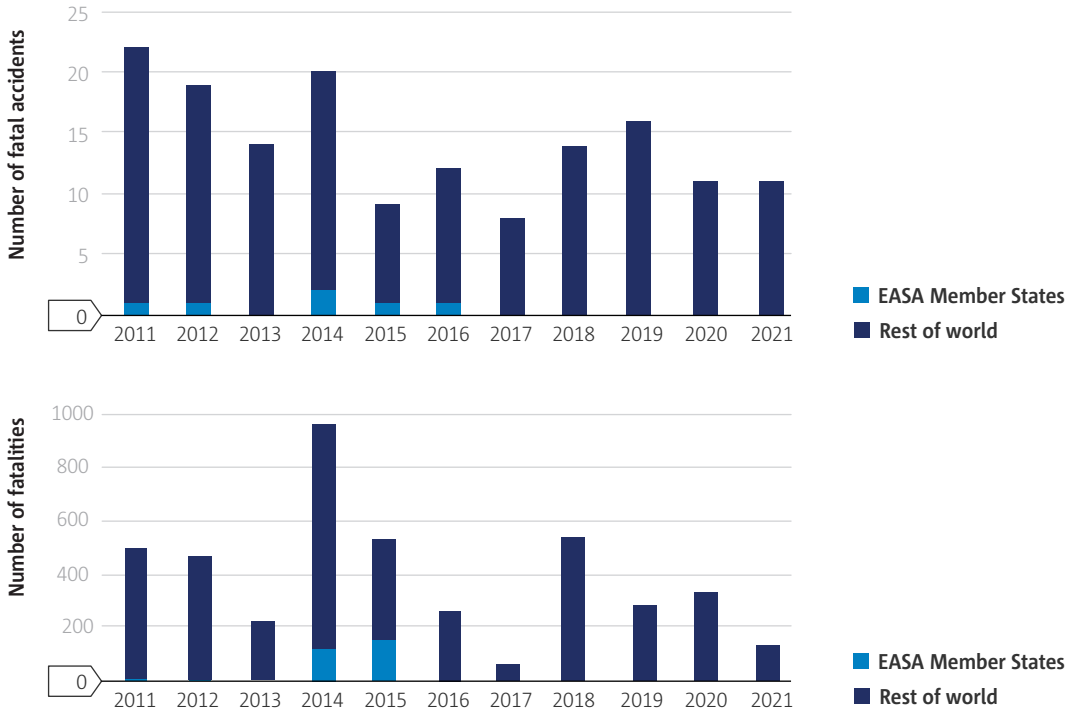


Figure 1 Fatal accidents and fatalities involving large aeroplane passenger and cargo operations, EASA Member States and the rest of the world

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, such acts have often been investigated by safety investigation authorities and the management of safety and security risks are increasingly connected. This year for the first time, the data presented in Figure 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. When focussing on this most recent period (2014-2021), the fatalities caused by unlawful acts represent a significant percentage of the total number of fatalities. This observation, in conjunction with the current challenges associated with the developing geopolitical situations, increasingly focuses concern on security matters that require an integrated risk management approach in order to be adequately mitigated.

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

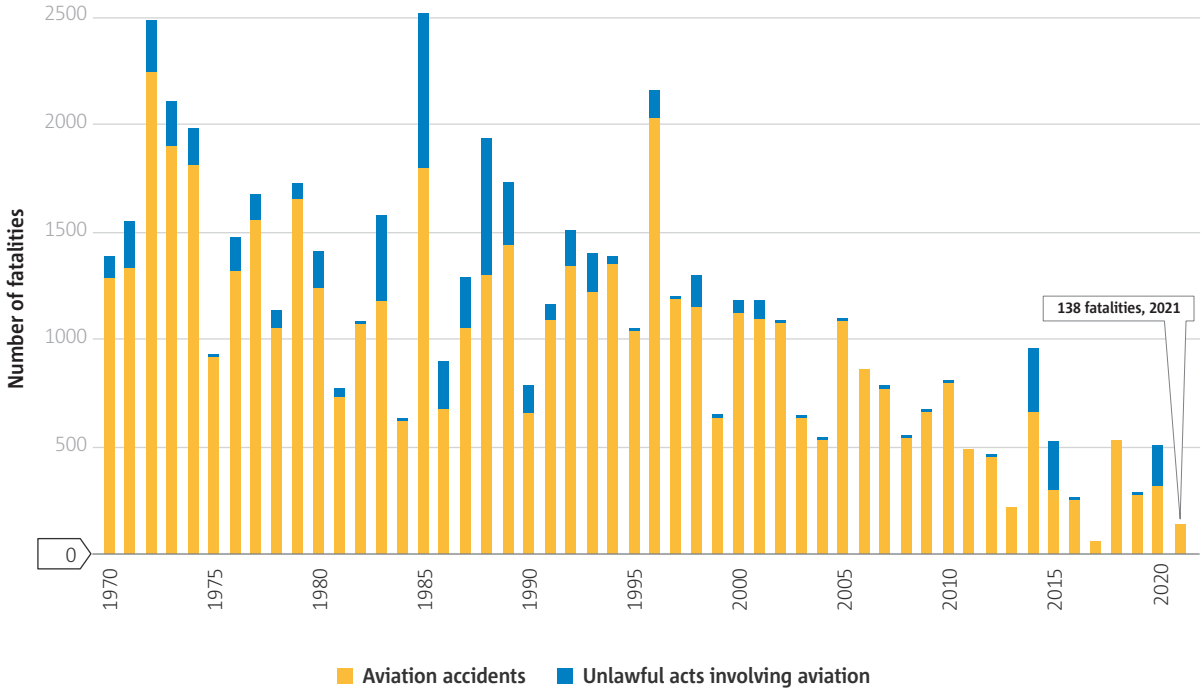


Figure 2 Fatalities involving large aeroplane passenger and cargo operations worldwide

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 accidents between 2017 and 2021 had the following characteristics:

- Over half of the fatal accidents in 2021 (6 out of 11) involved cargo operations. Cargo operations normally comprise a third of commercial large aeroplane accidents worldwide, however the COVID-19 pandemic has caused a shift in the relative proportions of cargo and passenger flights. This will have had a corresponding effect on the proportions of cargo and passenger fatal 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 have almost double the 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.

1.2 EASA Member States cross domain safety overview

Each domain presented in this review provides the number of fatal accidents and fatalities for 2021 as compared with the preceding ten years, 2011-2020. These figures are consolidated here, to provide a cross-domain safety overview. As a consequence of the UK's leaving the EASA system, in order that the data of 2021 can be compared to the preceding ten years on an equal basis, occurrence data originating from the UK is no longer included in the Annual Safety Review.

In almost all domains, the number of fatal accidents and fatalities was close to the minimum of the preceding decade. The exception to this is non-commercial helicopter operations, with 6 fatal accidents in 2021, compared with between 2 and 8 fatal accidents per year from 2011 – 2020, and 11 fatalities in 2021, compared with between 4 and 20 fatalities per year from 2011-2020.

Table 1 Cross domain comparison of EASA Member States aircraft fatal accidents and fatalities

AIRCRAFT DOMAIN	FATAL ACCIDENTS 2021	FATAL ACCIDENTS 2011 - 2020 MIN - MAX	FATALITIES 2021	FATALITIES 2011-2020 MIN - MAX	FATALITIES 2011-2020 MEDIAN
AEROPLANES					
CAT airlines	0	0-2	0	0 - 150	0
NCC business	0	0-1	0	0 - 4	0
Specialised operations	3	4 - 13	4	4 - 31	9
Non-commercial operations	58	40 - 82	95	81 - 115	83
HELICOPTERS					
Overall	8	5 - 16	13	10 - 37	24
CAT Operations	0	0 - 5	0	0 - 22	6
Specialised Operations	1	0 - 8	1	0 - 17	2
Non-commercial Operations	6	2 - 8	11	4 - 20	7
BALLOONS	2	0 - 4	1	0 - 5	2
SAILPLANES	14	14 - 49	17	21 - 42	27

A separate table is used for aerodromes and ground handling and ATM/ANS, reflecting the different definition for each; The tables include all fatal accidents and fatalities that happened at aerodromes or in airspace in an EASA Member State. 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 Member State.

Table 2 Cross domain comparison of EASA Member States infrastructure fatal accidents and fatalities

INFRASTRUCTURE DOMAIN	FATAL ACCIDENTS 2021	FATAL ACCIDENTS 2011 - 2020 MIN - MAX	FATALITIES 2021	FATALITIES 2011-2020 MIN - MAX	FATALITIES 2011-2020 MEDIAN
AERODROMES AND GROUND HANDLING	0	0 - 3	0	0 - 5	0
AIR TRAFFIC MANAGEMENT & AIR NAVIGATION SERVICES	0	0 - 2	0	0 - 8	4

The following graphs 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.

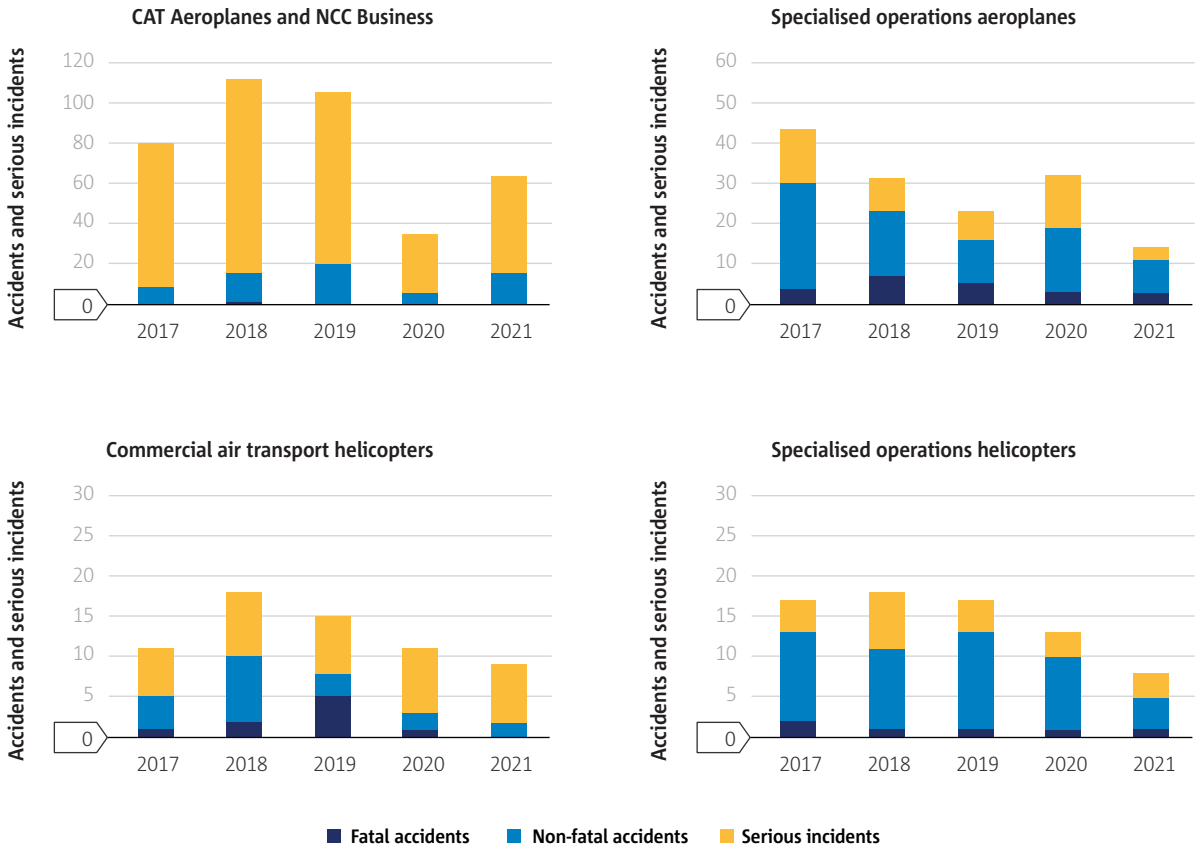


Figure 3 EASA Member States accidents and serious incidents per year for large CAT and NCC business aeroplanes, SPO aeroplanes, CAT helicopters and SPO helicopters

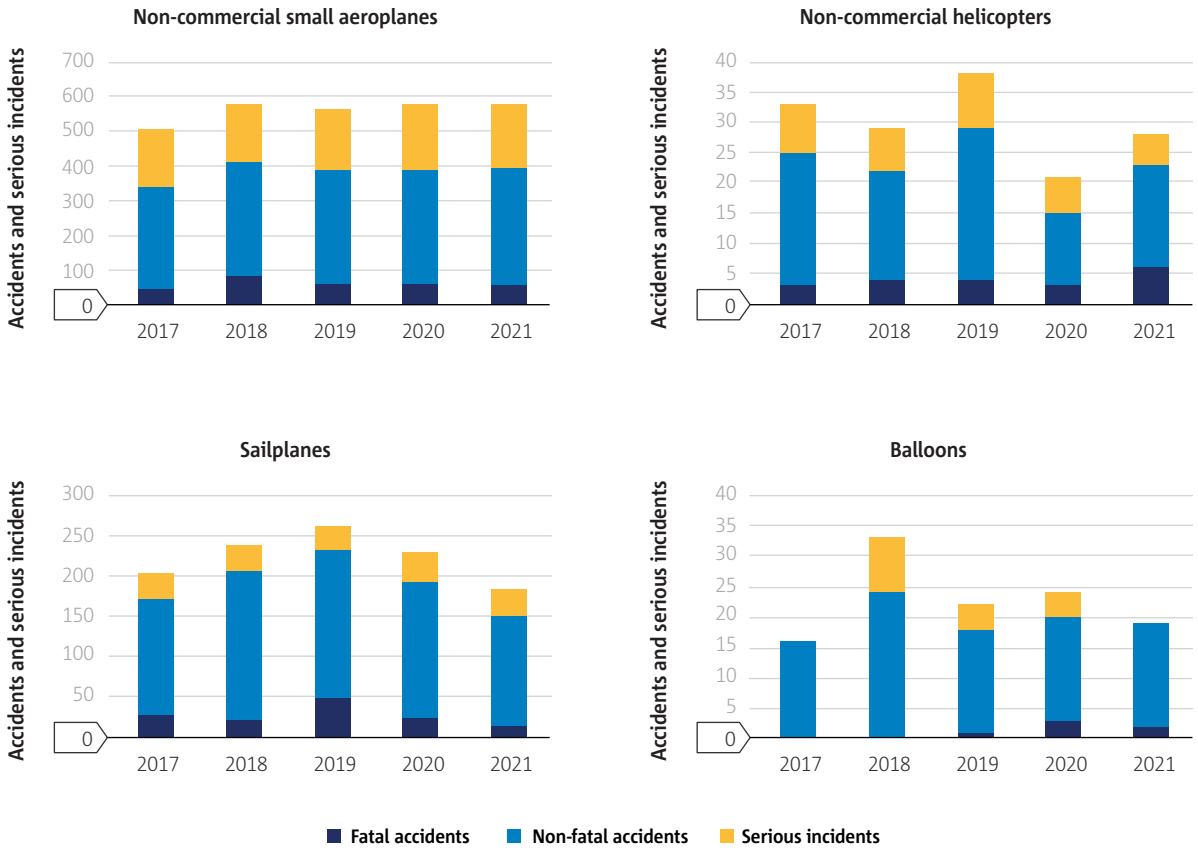


Figure 4 EASA Member States accidents and serious incidents per year for non-commercially operated aeroplanes and helicopters, and all sailplane and balloon operations.

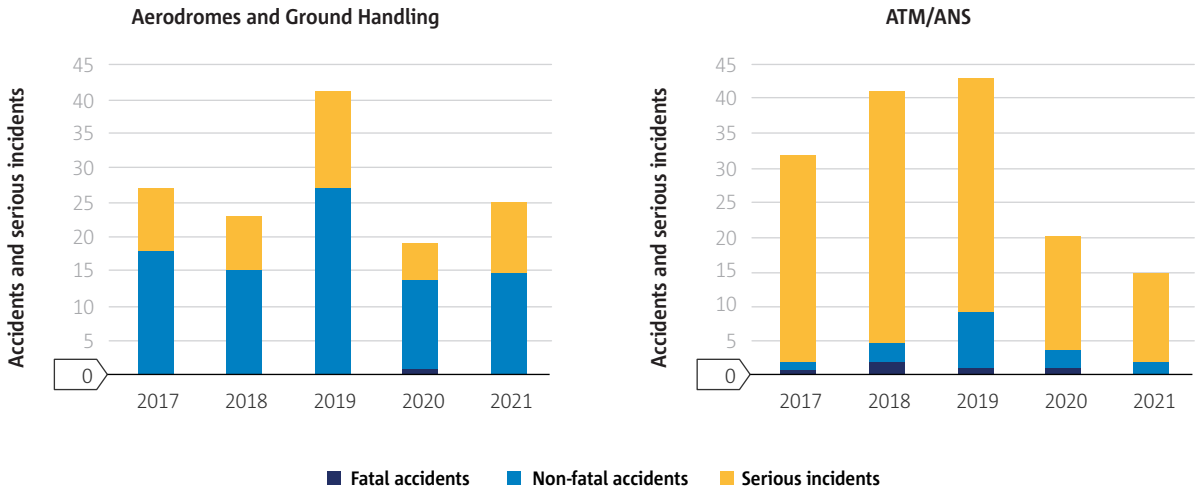


Figure 5 EASA Member States infrastructure related accidents and serious incidents per year

Chapter 2

Aeroplanes

This chapter covers all aeroplane operations. The chapter is divided in three main sections:

1. Airline and air-taxi passenger and cargo operations conducted by EASA Air Operators Certificate (AOC) holders with aeroplanes of a maximum take-off mass above 5 700 kg and EASA Member State registered complex aeroplanes operating non-commercial operations (NCC);
2. Specialised operations (SPO) conducted by EASA Member States registered aeroplanes or EASA Member States AOC holders. Examples include air ambulance, advertisement, photography, etc.;
3. Non-commercial operations conducted by EASA Member States registered non-complex aeroplanes, having a maximum take-off mass below 5 700 kg and not covered in the sections above.

As a consequence of the UK's leaving the EASA system, in order that the data of 2021 can be compared to the preceding ten years on an equal basis, occurrence data originating from the UK is no longer included in the Annual Safety Review.

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 are presented. Data portfolios are provided per aviation domain, giving an overview of the main safety risks for these types of operations at the European level, based on occurrence data.

The list of fatal accidents associated with the scope of this chapter is provided in Appendix 1 of this document, as is a list of fatal accidents involving non-certified aeroplanes (Annex I products).

2.1 Commercial air transport – Airlines and air taxi – Large aeroplanes

This section covers the airline and air-taxi passenger and cargo operations of EASA AOC holders with aeroplanes of a maximum take-off mass above 5 700 kg.

Key statistics

The key statistics for this domain are depicted in Table 3 and Table 4 and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the 10-year period (2011-2020)[7] and the last year (2021). It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe. In 2021 there were no fatal accidents involving European Commercial Air Transport (CAT) AOC holders. The numbers of non-fatal accidents and serious incidents were lower than the average of the previous 10-year period.

Table 3 Key statistics for commercial air transport airline and air-taxi aeroplanes

2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
6	Fatal accidents	0	↓
169	Non-fatal accidents	12	↓
675	Serious incidents	48	↓

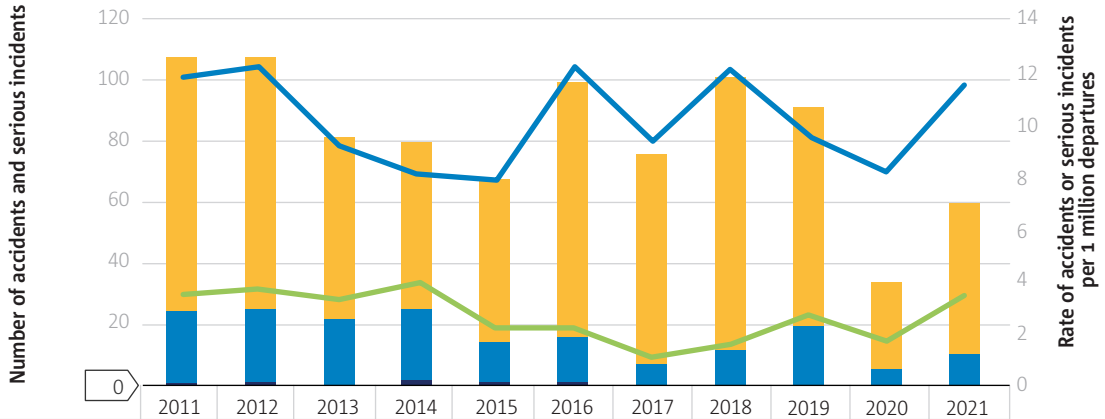
Table 4 Fatalities and serious injuries involving commercial air transport airline and air-taxi aeroplanes

	FATALITIES	SERIOUS INJURIES
2011 - 2020 Total	281	87
2011 - 2020 Max	150	17
2011 - 2020 Min	0	3
2021	0	6

7 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.

Figure 6 shows that the numbers of non-fatal accidents and serious incidents in 2021 have increased in comparison with the previous year. However, serious incidents in 2021 remained below the levels of the years 2011 to 2019. Non-fatal accidents reached or exceeded the levels of the years 2017, 2018 and 2020. These figures should be considered in the context of the COVID-19 pandemic, where air traffic in 2021 was approximately 57% of the 2019 traffic level.

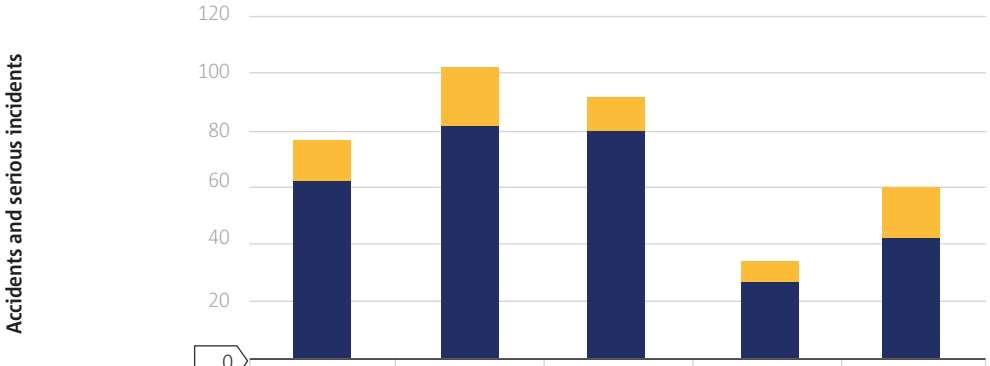
Figure 6 also shows that the rate of accidents and serious incidents has increased in 2021. The rate of accidents is now higher than in 2020, returning to levels seen in 2019. The rate of serious incidents, which typically have a higher risk than accidents, is similar to the period immediately pre-pandemic.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	83	83	60	54	53	84	68	90	72	28	48
Non-fatal accidents	24	24	22	24	14	15	8	12	20	6	12
Fatal accidents	1	1	0	2	1	1	0	0	0	0	0
Serious incident rate	11.9	12.3	9.2	8.2	7.9	12.1	9.5	12.2	9.6	8.2	11.3
Accident rate	3.6	3.7	3.4	3.9	2.2	2.3	1.1	1.6	2.7	1.8	2.8

Figure 6 Numbers and rates of fatal accidents, non-fatal accidents and serious incidents per million departures involving commercial air transport airline and air-taxi aeroplanes

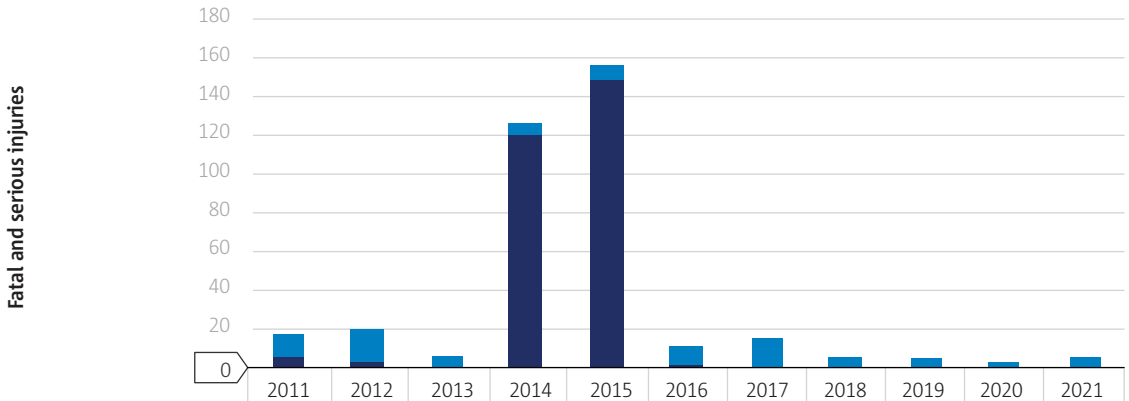
Figure 7 shows occurrences that have been risk scored using the ERCS methodology and divided into higher and lower risk. The aggregated ERCS scores by higher risk and lower risk occurrences show a different pattern than the representation of accidents and serious incidents. This is because some occurrences classified as serious incidents have inherent risk profiles that may be equal or even exceed the risk of some accidents. The numbers of accidents and serious incidents dropped in 2020, and increased in 2021, even though the proportion of higher risk occurrences remained again higher in comparison with lower risk occurrences.



	2017	2018	2019	2020	2021
Lower Risk (ERCS)	14	20	13	7	18
Higher Risk (ERCS)	62	82	79	27	42

Figure 7 ERCS higher and lower risk occurrences per year involving commercial air transport airline and air-taxi aeroplanes

The number of serious injuries, with the lowest number in 2020, increased in 2021 and exceeds the numbers of 2018 and 2019. The number of fatalities per year relates to the operation type (passenger or cargo), size and occupancy of the aeroplane involved in the accident. Injuries in 2021 were attributable to a passenger being injured during disembarkation by falling from the stairs, and encounters with turbulence during flight.

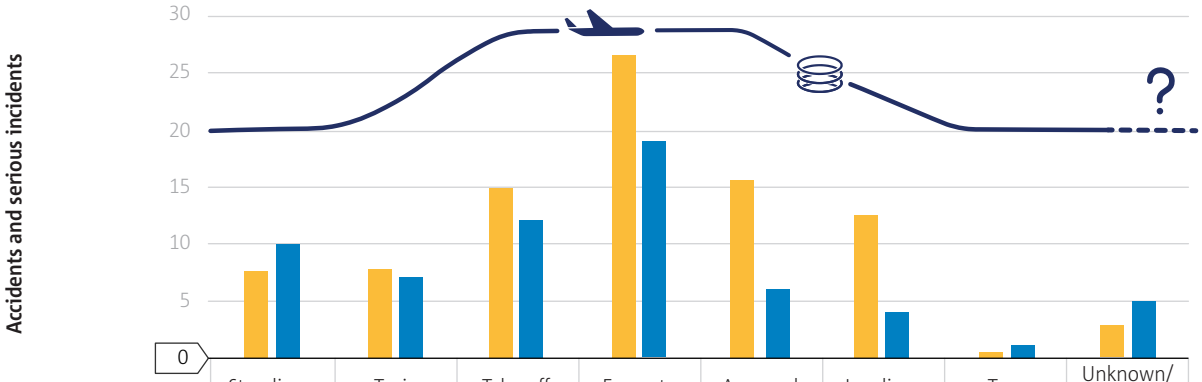


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	11	17	7	7	7	10	15	5	5	3	6
Fatalities	6	3	0	120	150	2	0	0	0	0	0

Figure 8 Fatal and serious injuries per year involving commercial air transport airline and air-taxi aeroplanes

Phase of flight

The numbers for 2021 in Figure 9 show a distribution of accidents and serious incidents per flight phase with a greater number during en route, take-off, and standing. Accidents and serious incidents during approach and landing, critical phases of flight, in 2021 were noticeably lower than the 2011-2020 average. In 2021 accidents and serious incidents during the standing and tow phases exceeded 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.

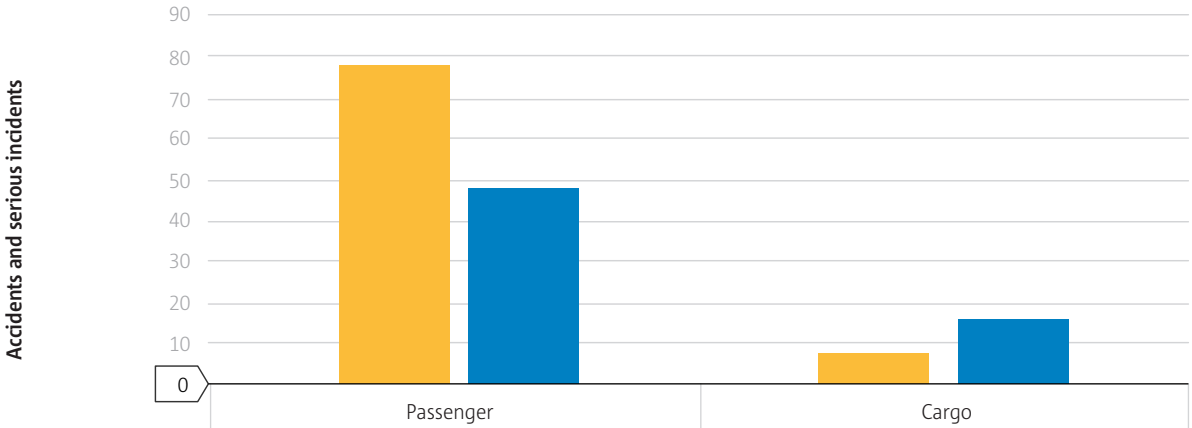


	Standing	Taxi	Take-off	En route	Approach	Landing	Tow	Unknown/ Blank
Average 2011-2020	7.5	7.8	14.9	26.5	15.5	12.5	0.4	2.7
2021	10	7	12	19	6	4	1	5

Figure 9 Accidents and serious incidents by phase of flight involving commercial air transport airline and air-taxi aeroplanes

Operation type

Figure 10 compares the number of accidents and serious incidents per operation type (passenger and cargo), showing the figures for 2021 compared with the 10-year average (2011-2020). In 2021, like in 2020, the number of occurrences for passenger flight operations remained well below the 10-year average. The number of accidents and serious incidents for cargo flights more than doubled compared with the 10-year average. Note that cargo operations in 2021 again exceeded 2019 levels, whereas passenger flights were still heavily impacted by the pandemic.

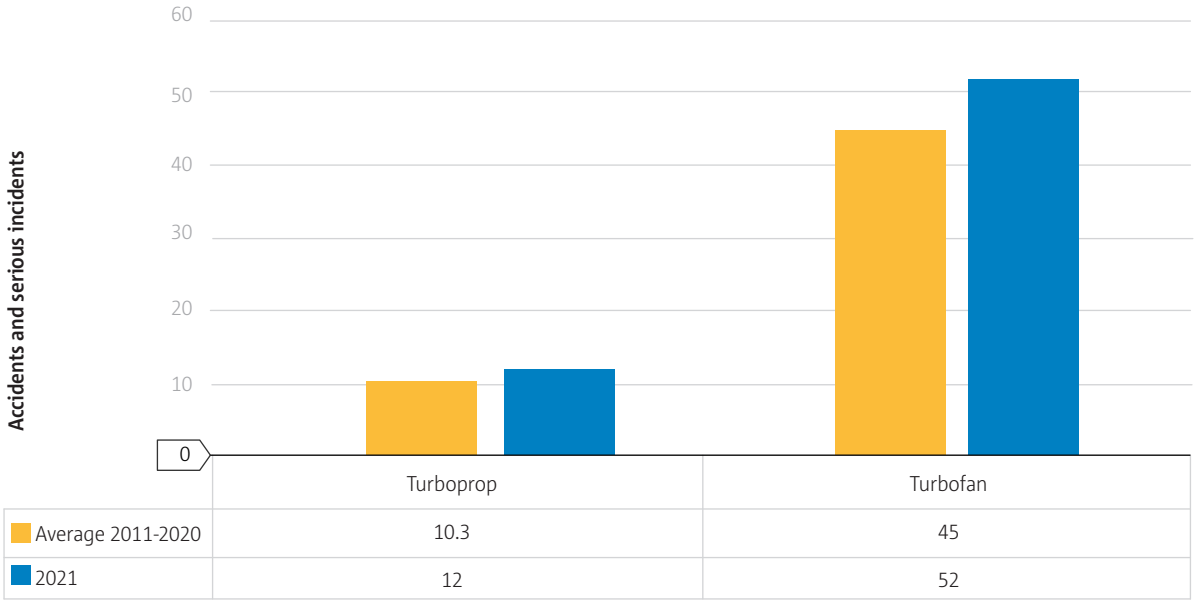


	Passenger	Cargo
Average 2011-2020	78.1	7.3
2021	48	16

Figure 10 Accidents and serious incidents by operation type involving commercial air transport airline and air-taxi aeroplanes

Propulsion type

Figure 11 shows the distribution by propulsion type in 2021 compared with the 10-year average (2011-2020). The figure shows a similar pattern between the 2021 figures and the 2011-2020 figures, although the absolute numbers are higher in 2021 compared with the 10-year average (2011-2020). The split between turbofan and turboprop is consistent with the aircraft fleet sizes and utilisation.

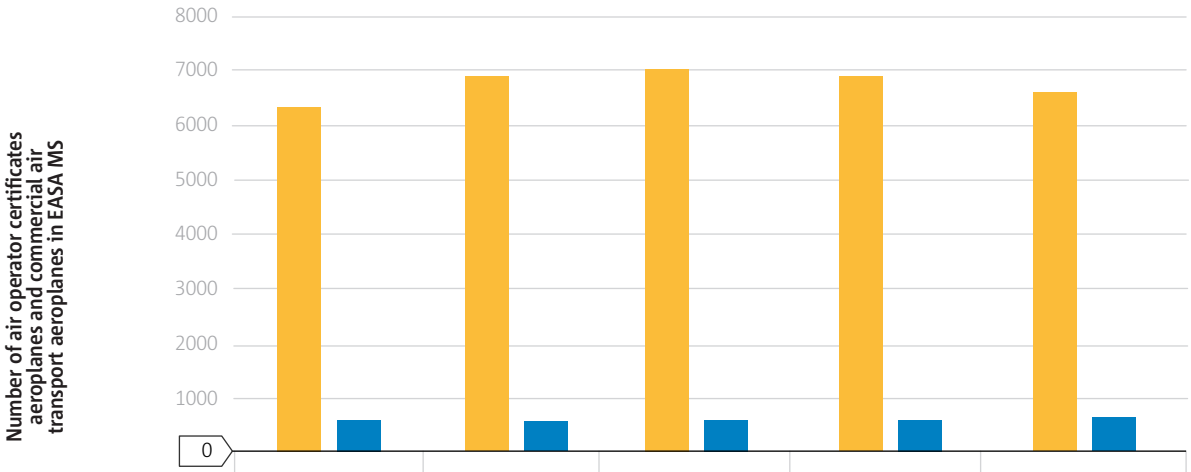


	Turboprop	Turbofan
Average 2011-2020	10.3	45
2021	12	52

Figure 11 Accidents and serious incidents by propulsion type involving commercial air transport airline and air-taxi aeroplanes

Numbers of air operator certificate holders and CAT aeroplanes

Figure 12 shows the number of air operator certificate (AOC) holders and the number of commercial air transport aeroplanes within EASA Member States. It shows that in 2021, the number of AOC aeroplane holders has been above the previous 4-year average and has exceeded the numbers of previous years. The number of CAT aeroplanes has further dropped and ended below the previous 4-year average, however still exceeding the lowest level of 2017.

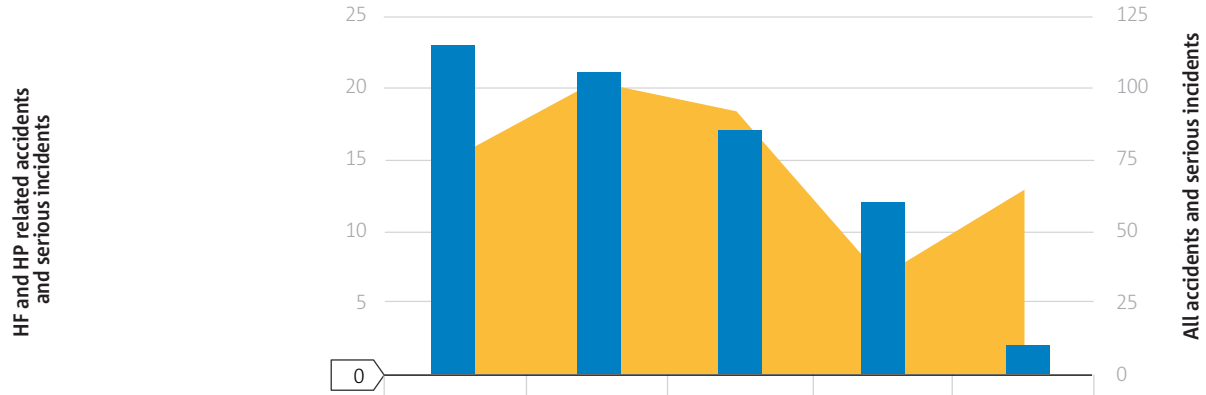


	2017	2018	2019	2020	2021
Aeroplanes (CAT ops)	6343	6904	7017	6883	6593
AOC (A)	588	603	585	575	635

Figure 12 Numbers of Air Operator Certificates Aeroplanes and Commercial Air Transport aeroplanes in EASA MS

Human factors and human performance

Close to a fifth of commercial air transport large aeroplane accident and serious incident reports identify human factors (HF) or human performance (HP) issues. Looking at the figures for the past five years, reduction in overall number of accidents and serious incidents for 2020 is not reflected in the number of HF/HP related issues for the same year. The figure for 2021 should be viewed as preliminary and is likely to increase, since HF or HP issues are often not recorded within accident and serious incident reports until the final report is published.



	2017	2018	2019	2020	2021
Accidents and serious incidents	76	102	92	34	64
HF/HP accidents and serious incidents	23	21	17	12	2

Figure 13 Human factors and human performance accidents and serious incidents involving commercial air transport airline and air-taxi aeroplanes

The application of HF or HP codes at a high level can be seen in Figure 14. Clearly, task performance issues are more easily diagnosable following an accident or serious incident than the factors that cause them, such as physiological or experience and knowledge events.

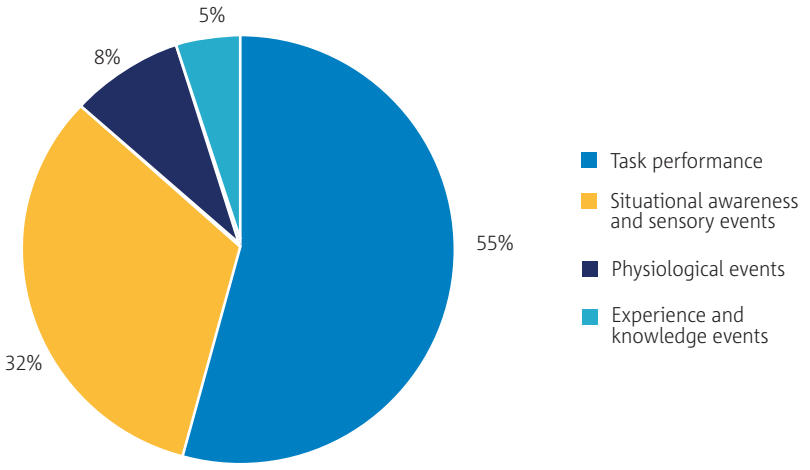


Figure 14 High level human factors and human performance event codes applied to accidents and serious incidents involving commercial air transport airline and air-taxi aeroplanes

Figure 15 compares the number of accidents and serious incidents with the aggregate ERCS risk score of those occurrences, using detailed HF and HP event codes. It can be seen that some types of events have a greater risk than others, as indicated where the aggregated risk score is far higher than the number of accidents and serious incidents. In particular, whereas accidents and serious incidents related to memory are quite common, their aggregated risk is much lower when compared to events involving task management and perception, which have a much higher aggregated risk score.

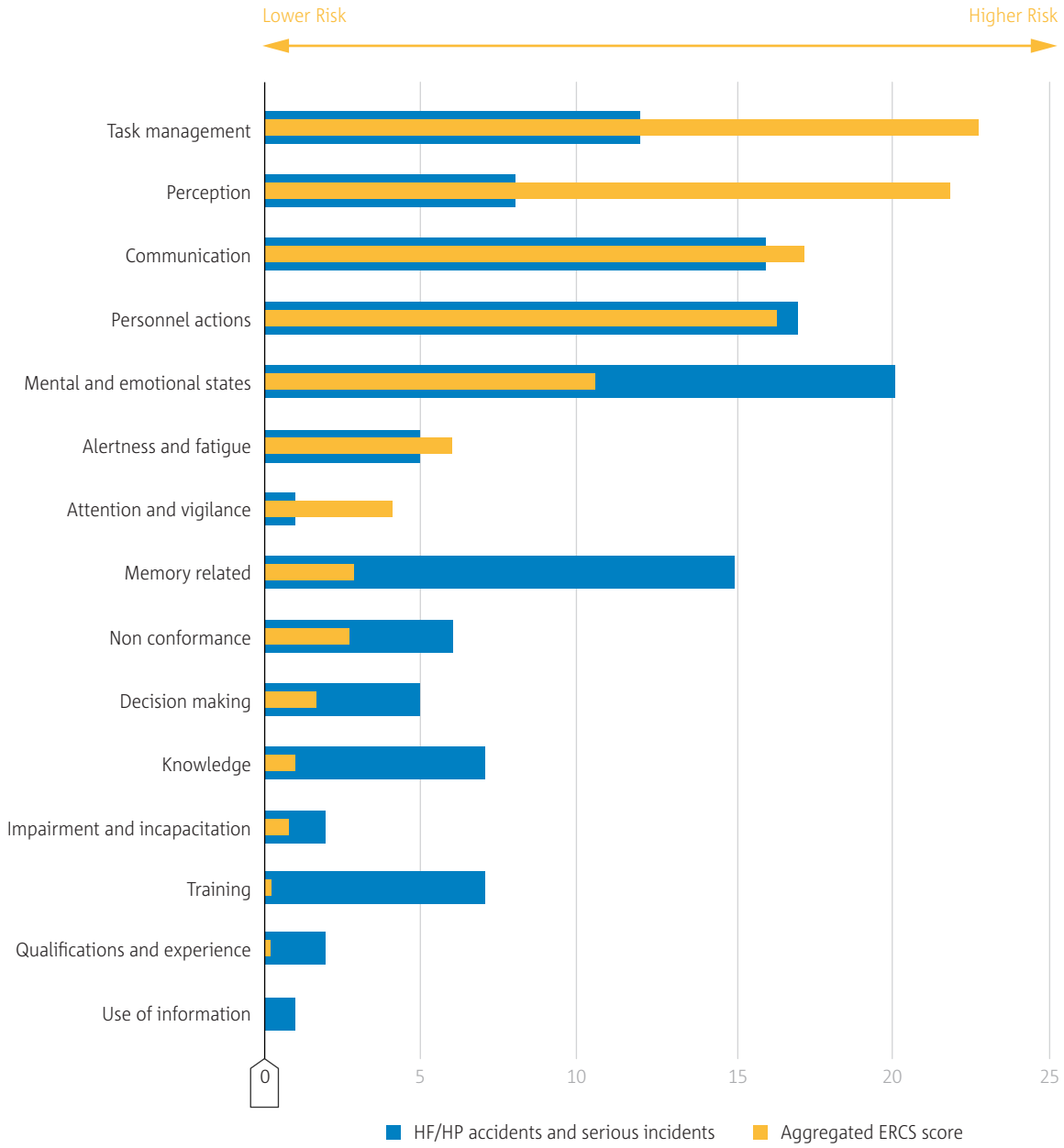


Figure 15 Detailed human factors and human performance event codes by aggregated ERCS score and numbers of accidents and serious incidents involving commercial air transport airline and air-taxi aeroplanes

2.2 Non-commercial complex business aeroplanes

This section covers the safety performance of EASA MS registered complex aeroplanes operating non-commercial operations (NCC).

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 10-year period (2011-2020) and the last year (2021). Also included is a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

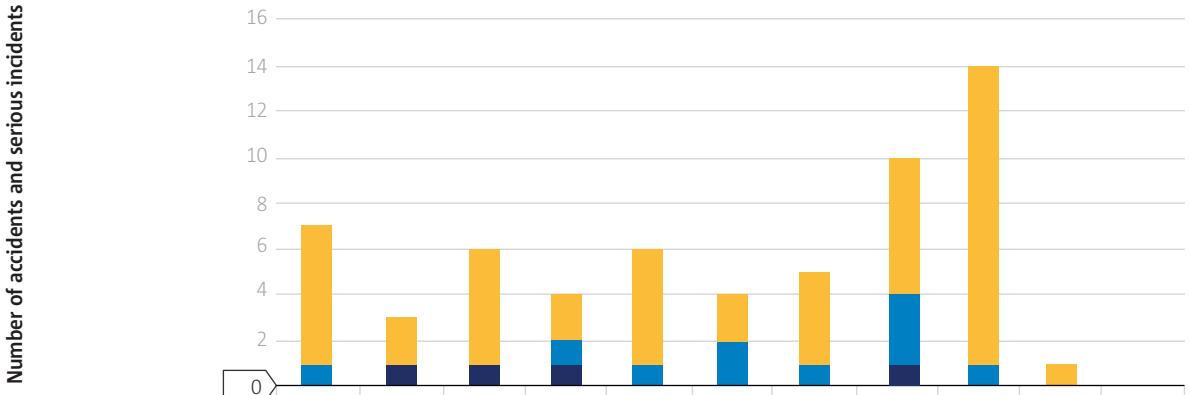
Table 5 Key statistics for non-commercial complex business aeroplanes

2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
4	Fatal accidents	0	↓
10	Non-fatal accidents	0	↓
46	Serious incidents	0	↓

Table 6 Fatalities and serious injuries involving non-commercial complex business aeroplanes

	FATALITIES	SERIOUS INJURIES
2011 - 2020 Total	7	2
2011 - 2020 Max	4	2
2011 - 2020 Min	0	0
2021	0	0

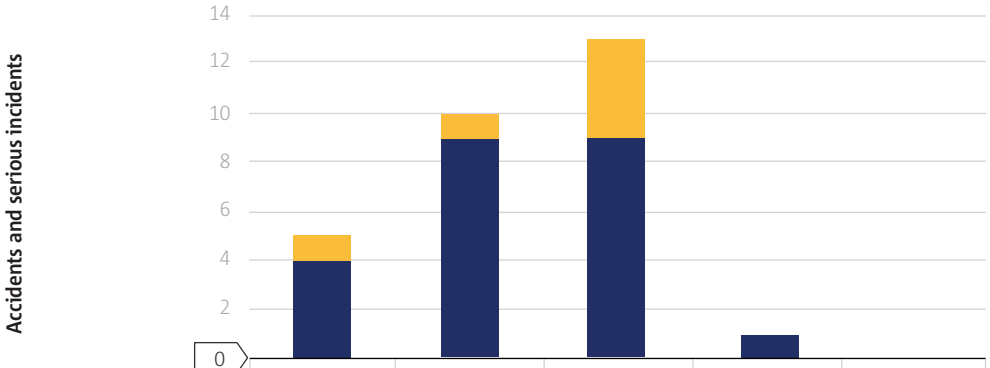
Figure 16 shows that during 2021, for the second year in a row there were no accidents involving an EASA MS registered NCC business aeroplane.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	6	2	5	2	5	2	4	6	13	1	0
Non-fatal accidents	1	0	0	1	1	2	1	3	1	0	0
Fatal accidents	0	1	1	1	0	0	0	1	0	0	0

Figure 16 Fatal accidents, non-fatal accidents and serious incidents per year involving non-commercial complex business aeroplanes

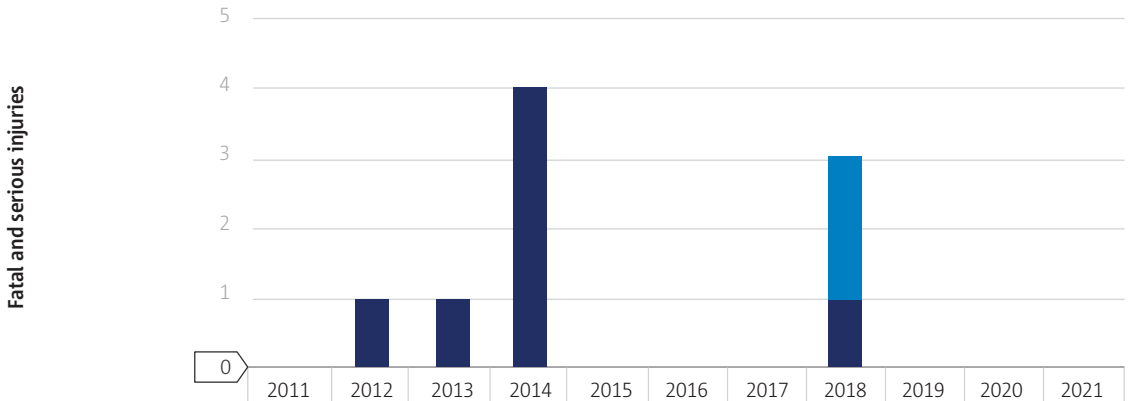
Figure 17 shows occurrences that have been risk scored using the ERCS methodology and divided into higher and lower risk. An explanation of the ERCS and why it is useful is provided in the introduction to the review. The aggregated ERCS scores by higher risk and lower risk occurrences show a different pattern than the representation of accidents and serious incidents. This is because some occurrences classified as serious incidents have inherent risk profiles that may be equal or even exceed the risk of some accidents. As can be seen in the figure, there is a low number of lower risk occurrences. This is likely due to the low reporting in the NCC domain, where only high-risk accidents and serious incidents, normally very visible and with severe outcomes, are reported and thus able to be investigated.



	2017	2018	2019	2020	2021
Lower Risk (ERCS)	1	1	4	0	0
Higher Risk (ERCS)	4	9	9	1	0

Figure 17 ERCS higher and lower risk occurrences per year involving non-commercial complex business aeroplanes

The number of fatalities and serious injuries per year is shown in Figure 18. Due to the size of the aeroplanes used for most of this type of operation, the number of fatalities is low, with an average of approximately 1 fatality per year. As can be seen in Figure 16, there have been four fatal accidents in ten years.

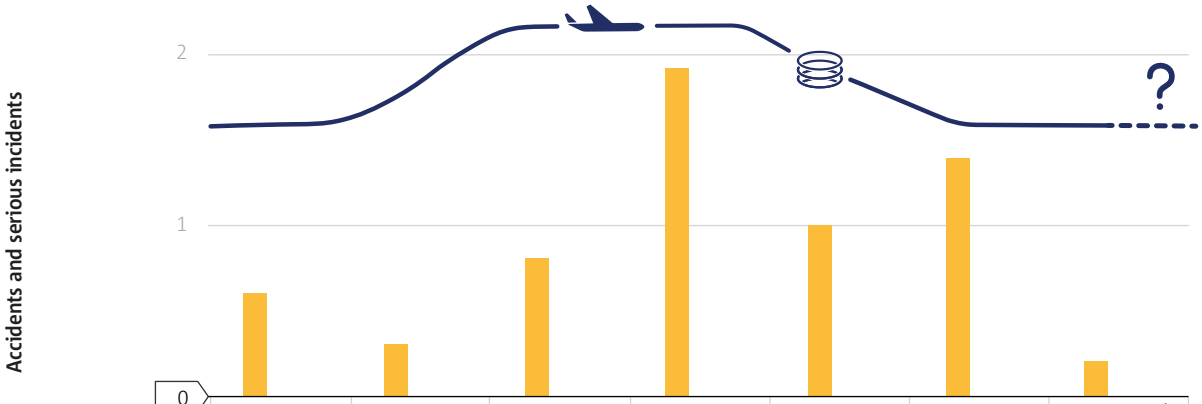


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	0	0	0	0	0	0	0	2	0	0	0
Fatalities	0	1	1	4	0	0	0	1	0	0	0

Figure 18 Fatal and serious injuries per year involving non-commercial complex business 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 19.

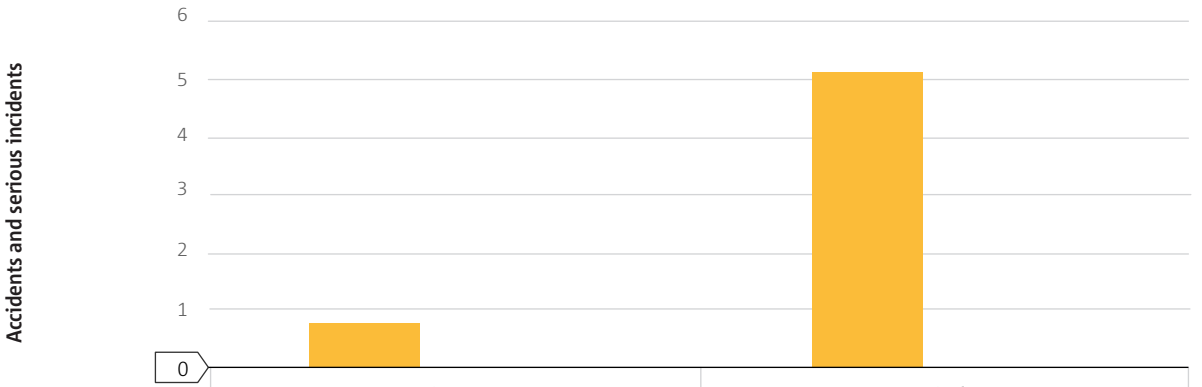


	Standing	Taxi	Take-off	En route	Approach	Landing	Unknown/ Blank
Average 2011-2020	0.6	0.3	0.8	1.9	1	1.4	0.2
2021	0	0	0	0	0	0	0

Figure 19 Accidents and serious incidents by phase of flight involving non-commercial complex business 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 20.



	Turboprop	Turbofan
Average 2011-2020	0.8	5.1
2021	0	0

Figure 20 Accidents and serious incidents by propulsion type involving non-commercial complex business aeroplanes

2.3 Safety risks for large aeroplanes (CAT airlines, air taxi and NCC business)

CAT airlines, air-taxi and NCC business operations are covered by a single data portfolio due to the similarity of the main risk areas and safety issues for these operation types, as well as the small amount of data available for NCC business. The data portfolio is derived from occurrence data from the EASA occurrence repository and the European Central Repository (ECR).

The key risk areas for this domain are highlighted in Figure 21 and are defined by their potential accident outcome and by the immediate precursors of that accident outcome. The data portfolio risk picture by key risk areas has in general retained a similar pattern to the one from the previous year. The most prominent change is for the aircraft upset key risk area that has reduced its risk level. One of the main reasons for this change is that EASA has aligned its ERCS coding practices with the new Commission Delegated Regulation for the ERCS[8], such that only one key risk area is allocated per occurrence. Previously, one occurrence may have been assigned multiple key risk areas.

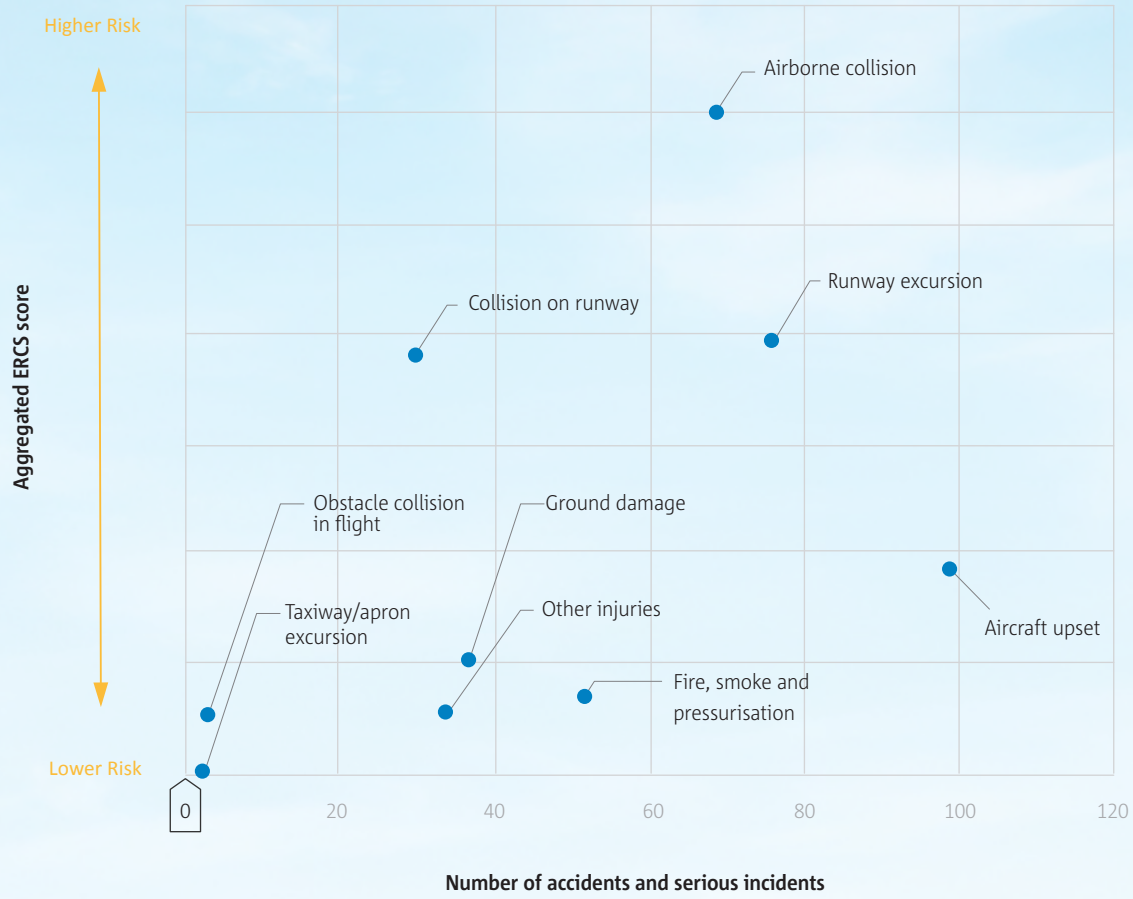


Figure 21 Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving commercial air transport airlines and air-taxi

8 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

As illustrated in Figure 21, the higher risk key risk areas 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 2021 the highest risk contributors were occurrences such as a loss of separation between a solo student pilot flying VFR and climbing into controlled airspace and CAT aeroplane climbing after taking off, several TCAS resolution advisories cases, and air proximity with a drone close to a flight path. This key risk area is mainly managed through safety issues identified in the ATM/ANS safety risk portfolio.
- **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 2021 the highest risk contributors were occurrences involving the use of erroneous take off parameters at take-off (such as a take-off roll beginning at an intersection, but calculations for a full runway length), detachment of the main landing gear support during landing, severe damage due to tyre bust, and an actual runway excursion after landing in adverse weather conditions (heavy snowfall).
- **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 2021 the highest risk contributors were occurrences involving runway incursions by large aeroplanes and vehicles. This key risk area is mainly managed through safety issues identified in the ATM/ANS and the Aerodromes and Ground handling safety risk portfolios.

Figure 22 lists the safety issues in the large aeroplanes data portfolio and shows both the number of occurrences and the risk score. In this case, the aggregated ERCS score is not considered a complete risk indicator. This is because the finer granularity of the safety issue renders this indicator more vulnerable to the reactiveness of the data type used (only accidents and serious incidents).

The most prominent change for safety issues since the last year's review is that deconfliction between IFR and VFR flights, approach path management, and entry of aircraft performance data safety issues have increased in terms of aggregated ERCS score in comparison with the previous 5-year period result and have replaced the top three safety issues of the data portfolio. These are safety issues that are among the Agency's priorities on assessing and proposing mitigating measures through the European Safety risk management process.

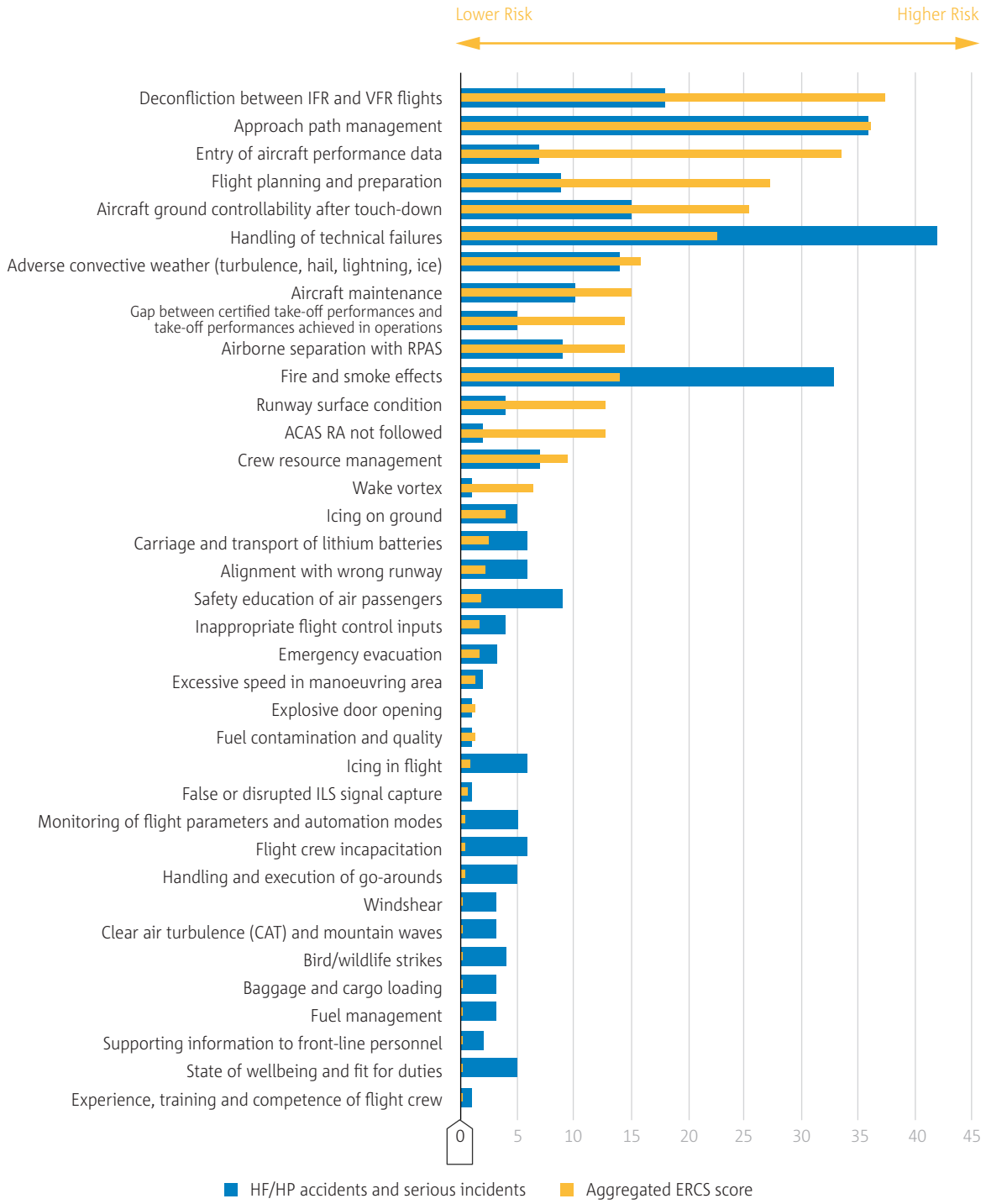


Figure 22 Safety issues by aggregated ERCS score and numbers of accidents and serious incidents involving commercial air transport airline and air-taxi and non-commercial business operations

The data portfolio is shown in Table 9 and lists the safety issues for the domain and cross-references these with the key risk areas, highlighting the most important key risk areas and safety issues. The key risk areas are sorted by the aggregated risk score from left (highest) to right (lowest). The safety issues are listed on the left of the table and are also sorted from the top by decreasing aggregated ERCS risk score. The different colour bands denote high to low risk of the safety issues.

The highest contribution to the airborne collision key risk area in terms of aggregated ERCS score is the deconfliction between IFR and VFR flights safety issue.

For the runway excursion key risk area, there are several main contributing safety issues but the one with the highest aggregated ERCS score is aircraft ground controllability after touch-down, followed by handling of technical failures and entry of aircraft performance data.

For the collision on runway key risk area the main contributing safety issue from the flight operations perspective in terms of aggregated ERCS score is the crew resource management safety issue (Note that others are managed through the ATM/ANS and the Aerodromes and Ground handling data portfolios).

Table 7 Data portfolio for large aeroplanes (commercial air transport airline and air-taxi and non-commercial business operations)

Safety issue	Key Risk Areas (ERCS)										
	Airborne collision	Runway excursion	Collision on runway	Aircraft upset	Ground damage	Fire, smoke and pressurisation	Obstacle collision in flight	Other injuries	Taxiway/apron excursion	Terrain collision	Security
Deconfliction between IFR and VFR flights	x										
Approach path management	o	x		o	o						
Entry of aircraft performance data		o		o							
Flight planning and preparation		o	o	o	o						
Aircraft ground controllability after touch-down		x									
Handling of technical failures	o	x	o	x	o	o					
Adverse convective weather (turbulence, hail, lightning, ice)		o		o				o			
Aircraft maintenance		o		o	o						
Gap between certified take-off performances and take-off performances achieved in operations		o		o							
Airborne separation with RPAS	o										
Fire and smoke effects				o		x		o			
Runway surface condition		o									
ACAS RA not followed	o										

Crew resource management		o	o	o								
Wake vortex				o								
Icing on ground				o		o						
Carriage and transport of lithium batteries						o						
Alignment with wrong runway		o	o		o							
Safety education of air passengers				o		o		o				
Inappropriate flight control inputs		o						o				
Emergency evacuation						o		o				
Excessive speed in manoeuvring area		o					o		o			
Fuel contamination and quality				o								
Explosive door opening								o				
Icing in flight		o		o								
False or disrupted ILS signal capture		o										
Monitoring of flight parameters and automation modes				o								
Flight crew incapacitation				o				o				
Handling and execution of go-arounds	o			o								
Clear air turbulence (CAT) and mountain waves								o				
Windshear	o	o		o								
Bird/wildlife strikes		o	o	o								
Baggage and cargo loading				o	o							
Fuel management				o								
Supporting information to front-line personnel		o		o								
State of wellbeing and fit for duties				o								
Experience, training and competence of flight crew		o										

x = higher number of associated occurrences
o = lower number of associated occurrences

2.4 Specialised operations aeroplanes

The scope of this section covers specialised operations (SPO) involving aeroplanes of all mass categories having an EASA Member State as state of registry or state of operator.

Key statistics

The key statistics for this domain are in Table 8 and Table 9 and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the 10-year period (2011-2020) and the last year (2021). It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe. The numbers of fatal accidents, non-fatal accidents and serious incidents in 2021 were around half the average of the preceding decade. The numbers of fatalities and serious injuries in 2021 were equal to the minimum values of the preceding decade.

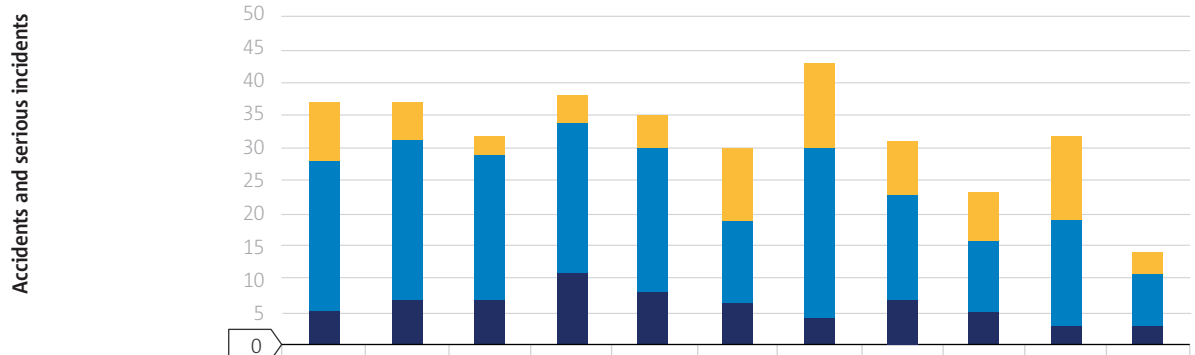
Table 8 Key statistics for specialised operations aeroplanes

2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
63	Fatal accidents	3	↓
196	Non-fatal accidents	8	↓
79	Serious incidents	3	↓

Table 9 Fatalities and serious injuries involving specialised operations aeroplanes

	FATALITIES	SERIOUS INJURIES
2011 - 2020 Total	120	64
2011 - 2020 Max	31	16
2011 - 2020 Min	4	1
2021	4	1

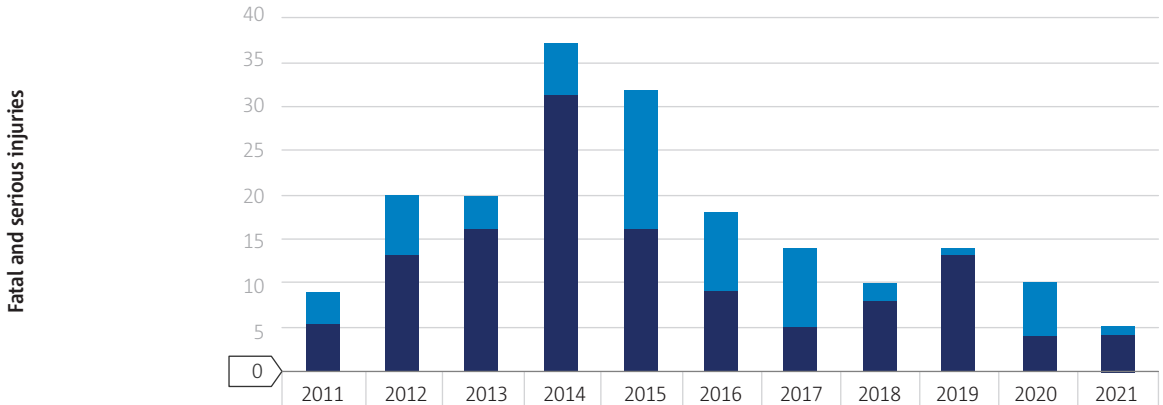
The number of accidents and serious incidents per year is shown in Figure 23. The numbers of fatal accidents and serious incidents in 2021 were equal to the minimum values of the preceding decade. The number of fatal accidents in 2021 was the same as in 2020, whereas the number of serious incidents in 2021 was the same as in 2013. The number of non-fatal accidents in 2021 was lower than all years in the preceding decade. As in all years of the preceding decade, the number of non-fatal accidents in 2021 is higher than the number of serious incidents and the number fatal accidents in 2021.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	9	6	3	4	5	11	13	8	7	13	3
Non-fatal accidents	23	24	22	23	22	13	26	16	11	16	8
Fatal accidents	5	7	7	11	8	6	4	7	5	3	3

Figure 23 Fatal accidents, non-fatal accidents and serious incidents per year involving specialised operations aeroplanes

The number of fatalities and serious injuries per year is shown in Figure 24. The numbers of fatalities and serious injuries in 2021 are equal to the lowest numbers of the preceding decade, most recently observed in 2020 for the number of fatalities and in 2019 for the number of serious injuries. The number of serious injuries in 2021 is low in relation to the number of non-fatal accidents. Six of the eight non-fatal accidents resulted in substantial damage to the aircraft with minor or no injuries. In the two other non-fatal accidents, the aircraft was destroyed, one accident resulting in one serious injury, the other in a minor injury.

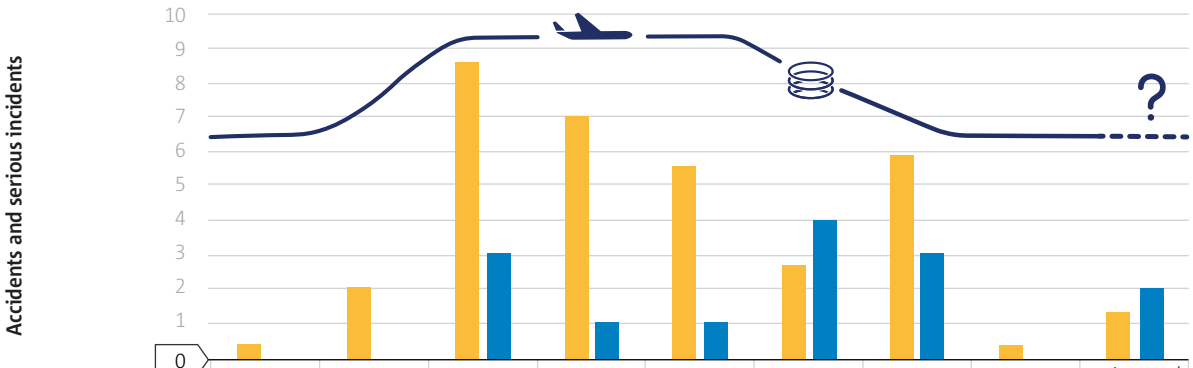


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	4	7	4	6	16	9	9	2	1	6	1
Fatalities	5	13	16	31	16	9	5	8	13	4	4

Figure 24 Fatal and serious injuries per year involving specialised operations aeroplanes

Phase of flight

Figure 25 shows the distribution of accidents and serious incidents by flight phase. The numbers of serious incidents and accidents in 2021 were lower than the average of the preceding decade for all flight phases except approach. In 2021, 10 out of the 14 accidents and serious incidents occurred at take-off, during approach or at landing.

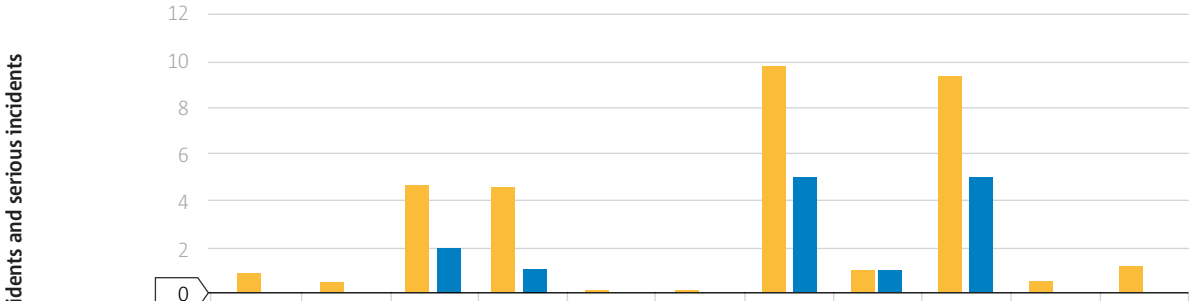


	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Tow	Unknown/ Blank
Average 2011-2020	0.4	2	8.6	7	5.6	2.7	5.9	0.3	1.3
2021	0	0	3	1	1	4	3	0	2

Figure 25 Accidents and serious incidents by phase of flight involving specialised operations aeroplanes

Operation type

Figure 26 shows the numbers of accidents and serious incidents by specialised operation. In 2021 the numbers of accidents and serious incidents were equal or lower than the average of the preceding decade for all operation types. In 2021, 10 out of the 14 accidents and serious incidents were in parachute drop and sailplane towing operations. There were only two accidents in agricultural operations and one accident in airshow/race in 2021. There were no accidents or serious incidents in aerial advertising, aerial observation, animal herding/mustering, or calibration operations.

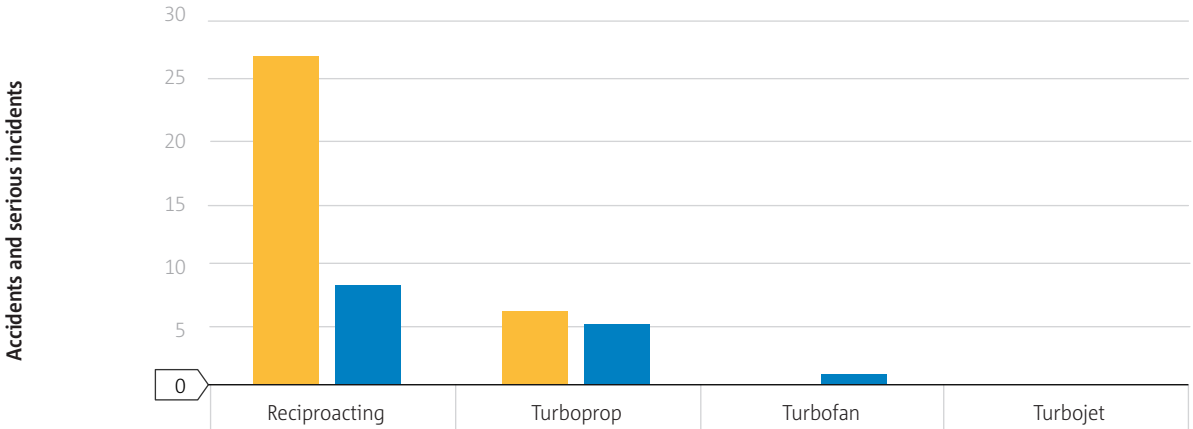


	Aerial advertising	Aerial observation	Agri-cultural	Air show/ race	Animal herding/ Mustering	Calibra-tion	Parachute drop	Photo-graphy	Towning	Other	Unknown/ blank
Average 2011-2020	0.9	0.5	4.7	4.6	0.1	0.1	9.8	1	9.3	0.5	1.1
2021	0	0	2	1	0	0	5	1	5	0	0

Figure 26 Accidents and serious incidents by specialised operation type involving aeroplanes

Propulsion type

Figure 27 shows the numbers of accidents and serious incidents by propulsion type. The number of accidents and serious incidents involving aircraft with reciprocating engines in 2021 was significantly lower than the average of the preceding decade. The number of accidents and serious incidents involving aircraft with turboprop engines was slightly lower in 2021 compared to the 2011-2020 average, whereas the number involving turbofan aircraft was slightly higher. There were no accidents or serious incidents involving turbojet engines in 2021.

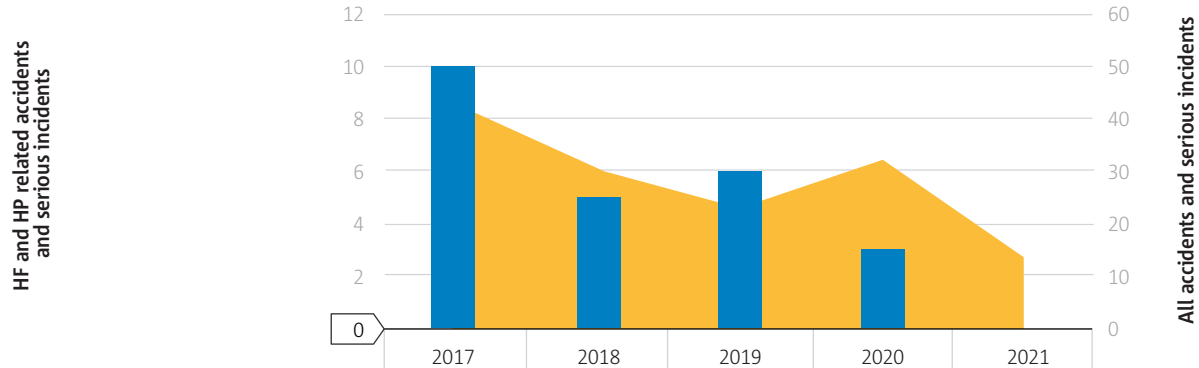


	Reciproacting	Turboprop	Turbofan	Turbojet
Average 2011-2020	27.1	6	0.2	0.2
2021	8	5	1	0

Figure 27 Accidents and serious incidents by propulsion type involving specialised operations aeroplanes

Human factors and human performance

The trend of approximately one sixth of specialised operations aeroplane accident and serious incident reports identifying human factors (HF) or human performance (HP) issues remains in this edition. These are labelled as personnel occurrences in the ECCAIRS taxonomy. Looking at the figures for the past five years, there is an apparent increase in 2019, followed by a dip in 2020, the year of the start of the pandemic. The figure for 2021 should be viewed as preliminary and is likely to increase, since HF or HP issues are often not recorded within accident and serious incident reports until the final report is published. Nevertheless, reduction in number of accidents and serious incidents in this domain in 2021 is proportionally reflected in the reduction of issues related to HF/HP.



	2017	2018	2019	2020	2021
Accidents and serious incidents	43	31	23	32	14
HF/HP accidents and serious incidents	10	5	6	3	0

Figure 28 Human factors and human performance accidents and serious incidents involving specialised operations aeroplanes

The application of HF or HP codes at a high level can be seen in Figure 29. As in the previous Annual Safety Review, situational awareness and task performance issues remain more easily discernible following an accident or serious incident than the factors that cause them, such as physiological or experience and knowledge events. This remains particularly true where investigations are not yet complete.

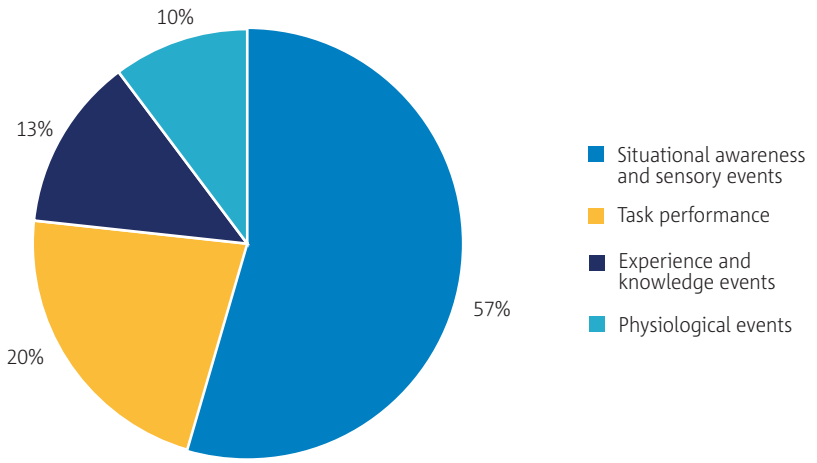


Figure 29 High level human factors and human performance event codes applied to accidents and serious incidents involving specialised operations aeroplanes

Figure 30 compares the numbers of accidents and serious incidents with the aggregated ERCS risk score of those incidents, using detailed HF and HP event codes. It can be seen that some events have a greater risk than others, as indicated where the aggregated risk score is far higher than the number of accidents and serious incidents. For example, accidents and serious incidents relating to attention and vigilance are more numerous but less risky than those relating to non-conformance and communication.

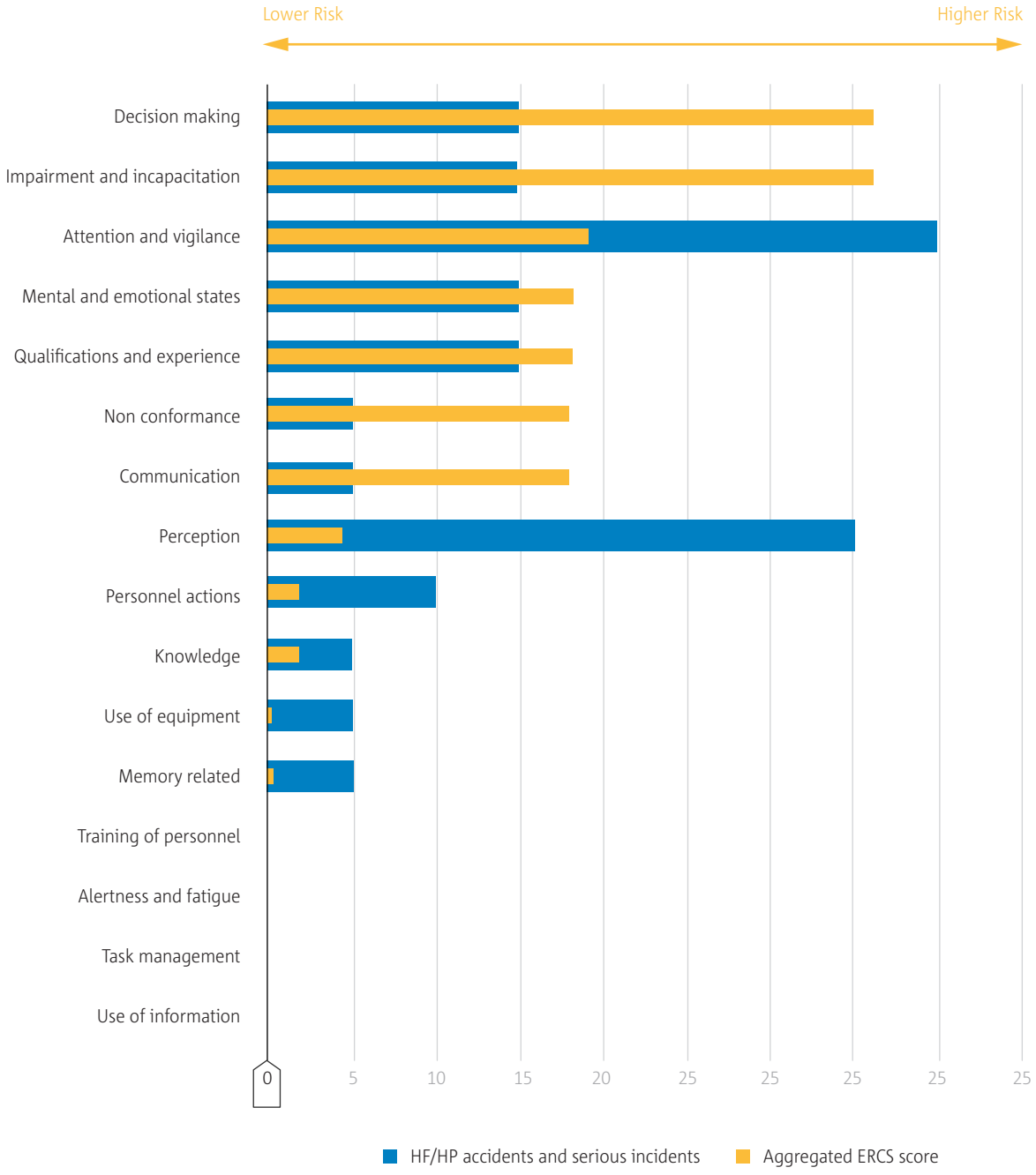
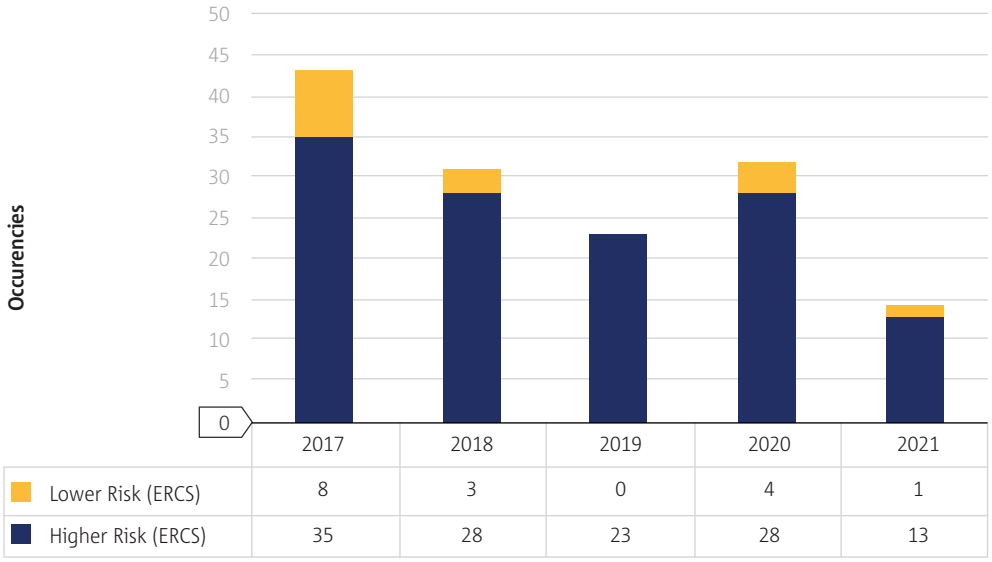


Figure 30 Detailed human factors and human performance event codes by aggregated ERCS score and numbers of accidents and serious incidents involving specialised operations aeroplanes

Safety risks for specialised operations aeroplanes

The safety risks for specialised operations aeroplanes have been identified by EASA. They are derived from occurrence data from the EASA occurrence repository and the European Central Repository (ECR).

EASA has reviewed the accidents, serious incidents and some incidents involving specialised operations aeroplanes for 2017-2021 with regards to risk. All occurrences within the scope have been risk assessed using the European Risk Classification Scheme (ERCS) methodology and have been given an ERCS score. The number of ERCS scored occurrences per year is shown in Figure 31.



	2017	2018	2019	2020	2021
Lower Risk (ERCS)	8	3	0	4	1
Higher Risk (ERCS)	35	28	23	28	13

Figure 31 ERCS higher and lower risk occurrences per year involving specialised operations aeroplanes

The key risk areas for specialised operations involving aeroplanes are shown in Figure 32. It can be observed that aircraft upset is the most likely type of accident which accidents and serious incidents have (resp. might have) escalated to. Aircraft upset also presents the highest risk in this domain. There have been approximately 35 occurrences where excursion is the key risk area, however aggregated ERCS risk score of these accidents and serious incidents is lower than, for example, the risk score of terrain collision or airborne collision.

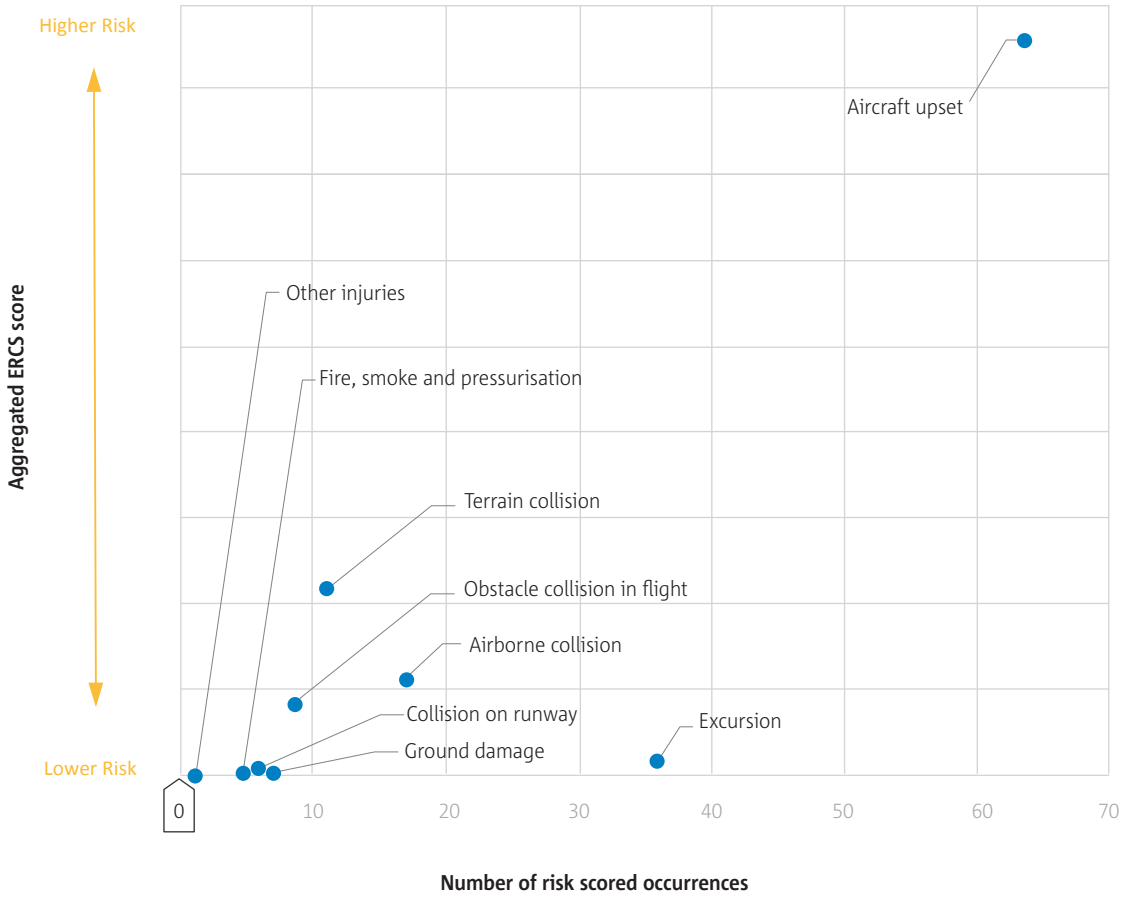


Figure 32 Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving specialised operations aeroplanes

Figure 33 shows a comparison between the number of occurrences per safety issue and their aggregated ERCS score. The number of occurrences provides an indication of how frequently the safety issue occurs, whereas the aggregated ERCS score provides an indication of the accumulated risk of the safety issue. The ERCS score is not used on its own because the finer granularity of the safety issue renders this indicator more vulnerable to the reactiveness of the data type used (only accidents and serious incidents).

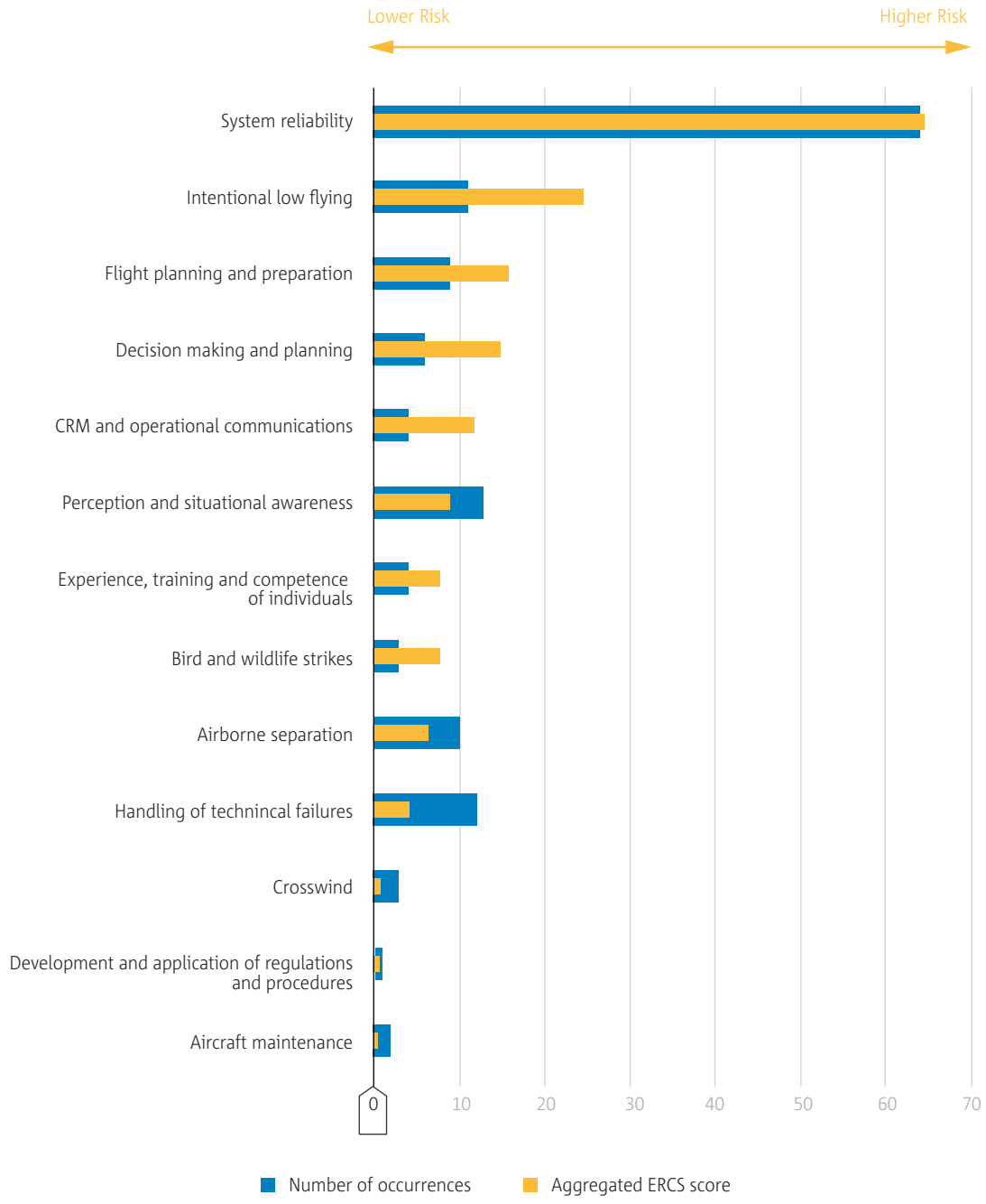


Figure 33 Safety Issues by aggregated ERCS score and number of occurrences involving specialised operations aeroplanes

The data portfolio is shown in Table 10 and lists the safety issues for the domain and cross-references these with the key risk areas, highlighting the most important key risk areas and safety issues. The key risk areas are sorted by the aggregated risk score. The safety issues are listed on the left of the table and are also sorted from the top by decreasing aggregated ERCS risk score. The different colour bands denote high to low risk of the safety issues.

Based on the occurrence data, limited to accidents and serious incidents, system reliability is the safety issue with the highest aggregated risk score. Besides system reliability, perception and situational awareness along with flight planning and preparation are the safety issues that affect the most key risk areas.

Table 10 Data portfolio for specialised operations aeroplanes

Safety issue	Key Risk Areas (ERCS)								
	Aircraft upset	Terrain collision	Airborne collision	Obstacle collision in flight	Excursion	Collision on runway	Fire, smoke and pressurisation	Ground damage	Other injuries
System reliability	x	x		o	x	o	x		
Intentional low flying	o	o		x				o	
Flight planning and preparation	o	o	o		o			o	
Decision making and planning	o	o	o						
CRM and operational communications	o	o	o						
Perception and situational awareness	o		o	o	x	x			o
Experience training and competence of individuals	o	o			o	o			
Bird and wildlife strikes	o	o							
Airborne separation			x						
Handling of technical failures	x				o				
Crosswind					o	o			
Development and application of regulations and procedures						o			
Aircraft maintenance	o						o		

x = higher number of associated occurrences
o = lower number of associated occurrences

2.5 Non-commercially operated small aeroplanes

The scope of this section covers non-commercial operations involving aeroplanes with a maximum take-off mass below 5 700 kg with an EASA Member State as the state of registry.

For the first time this chapter uses the European Central Repository database as its main source for the key statistics. However, the data portfolio and human factors and human performance figures use the EASA database, 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 10-year period (2011-2020) and the last year (2021). It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

Table 11 shows an increase of accidents and serious incidents in 2021. Fatal accidents increased by 5%, non-fatal accidents by 14% and serious incidents increased by 61% compared to the 10-year average. Accident rates for the past five years are available in Figure 36.

Table 11 Key statistics for non-commercially operated small aeroplanes

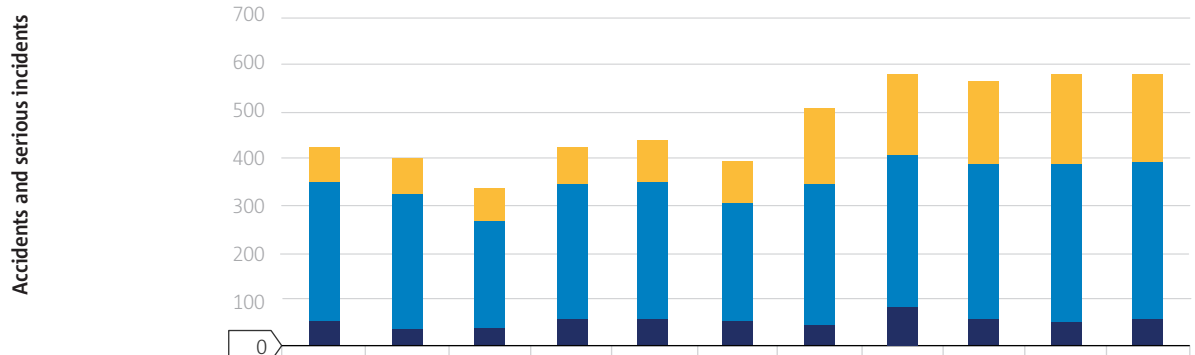
2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
552	Fatal accidents	58	↑
2937	Non-fatal accidents	335	↑
1154	Serious incidents	186	↑

Table 12 presents the numbers of fatalities and serious injuries last year compared to the 10-year period. The table shows a 21% increase in the number of fatalities in 2021 and there was a 12% increase in serious injuries compared to the 10-year average.

Table 12 Numbers of fatalities and serious injuries involving non-commercially operated small aeroplanes

	FATALITIES	SERIOUS INJURIES
2011 - 2020 total	872	410
2011 - 2020 max	110	47
2011 - 2020 min	68	31
2021	95	47

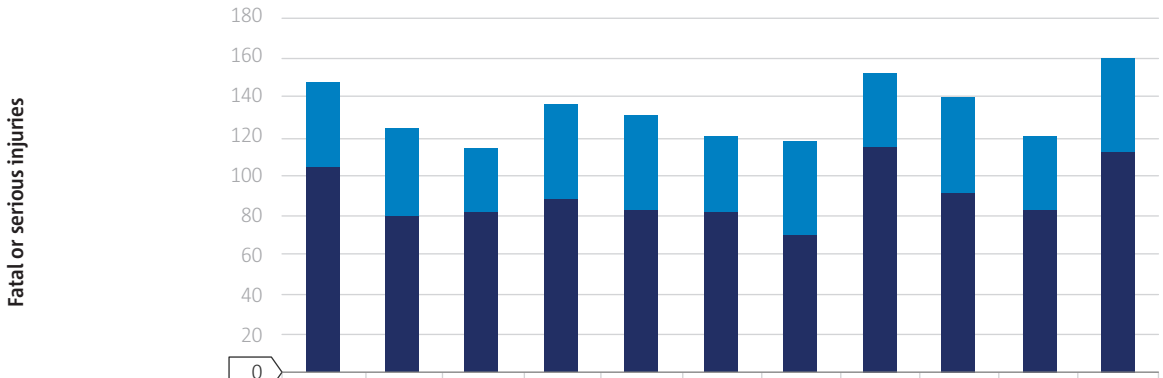
Figure 34 shows the numbers of fatal and non-fatal accidents and serious incidents per year. The figure shows no change over the past three years, with very similar figures for fatal accidents, non-fatal accidents and serious incidents. Given the fact that Regulation (EU) 376/2014 better established occurrence reporting, it is possible that serious incidents were under-reported in the period before the regulation entered into force in late 2015.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	71	71	68	78	87	85	164	169	174	187	186
Non-fatal accidents	297	288	226	287	295	251	299	328	330	336	335
Fatal accidents	55	40	41	59	58	57	45	82	59	56	58

Figure 34 Fatal accidents, non-fatal accidents and serious incidents per year involving non-commercially operated small aeroplanes

Figure 35 shows the total number of fatalities and serious injuries over time. The number of fatalities in 2021 was significantly higher compared to the 10-year average. The number of serious injuries was a bit higher compared to the 10-year average of the preceding decade.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	42	43	33	48	48	39	48	38	48	37	48
Fatalities	105	81	82	88	83	82	70	115	92	83	112

Figure 35 Fatal and serious injuries per year involving non-commercially operated small aeroplanes

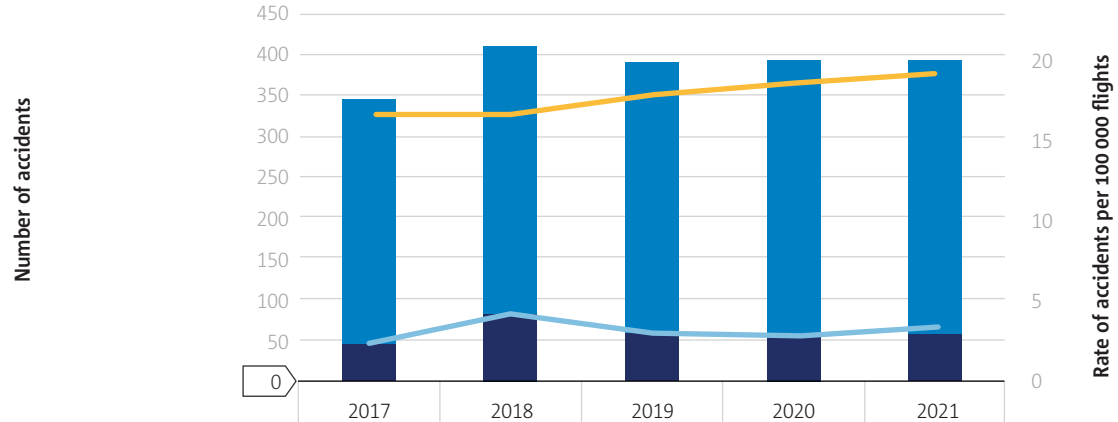
Rates of accidents

Five 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, including figures for 2021. The data received from GAMA and AOPA contain an estimated number of flight hours and number of flights on certified single engine, multi engine piston and single engine turboprop aircraft.

In the previously used exposure data, the fleet size was larger as differentiation was lacking between certified and non-certified aircraft. This year, non-certified aircraft (Annex I to Regulation (EU) 2018/1139) were removed from the exposure dataset, which in turn increases the rate compared to the previous publications.

It is important to note that these rates are not compatible with the published figures from the United States. The FAA's Part-91 involves a significantly broader fleet scope resulting in a lower accident rate. The data shown in Figure 36 focuses solely on certified aircraft within the EASA MS.

Figure 36 displays the number of fatal and non-fatal accidents for the past 5 years and the accident rates per 100 000 flights.



	2017	2018	2019	2020	2021
Non-fatal accidents	299	328	330	336	335
Fatal accidents	45	82	59	56	58
Fatal accident rate	2.5	4.1	3.2	3.1	3.3
Non-fatal accident rate	16.8	16.5	18.0	18.5	19.3

Figure 36 Numbers and rates of accidents involving non-commercially operated small aeroplanes

In the 2021 Annual Safety Review, there was an indication of a significant increase in the accident rates. This was because early data indicated a reduction in flights of 18%. However, the final data showed an approximate 10% decrease. Based on the GAMA/AOPA survey this year, both the numbers of flights and flight hours have slightly increased since 2020. The updated rates are reflected in Figure 36. The fatal accident rate is somewhat higher in 2021 however, the non-fatal accident rate in 2021 increased by 4%.

Figure 37 compares the number of accidents per month from 2019-2021. 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 increased accident rates result from fewer flights but with a slight increase in the number of accidents. Airborne conflicts increased in the period, due to increased traffic volume in a smaller time frame. 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 later in this chapter for further information.

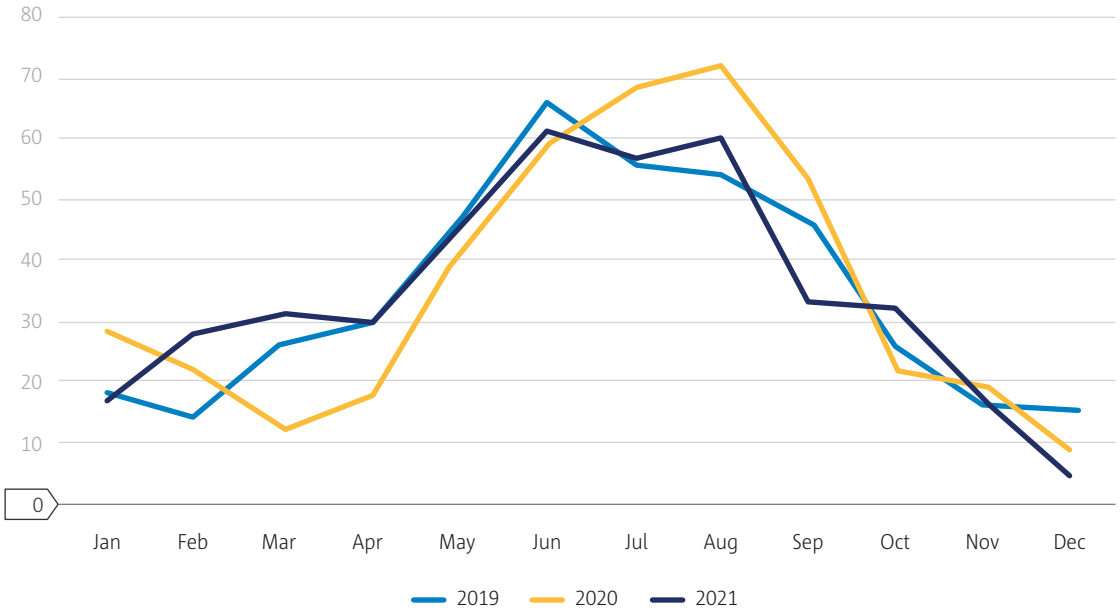
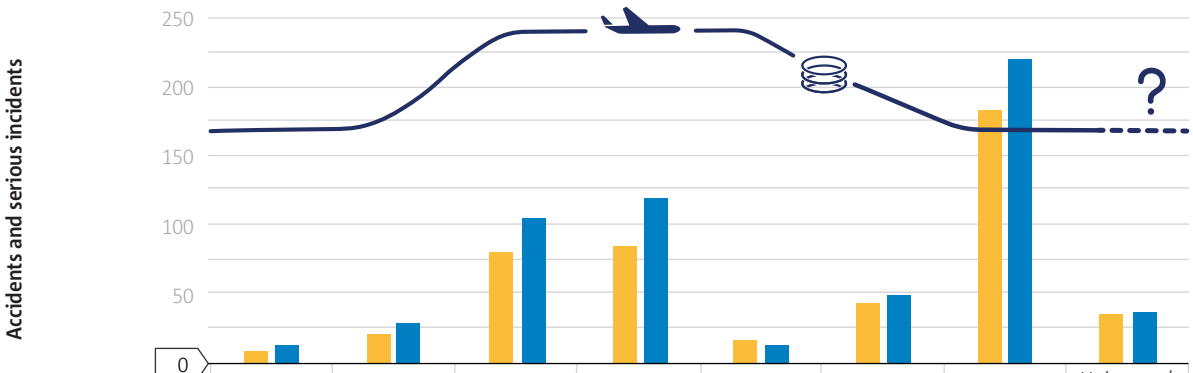


Figure 37 Comparison of number of accidents involving non-commercially operated small aeroplanes per month from 2019-2021

EASA encourages pilots to spend time on their flight preparation and mentally prepare themselves by visualising various problem 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.

Phase of flight

The accidents in general aviation most commonly occur in the landing phase. The year 2021 was no exception and there was a noticeable increase in most flight phases. A 20-40% increase is reflected in the flight phases of take-off, en route and landing. 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.

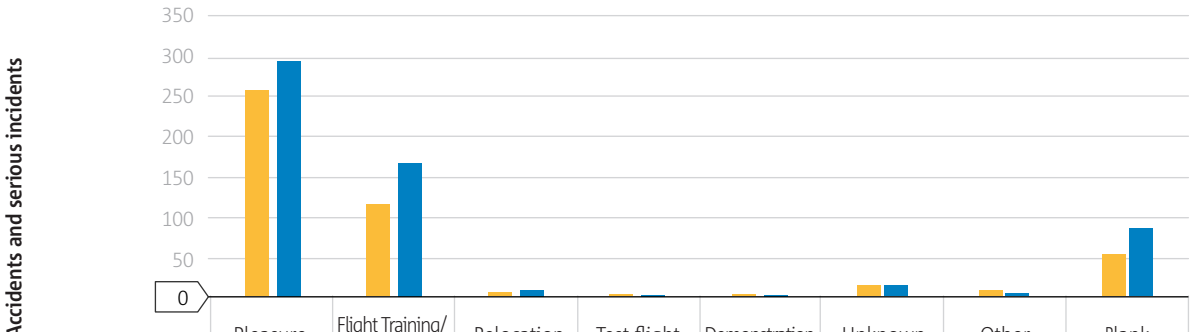


	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Unknown/ Blank
Average 2011-2020	9.0	20.9	80.6	84.9	16.1	42.7	182.6	34.5
2021	12	29	105	119	13	50	219	37

Figure 38 Accidents and serious incidents by phase of flight involving non-commercially operated small aeroplanes

Operation type

The two main operation types in NCO are pleasure/recreational flying and training flights. In Figure 39, it can be observed that there were almost twice as many accidents in pleasure flying as there were in flight training in 2021. This is proportionally comparable to the 10-year average however, there is a noticeable increase of flight training accidents in 2021.

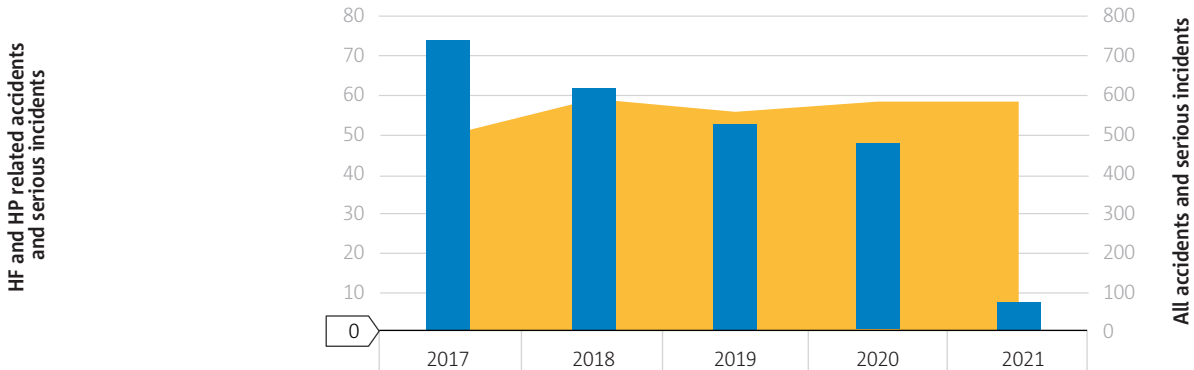


	Pleasure	Flight Training/ instructional	Relocation	Test flight	Demonstration	Unknown	Other	Blank
Average 2011-2020	256.9	117	6.6	5.6	1.5	18.6	9.2	54.8
2021	295	168	11	4	1	17	8	88

Figure 39 Accidents and serious incidents by operation type involving non-commercially operated small aeroplanes

Human factors and human performance

Approximately one quarter of non-commercially operated small aeroplane accident and serious incident reports identify human factors (HF) or human performance (HP) issues. These are labelled as personnel occurrences in the ECCAIRS taxonomy. The figures for 2017 – 2020 are relatively stable, showing a slight decrease in the number of HF/HP issues identified whereas, the figure for 2021 shows a significant drop. This is because HF and HP issues are often not recorded within accident and serious incident reports until the final report is published. In addition, there are often less data available to investigators owing to the lack of recording devices on board aircraft in this category.



	2017	2018	2019	2020	2021
Accidents and serious incidents	508	579	563	579	579
HF/HP accidents and serious incidents	74	62	53	48	8

Figure 40 Human factors and human performance accidents and serious incidents involving non-commercially operated small aeroplanes

The application of high-level HF or HP codes can be seen in Figure 41. Clearly, events relating to task performance and situational awareness are easier to diagnose following an accident or serious incident than the underlying factors relating to the performance success.

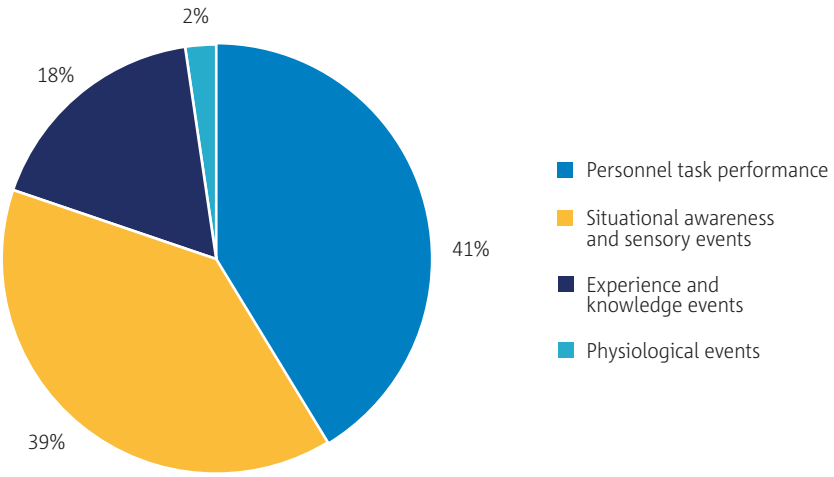


Figure 41 High level human factors and human performance event codes applied to accidents and serious incidents involving non-commercially operated small aeroplanes

Figure 42 compares the numbers of accidents and serious incidents with the aggregated ERCS risk score of those incidents, using detailed HF and HP event codes. Some events carry a greater risk than others, as indicated where the aggregated risk score is higher than the number of accidents and serious incidents.

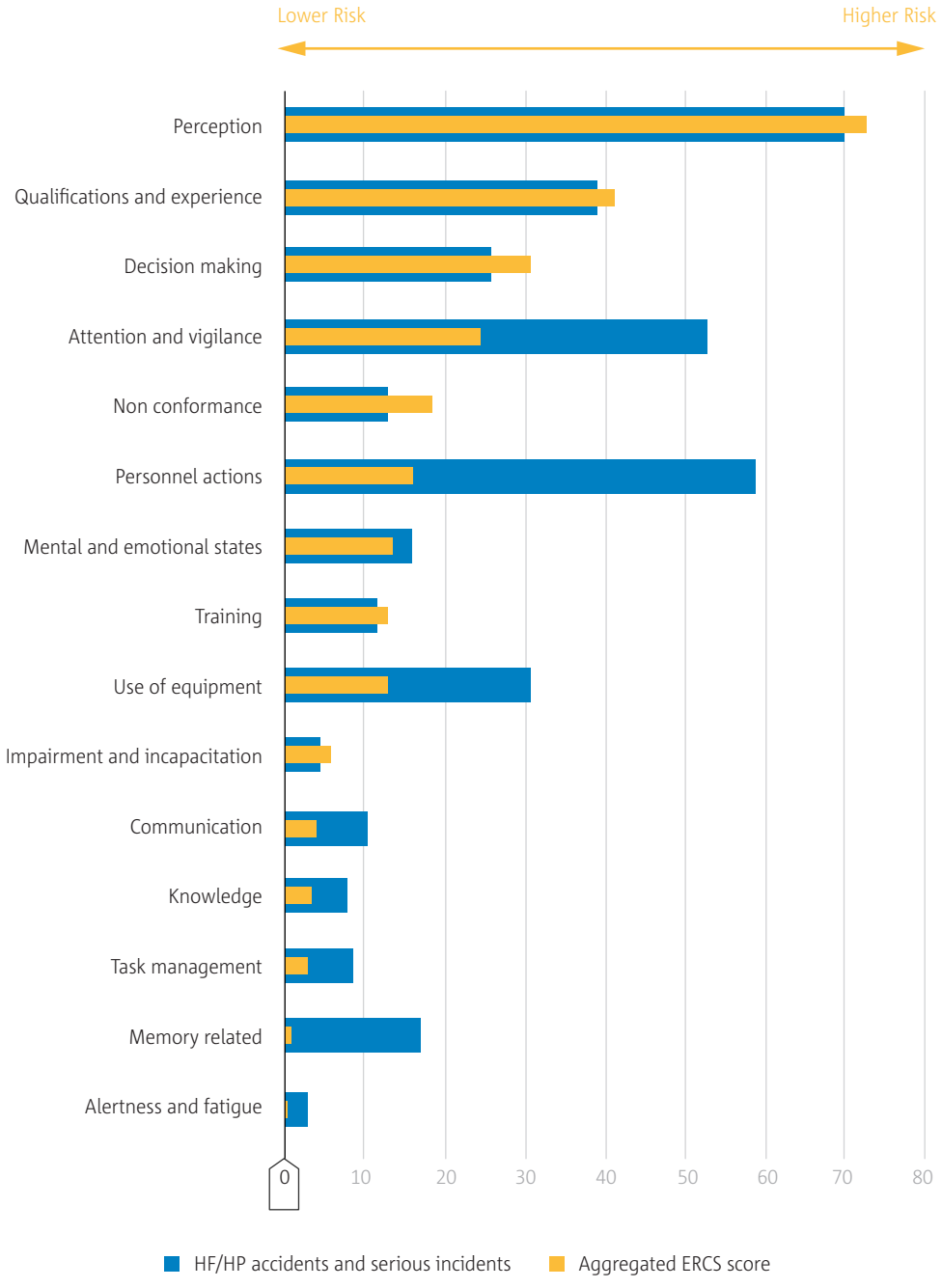


Figure 42 Detailed human factors and human performance event codes by aggregated ERCS score and numbers of accidents and serious incidents involving non-commercially operated small aeroplanes

Safety risks for non-commercially operated small aeroplanes

EASA has reviewed the accidents and serious incidents involving non-commercially operated small aeroplanes for 2017-2021 with regard to risk. They are derived from occurrence data from the EASA occurrence repository. All occurrences within the scope have been risk assessed using the European Risk Classification Scheme (ERCS) methodology and have been given an ERCS score.

Figure 43 shows the key risk areas (KRA) in relation to the number of accidents compared to the aggregated ERCS score. The KRA with the highest risk is aircraft upset. This KRA has 469 occurrences over the 5-year period 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.

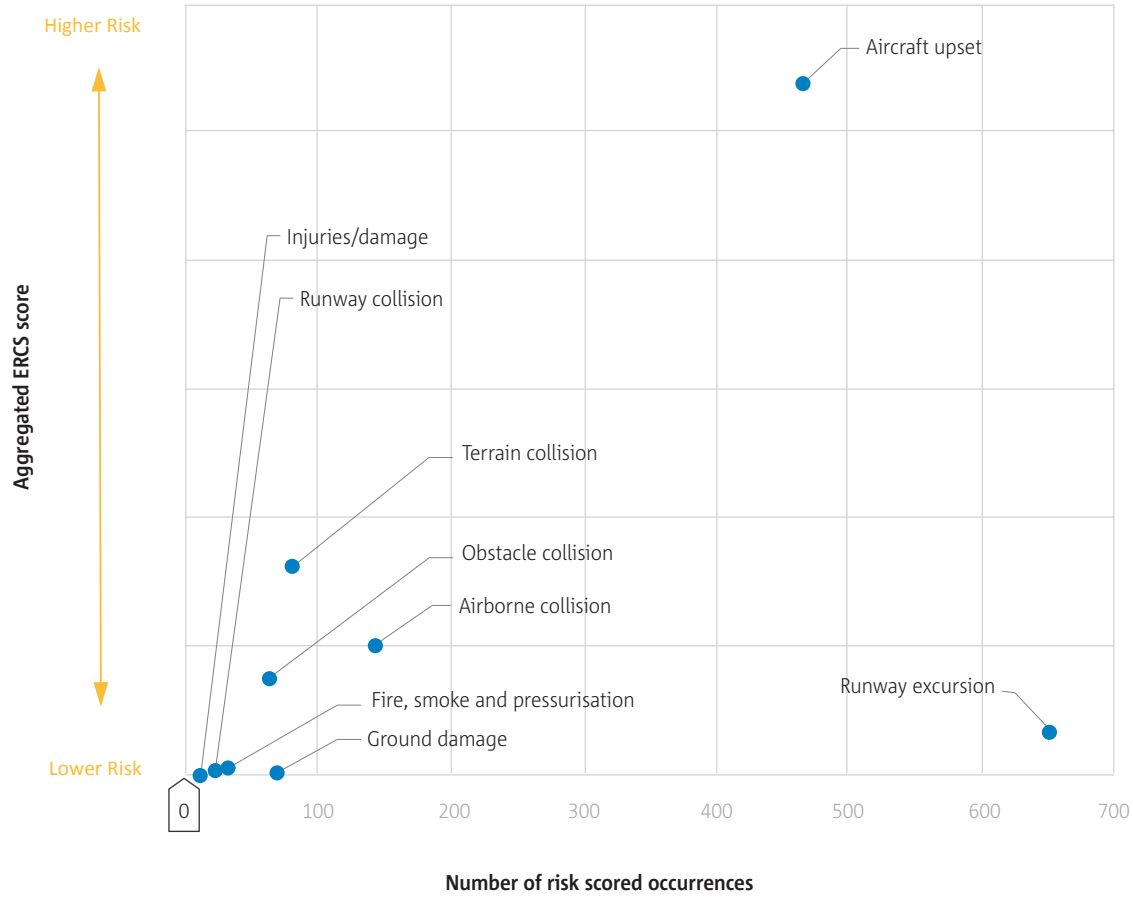


Figure 43 Key Risk Areas by aggregated ERCS score and number of risk-scored occurrences, involving non-commercially operated small aeroplanes

The safety issues identified in the non-commercially operated small aeroplane data portfolio are shown in Figure 44. The list of safety issues provides a more detailed understanding of the main safety risks. The figure shows both the number of occurrences that are identified under the safety issue, and the level of risk through the aggregated ERCS risk score. This provides a picture that displays the risk in relation to how often the safety issue is materialising.

The top issue in Figure 44 is pre-flight planning and preparation. The data behind the issue are 45 occurrences, but the risk is considered very high due to the many fatal accidents contributing to this list. Therefore, these occurrences receive the highest score based on the severity. To contrast this explanation, Figure 44 shows that the safety issue pre-flight planning and preparation is the highest in terms of risk but not the number of occurrences.

General aviation aircraft usually have good glide ratios, enabling pilots to find a suitable landing area after an engine or other system failure, depending on their pre-flight preparation and sufficient altitude at the time of the failure. This issue is strongly linked to the handling of technical failures safety issue and inflight decision making and planning issues. Many of the accidents under this issue result in serious injuries or fatal accidents. A high-risk score is therefore evident. These three HF/HP issues highlight the importance of planning each flight carefully and of anticipating and visualising various scenarios in the planning. Such scenario planning helps pilots to react correctly to the safety critical situation and perhaps avoid a serious outcome – specifically loss of control situations. This is supported in Figure 43, which shows aircraft upset bearing the highest risk. Other safety issues that also play a part in aircraft upset are experience, training, and competence of individuals, inadvertent flight into IMC/marginal flying (colloquially called scud flying), approach path management on GA aircraft, and inappropriate control input. The first eleven safety issues show a decreasing risk but the gap between attributed risk and number of occurrences is quite large.

In last year's edition, consideration was given to splitting the system reliability issue, which has been used in the portfolio for some time, between engine issues and all other equipment failures for better clarity. Another aspect of the system reliability issue requiring this change relates to equipment failures, as many involve runway excursions due to hard landings and result in damage to landing gear, wings, and engines/ propellers. Landing gear may break during hard landings but, it is not easy to determine if the gear were been exposed to loads outside the certified specifications or other factors including previous landings.

The second issue in Figure 44, airborne conflict, concerns both actual collisions and near misses. Due to the nature of the issue, it often bears a high risk and is therefore high on the list. Another issue that was added to the portfolio last year is parachute operations. In recent years, accidents have occurred causing multiple fatalities. The operation of the aircraft for parachute dropping is somewhat different from normal flying. Parachute operations are conducted both under special operation (SPO) rules and non-commercial operation (NCO) rules. In this review all the parachute operation accidents are concatenated into one issue, irrelevant of the operation type. Most of them, however, occurred under NCO. The aircraft used in this type of operation is flown, usually fully loaded with skydivers, to the desired height over the jump area, then after the skydivers jump out the engine is idled and the aircraft lands shortly afterwards to pick up more jumpers. This introduces a different load and stress to the aircraft engine components than that of non-parachute operations. This seems to be specifically evident in aircraft with a reciprocating engine. It is worth noting that in the latest fatal accidents in parachuting operations the root cause was weight and balance.

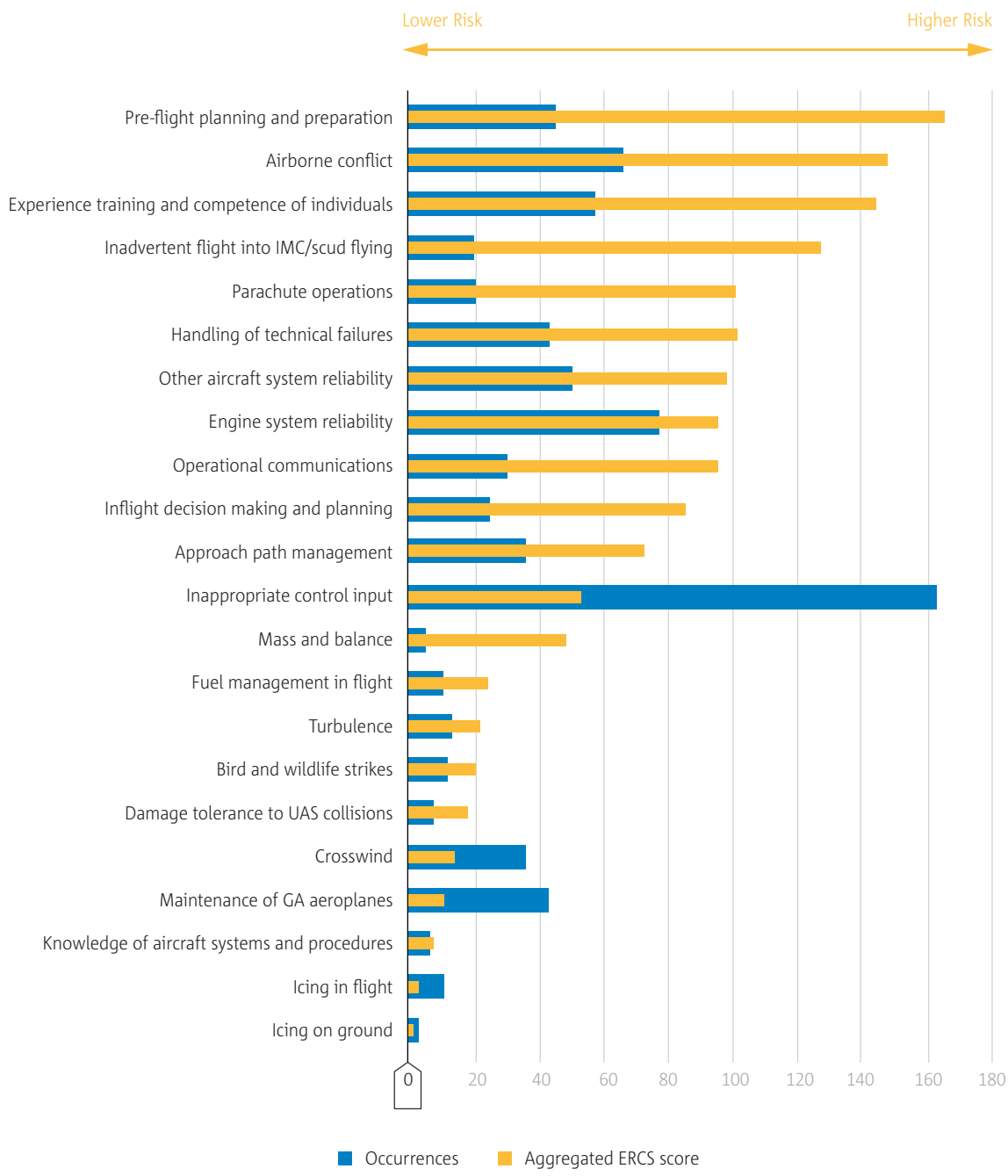


Figure 44 Safety Issues by aggregated ERCS score and numbers of accidents and serious incidents involving non-commercially operated small aeroplanes

The data presented in Figure 44 has been used to formulate the data portfolio presented in Table 13 and lists the safety issues for the domain cross-referenced with the key risk areas, which highlights the most important key risk areas and safety issues. The key risk areas are sorted from left to right by the decreasing aggregated risk score. The safety issues are listed on the left of the table and are also sorted from the top by their decreasing aggregated ERCS risk scores. The different colour bands denote the high to low risk of the safety issues. However, as many of the occurrences in 2019 are still being investigated, the conclusions and safety priorities may change as the data is further matured.

Table 13 Data portfolio for non-commercially operated small aeroplanes

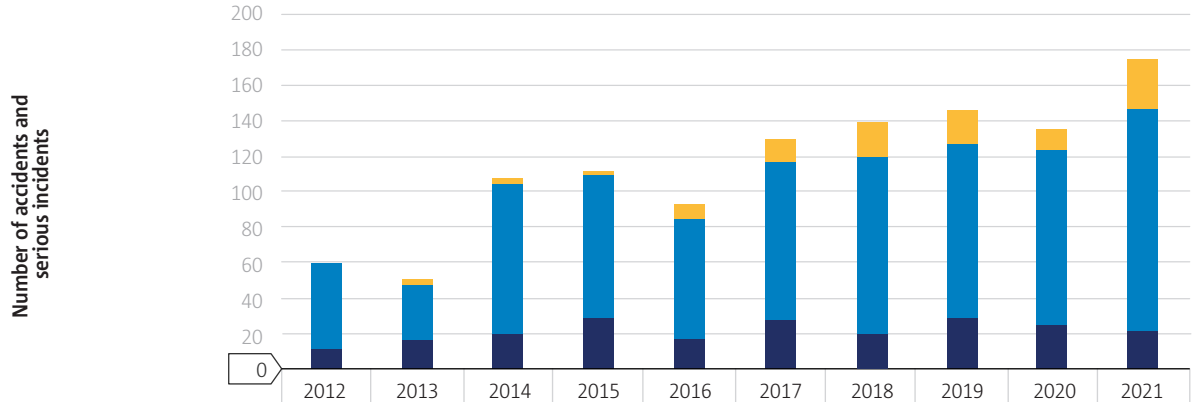
Safety issue	Key Risk Areas (ERCS)								
	Aircraft upset	Terrain collision	Airborne collision	Obstacle collision in flight	Runway excursion	Collision on runway	Ground damage	Fire, smoke, pressurisation	Other injuries
Pre-flight planning and preparation	x	o	o	o	o	o	o		
Airborne conflict			x						
Experience, training and competence of individuals	x	o	o	o	x	o	o	o	
Inadvertent flight into IMC/Scud flying	o	o		o	o	o			
Parachute operations	x	o		o	o				o
Handling of technical failure	x	o		o	x	o	o		
Other aircraft system reliability	x	o	o	o	x	o	o		
Engine system reliability	x	o			o			o	
Operational communications	o	o	x	o	o	o		o	
Inflight decision making and planning	o	o	o	o	x	o			
Approach path management on GA aeroplanes	o	o		o	x				o
Inappropriate control input	x	o		o	x	o	o	o	o
Mass and balance	o			o					
Fuel management in flight	o	o		o					
Turbulence	o			o	o		o		
Bird and wildlife strikes	o			o	o				
Damage tolerance to UAS collisions	o		o						
Crosswind	o	o			x	o			
Maintenance of GA aeroplanes	x				x			o	
Knowledge of aircraft systems and procedures	o		o	o	o			o	
Icing in flight	o						o		
Icing on ground	o								

x = higher number of associated occurrences
o = lower number of associated occurrences

Microlights

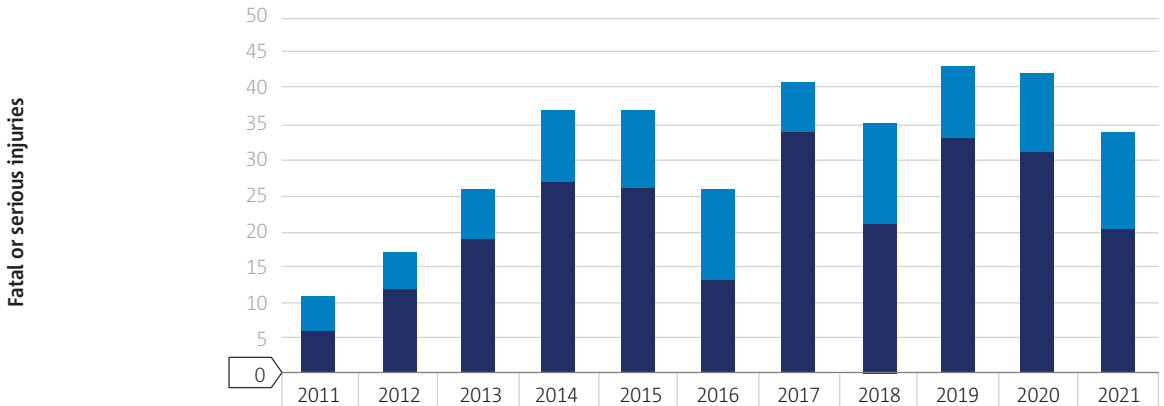
The diversity of general aviation exceeds EASA´s regulatory remit. However, most accidents involving EASA Member State registered microlights and ultralights also occur in Europe, with some accidents also occurring outside Europe. Figure 45 shows accidents and serious incidents from 2011 to 2021 that have been reported into the ECR. This data is probably not exhaustive and could change over time. The data for the first two years should be considered as partial data as ultralights do not specifically fall under EASA's remit. 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 46 provides an overview of the reported fatalities and injuries during the same period. Overall, the number of accidents, serious injuries and fatalities has increased. The number of fatalities and serious injuries shown in Figure 46 largely coincides with the data on accidents and serious incidents shown in Figure 45. However, in 2021 the numbers of fatalities and serious injuries were reduced in comparison with 2020, despite an increase in non-fatal accidents.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	0	2	3	2	8	12	20	18	12	28
Non-fatal accidents	49	33	86	82	69	91	101	99	100	127
Fatal accidents	10	15	19	28	16	27	19	29	24	21

Figure 45 Numbers of fatal accidents, non-fatal accidents and serious incidents per year involving non-commercially operated microlights



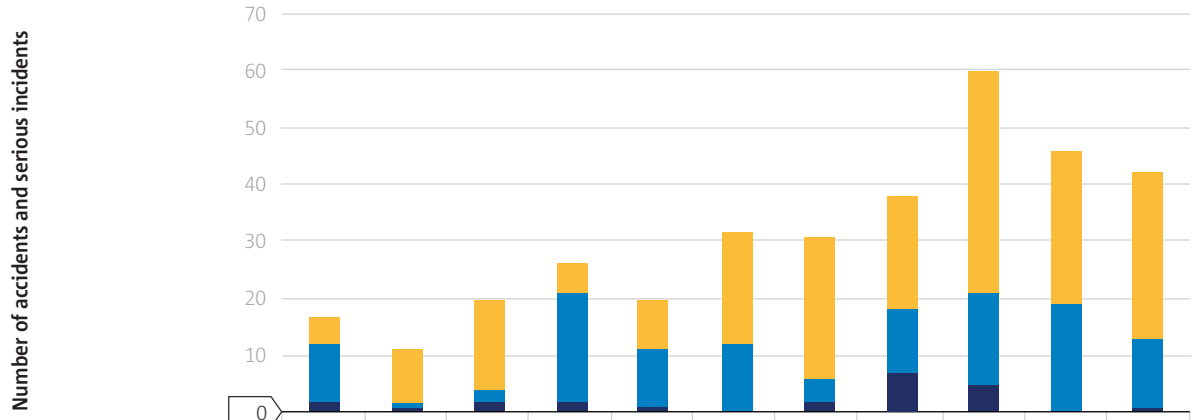
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	5	5	7	10	11	13	7	14	10	11	14
Fatalities	6	12	19	27	26	13	34	21	33	31	20

Figure 46 Numbers of fatal and serious injuries per year involving non-commercially operated microlights

Aircraft registered outside the EASA Member States

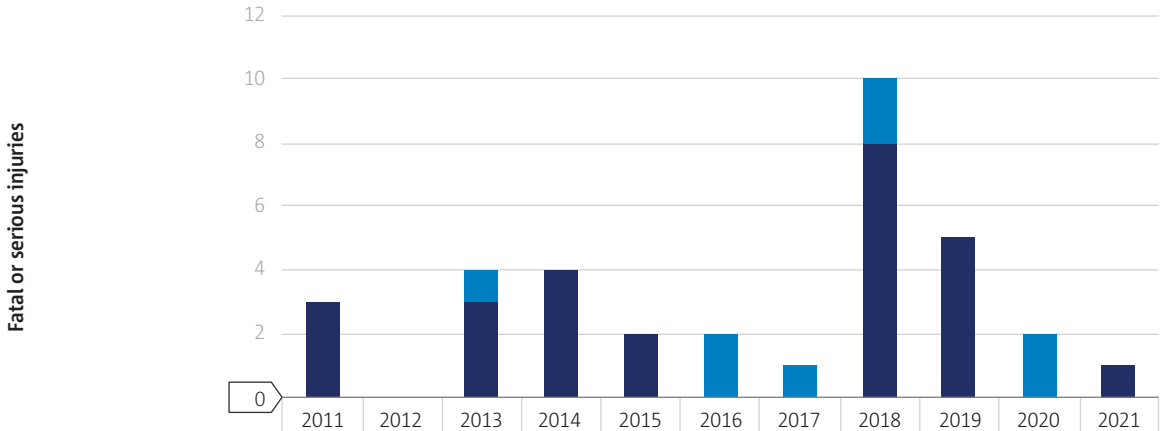
Aircraft registered outside the EASA Member States but operated inside the union, also fall outside of EASA's remit. Most of these aircraft are registered in the United States of America (N-registered aircraft), and now also in the United Kingdom (G-registered aircraft). To provide an overview of this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

Figure 47 shows 116 non-fatal and 23 fatal accidents from 2011-2021. Figure 48 shows that these accidents resulted in 26 fatalities and 8 serious injuries over the period.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	5	9	16	5	9	20	25	20	39	27	29
Non-fatal accidents	10	1	2	19	10	12	4	11	16	19	12
Fatal accidents	2	1	2	2	1	0	2	7	5	0	1

Figure 47 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.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	0	0	1	0	0	2	1	2	0	2	0
Fatalities	3	0	3	4	2	0	0	8	5	0	1

Figure 48 Fatal and serious injuries per year involving non-commercially operated aircraft not registered in the EASA MS

Figure 49 shows that over the 2011-2021 period that 51 N-registered aeroplanes, 33 G-registered aircraft, 9 non-EASA Member State registered aircraft and 22 aircraft of unknown registration were involved in fatal and non-fatal accidents in EU/EEA MS.

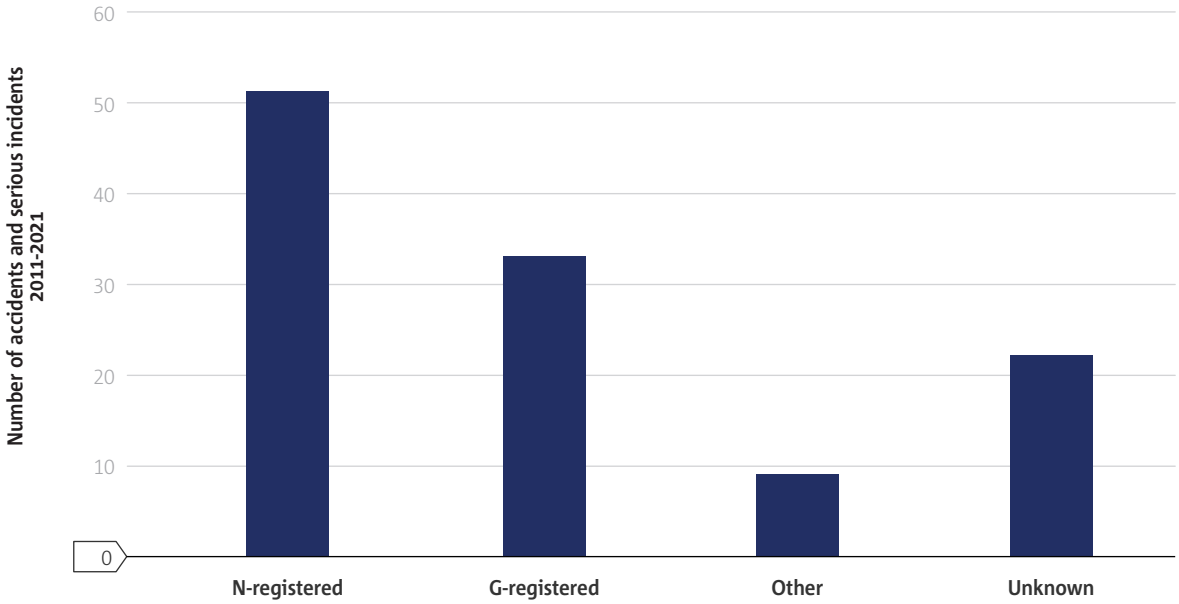


Figure 49 Fatal and non-fatal accidents on non-commercially operated aircraft not registered in the EASA MS and occurring within the EASA MS.

Chapter 3
Helicopters

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

1. **All helicopter operations** providing aggregated statistics on EASA certified or validated helicopters performing commercial air transport, specialised operations or non-commercial operations, and for which an EASA MS is either state of operator, state of registry or state of occurrence;
2. **Commercial air transport flights** conducted by EASA Air Operators Certificate (EASA AOC) holders and using certified helicopters. This section brings together commercial air transport helicopter operations for both onshore flights and includes HEMS, air taxi or sightseeing, and those flights to offshore oil, gas and renewable energy installations;
3. **Specialised operations** involving certified helicopters, such as sling load, advertisement, and photography with an EASA MS as state of operator or state of registry;
4. **Non-commercial operations** involving certified helicopters, with an EASA MS as the state of operator or state of registry. This section includes in particular training flights.

As a consequence of the UK's departure from the EASA system, in order that the data of 2021 can be compared to the preceding ten years on an equal basis, occurrence data originating from the UK is no longer included in the Annual Safety Review.

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.

For each section, the key statistics are presented. The sections 2, 3 and 4 also contain an individual data portfolio, which provides an overview of the main safety risks for these types of operations at the European level, based on occurrence data.

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

3.1 All helicopter operations

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

Key statistics

The key statistics for this domain are in Table 14 and Table 15. Included is a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the 10-year period (2011-2020) and the last year (2021). It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe. The number of fatal accidents in 2021 has been similar to the average of the preceding decade, whereas the number of non-fatal accidents has been significantly lower and the number of serious incidents higher than the 10-year average. The numbers of fatalities in 2021 was lower than the preceding decade average, and the number of serious injuries in 2021 was similar to this average.

Table 14 Key statistics for all helicopter operations

2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
91	Fatal accidents	8	↓
400	Non-fatal accidents	24	↓
132	Serious incidents	16	↑

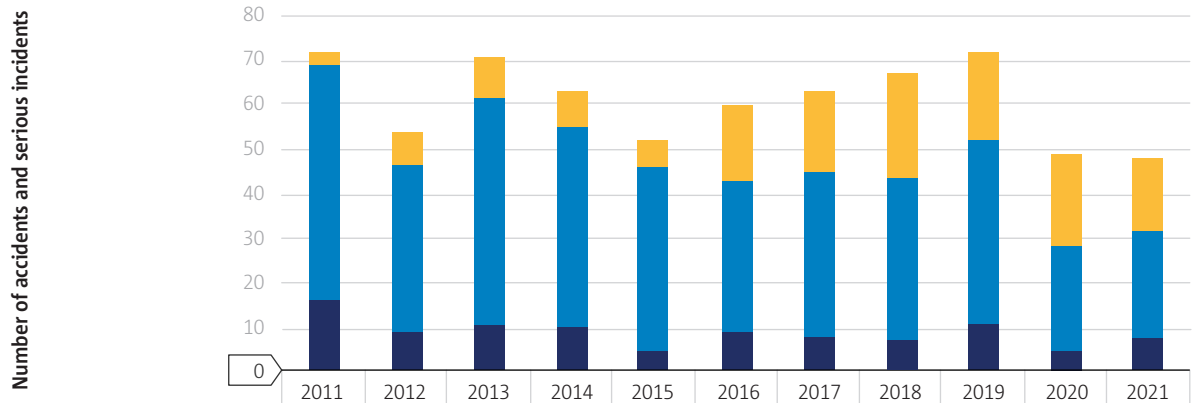
Table 15 Fatalities and serious injuries involving all helicopter operations

	FATALITIES	SERIOUS INJURIES
2011 - 2020 total	224	120
2011 - 2020 max.	31	21
2011 - 2020 min.	10	6
2021	13	11

The numbers of accidents and serious incidents per year are shown in Figure 50. The total number of accidents and serious incidents in 2021 was similar to 2020 and remains significantly below the figures observed prior to the COVID-19 pandemic. However, the number of fatal accidents in 2021 has increased compared to 2020.

Since these figures are not normalised with traffic data, the number of occurrences should be interpreted cautiously especially for 2020 and 2021, as the exact variation of helicopter flying activity at European level over the past two years is difficult to evaluate. The Agency is currently taking action to address the recurrent challenge of evaluating the level of helicopter flying activity in Europe within a specific stream of the rotorcraft safety roadmap.

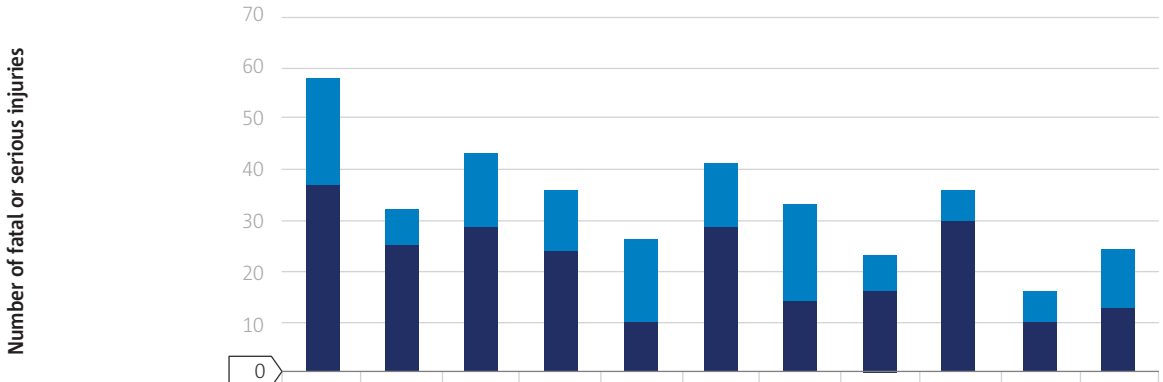
It should also be highlighted that any tangible trend should be based on a multi-year observation. It is therefore prudent to see if the figures in the coming years will confirm or refute any significant decreasing trend in the number of helicopter accidents and serious incidents.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	3	7	9	8	6	17	18	23	20	21	16
Non-fatal accidents	53	38	51	45	41	34	37	37	41	23	24
Fatal accidents	16	9	11	10	5	9	8	7	11	5	8

Figure 50 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 51. Whereas the figures in 2020 were the lowest observed since 2011, the number of fatalities and serious injuries in 2021 have increased compared to the year before. Over the period considered, the overall trend is still decreasing.

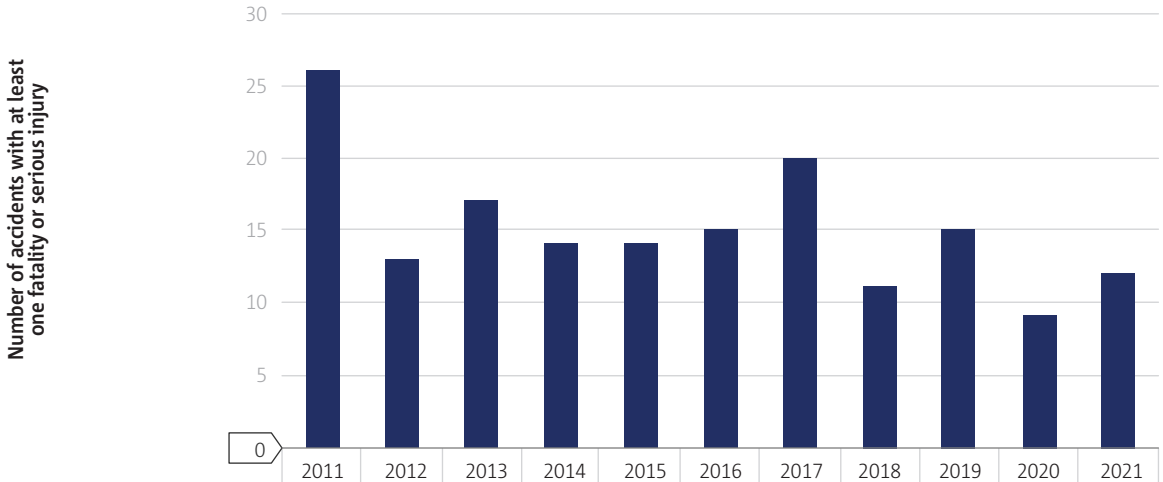


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	21	7	14	12	16	12	19	7	6	6	11
Fatalities	37	25	29	24	10	29	14	16	30	10	13

Figure 51 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 safety performance indicator used to monitor the effectiveness of the EASA rotorcraft safety roadmap which was launched in 2018. This indicator is shown in Figure 52. The 2021 figure is the third lowest observed since 2011 but has increased compared to 2020.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Roadmap SPI	26	13	17	14	14	15	20	11	15	9	12

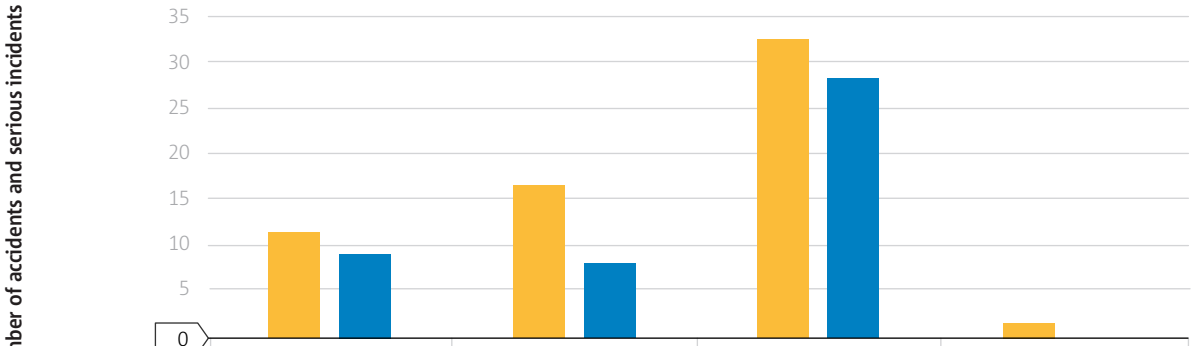
Figure 52 Number of accidents with a least one fatality or serious injury for all helicopter operations

Helicopter operations sub-domains

Figure 53 shows the numbers of accidents and serious incidents for the 4 main sub-domains of operations involving certified helicopters. Over the decade 2011-2020, the proportions of each domain are the following:

- 52% of all accidents and serious incidents involved certified helicopters performing non-commercial operations and for which an EASA MS was either the state of operator or state of registry
- 27% of all accidents and serious incidents involved certified helicopters performing specialised operations and for which an EASA MS was either the state of operator or state of registry
- 18% of all accidents and serious incidents involved certified helicopters performing commercial air transport conducted by EASA MS Air Operators Certificate (EASA AOC) holders
- 3% 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.

In 2021, similarly to 2020, the figures were lower in absolute numbers than the average of the preceding decade for all sub-domains. The decrease in 2021 is more pronounced for specialised operations than for commercial air transport and for non-commercial operations. These 3 sub-domains are further analysed in the following sections of this chapter. There was no accident or serious incident occurring in an EASA MS involving a certified helicopter registered in a foreign country in 2021.

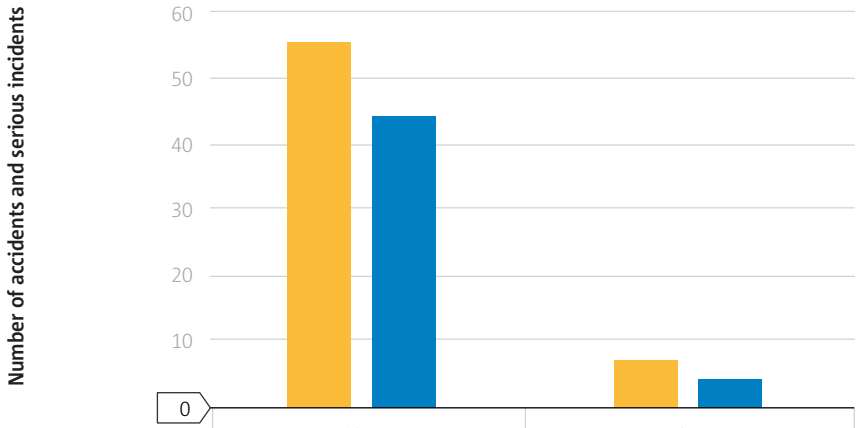


	CAT-EASA MS AoC holder	SPO-EASA MS operated or registered	Non commercial - EASA MS operated or registered	Third country registered
Average 2011-2020	11.3	16.5	32.4	1.6
2021	9	8	28	0

Figure 53 Accidents and serious incidents by helicopter operation sub-domains

Type of certified helicopter (CS27/CS29)

Figure 54 shows the numbers of accidents and serious incidents per type of certified product (CS27 or CS29). Over the decade 2011-2020, 89% of accidents and serious incidents involved CS27 helicopters and 11% of accidents and serious incidents involved CS29 helicopters. In 2021, the proportions remain similar to the average of the preceding decade.

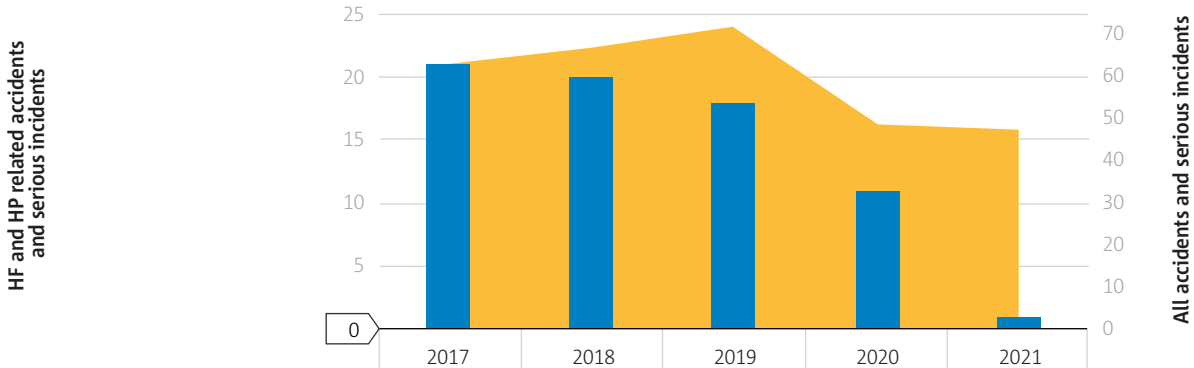


	CS27	CS29
Average 2011-2020	55.3	7
2021	44	4

Figure 54 Accidents and serious incidents by certification specification for all helicopter operations

Human Factors and Human Performance

Human factors (HF) or human performance (HP) issues, labelled as personnel occurrences in the ECCAIRS taxonomy, can be identified in over a quarter of accidents and serious incident reports involving helicopters. Looking at the figures for the past five years 2019 shows slight increase in accidents and serious incidents while the ones attributed to HF/HP appear to be less. Many of these issues are identified following more detailed investigations – meaning that the figures for 2021 are likely to increase once final investigation reports are published.



	2017	2018	2019	2020	2021
Accidents and serious incidents	63	67	72	49	48
HF/HP accidents and serious incidents	21	20	18	11	1

Figure 55 Human factors and human performance accidents and serious incidents involving all helicopter operations

The application of HF or HP codes at a high level can be seen in Figure 56. Issues relating to situational awareness and sensory events and to task performance events, persist in being more commonly recognised, experienced, and reported following an accident or serious incident than the factors that cause them.

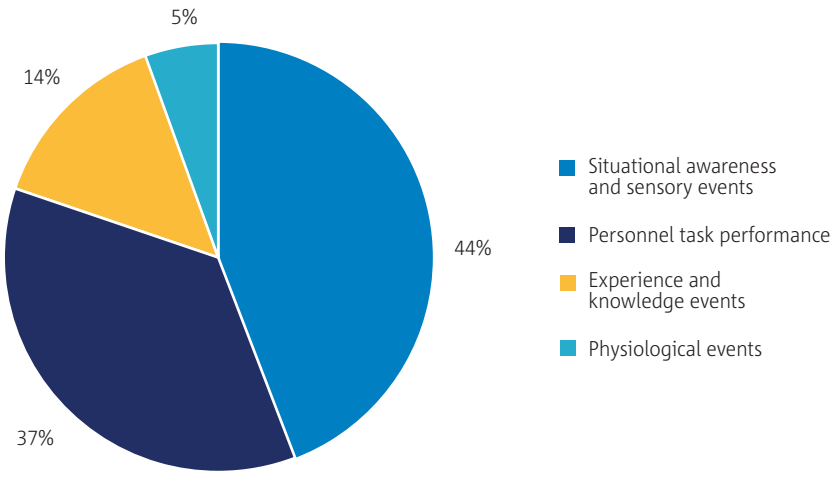


Figure 56 High level human factors and human performance event codes applied to accidents and serious incidents involving all helicopter operations

Figure 57 compares the number of accidents and serious incidents with the aggregated ERCS risk score of those occurrences, using detailed HF and HP event codes. It can be seen that some types of events have a greater risk than others, as indicated where the aggregated risk score is far higher than the number of accidents and serious incidents. Some occurrence types generate a higher risk per occurrence than others, as can be seen by comparing the risk scores and numbers of occurrences of issues such as decision making and attention and vigilance.

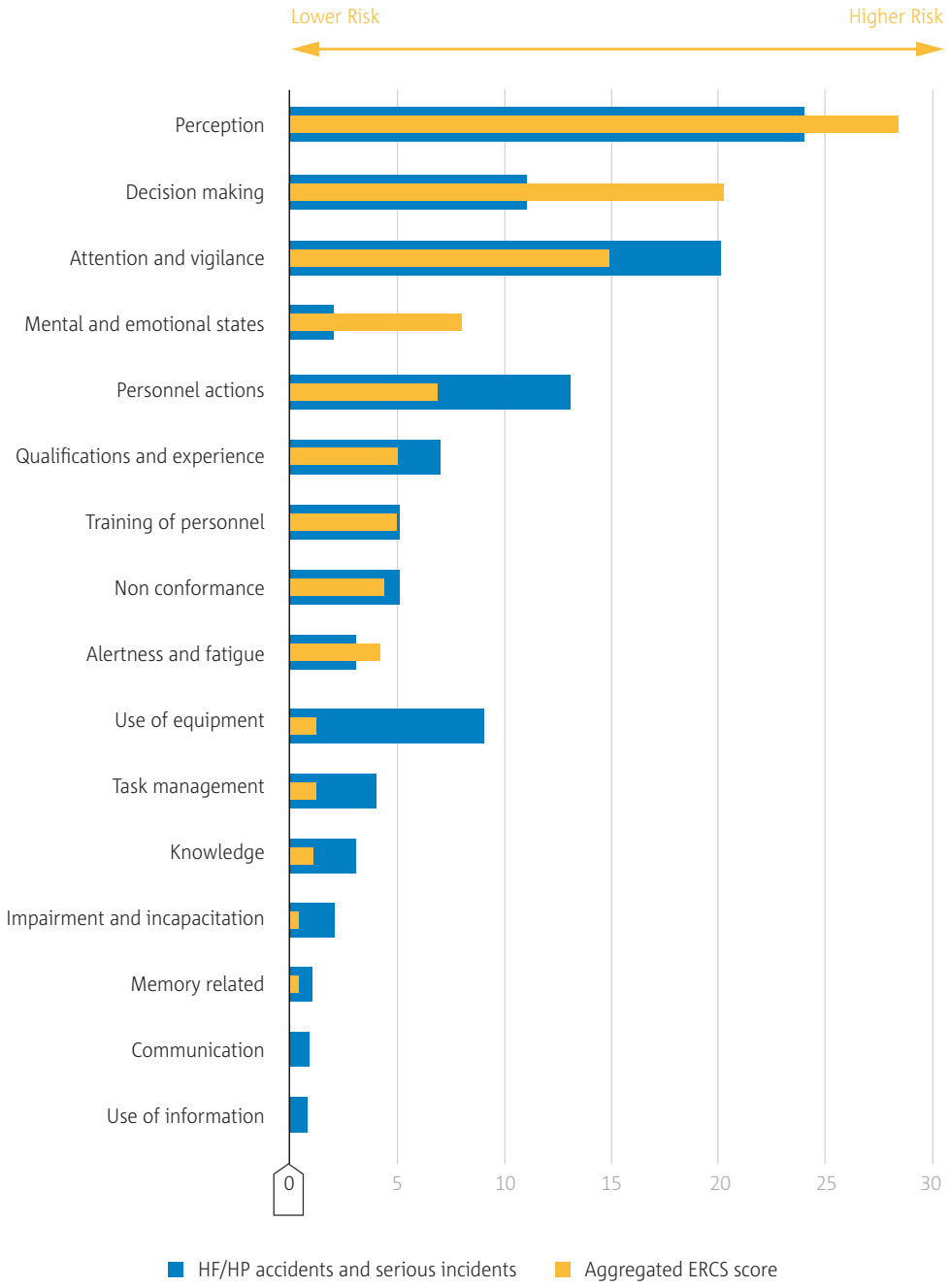


Figure 57 Detailed human factors and human performance event codes by aggregated ERCS score and number of accidents and serious incidents involving all helicopter operations

3.2 Commercial air transport helicopters

The scope of this section covers the key safety statistics for EASA certified or validated helicopters performing commercial air transport and operated by an EASA Member State AOC holder.

European CAT helicopter fleet

Figure 58 and Figure 59 show the size of the helicopter commercial air transport sector in the EASA Member States and its evolution over the period 2016-2021. Similar to the figures on accidents and serious incidents in this report, the change applied from this year on in relation to the scope (AOC holders from United Kingdom are no longer included in the statistics) make the following statistics not directly comparable to those of the annual safety review published last year.

After a small but steady decrease from 2017 to 2020, the number of helicopter AOC holders had a small increase in 2021 compared to the preceding year. A small increase was also observed in the number of helicopters performing commercial air transport. The average number of helicopters per AOC holders in 2021 was between 8 and 9.

Figure 58 Number of helicopter air operator certificate (AOC) holders in the EASA Member States

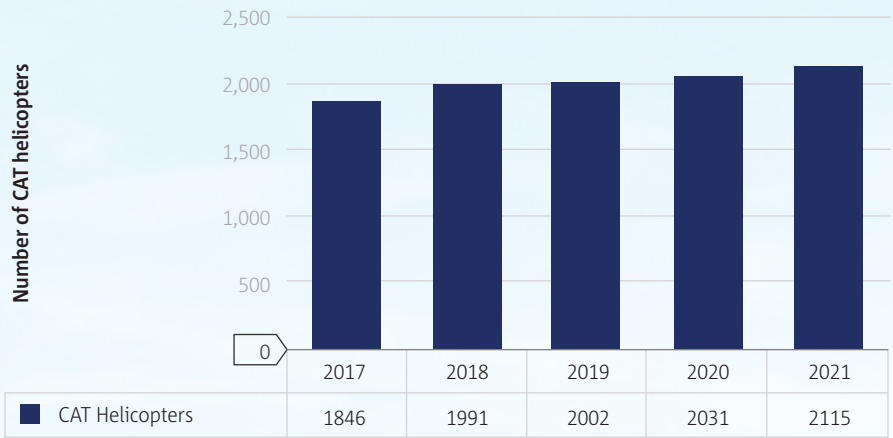


Figure 59 Number of helicopters performing commercial air transport in the EASA Member States

Key statistics

The key statistics for this domain are in Table 16 and Table 17, which include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the 10-year period (2011-2020) and the last year (2021). 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 2021 were significantly lower than the average of the previous decade.

Table 16 Key Statistics for commercial air transport helicopters

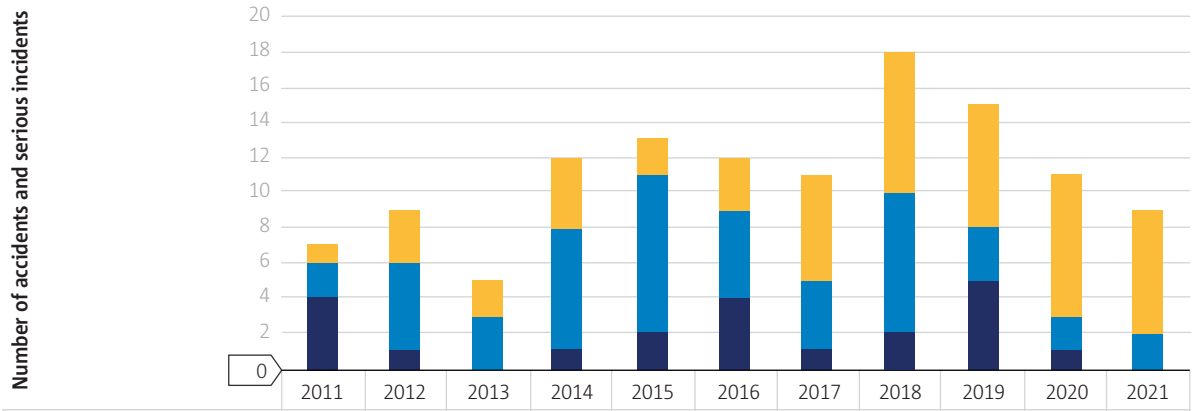
2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
21	Fatal accidents	0	↓
48	Non-fatal accidents	2	↓
44	Serious incidents	7	↑

Table 17 Fatalities and serious injuries involving commercial air transport helicopters

	FATALITIES	SERIOUS INJURIES
2011 - 2020 total	82	29
2011 - 2020 max.	22	7
2011 - 2020 min.	0	0
2021	0	1

The numbers of accidents and serious incidents per year are shown in Figure 60. It is important to note that the removal of the United Kingdom AOC holders from the following statistics, applied from this year, causes an overall decrease of the figures over the whole time period analysed, compared to the figures presented in the 2021 annual safety review . The United Kingdom helicopter commercial air transport operations represented a substantial part of the volume of European CAT helicopters operations and a non-negligible part of the related accidents and serious incidents.

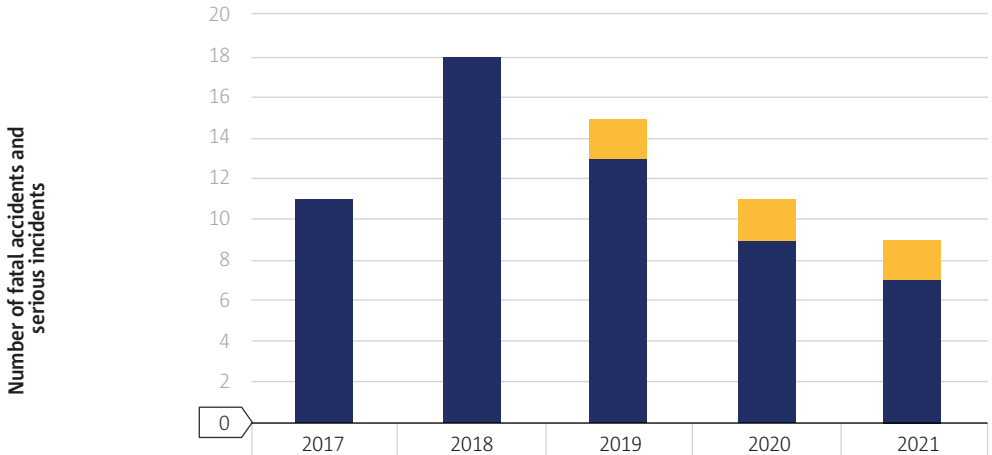
Whereas the number of serious incidents in 2021 remains at the level observed over the preceding 3 years, the number of accidents in 2021 were the lowest observed since 2011. For the first year since 2013, there were no fatal accidents in 2021 in commercial air transport helicopters operations.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incident	1	3	2	4	2	3	6	8	7	8	7
Non-fatal accident	2	5	3	7	9	5	4	8	3	2	2
Fatal accident	4	1	0	1	2	4	1	2	5	1	0

Figure 60 Fatal accidents, non-fatal accidents and serious incidents per year involving commercial air transport helicopters

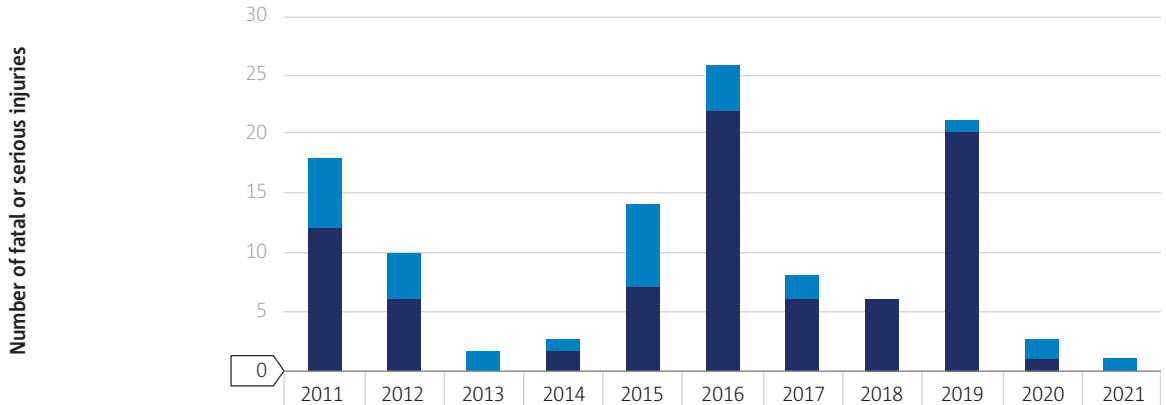
Figure 61 shows occurrences that have been risk scored using the ERCS methodology and divided into higher and lower risk. An explanation of the ERCS and why it is useful is provided in the introduction to the review. The aggregated ERCS scores by higher risk and lower risk occurrences show a different pattern from the representation of accidents and serious incidents. This is because some occurrences classified as serious incidents have inherent risk profiles that may be equal to or even exceed the risk of some accidents. Most of the accidents and serious incidents of the last five years were assessed of higher risk.



	2017	2018	2019	2020	2021
Lower Risk (ERCS)	0	0	2	2	2
Higher Risk (ERCS)	11	18	13	9	7

Figure 61 ERCS higher and lower risk occurrences per year involving commercial air transport helicopters

The numbers of fatalities and serious injuries per year are shown in Figure 62. With no fatality and one serious injury, 2021 was, in absolute figures, the safest year observed for helicopter commercial air transport in the past 11 years.

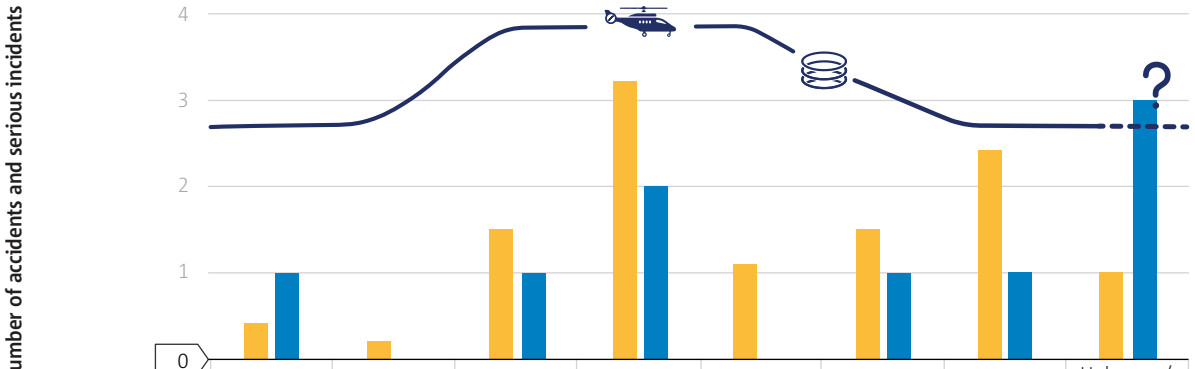


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	6	4	2	1	7	4	2	0	1	2	1
Fatalities	12	6	0	2	7	22	6	6	20	1	0

Figure 62 Fatal and serious injuries per year involving commercial air transport helicopters

Phase of flight

Figure 63 shows the distribution of accidents and serious incidents by flight phase. Over the decade 2011-2020, the most frequent flight phases observed are en route and landing. For 2021, only 6 occurrences could have their flight phase identified from the total of 9 occurrences. It is therefore difficult to derive conclusions from the 2021 distribution .

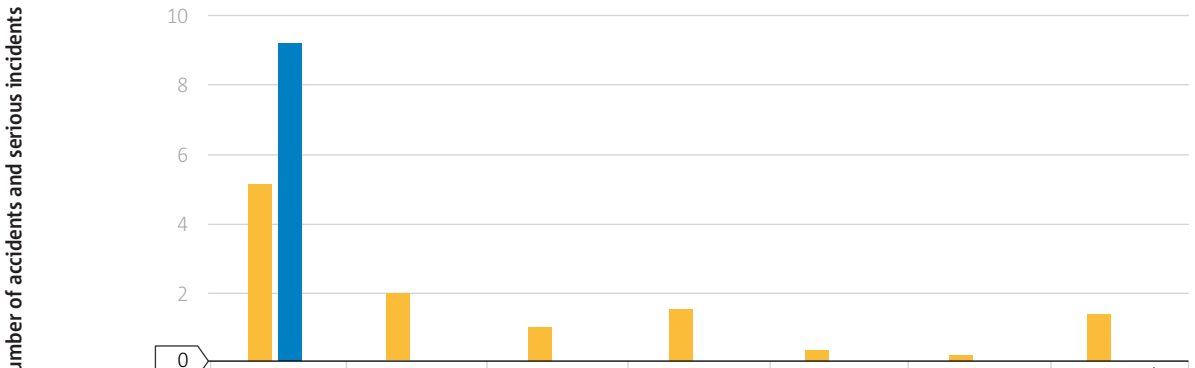


	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Unknown/ Blank
Average 2011-2020	0.4	0.2	1.5	3.2	1.1	1.5	2.4	1
2021	1	0	1	2	0	1	1	3

Figure 63 Accidents and serious incidents by phase of flight involving commercial air transport helicopters

Operation type

Figure 64 shows the numbers of accidents and serious incidents per type of operation. All 9 occurrences (2 accidents and 7 serious incidents) in 2021 involved HEMS operations, which is significantly above the average figures of the preceding decade for this type of operation.

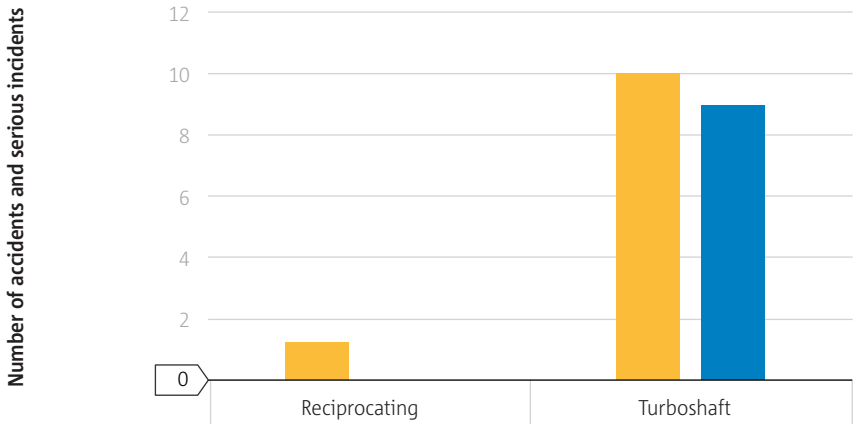


	HEMS	Air Taxi	Offshore	Sightseeing	Air Ambulance	Airline	Other/ unknown
Average 2011-2020	5.1	2	1	1.5	0.3	0.1	1.4
2021	9	0	0	0	0	0	0

Figure 64 Accidents and serious incidents by operation type involving commercial air transport helicopters

Propulsion type

Figure 65 shows the numbers of accidents and serious incidents per propulsion type. In 2021, all accidents and serious incidents in commercial air transport helicopters operations involved turboshaft helicopters.

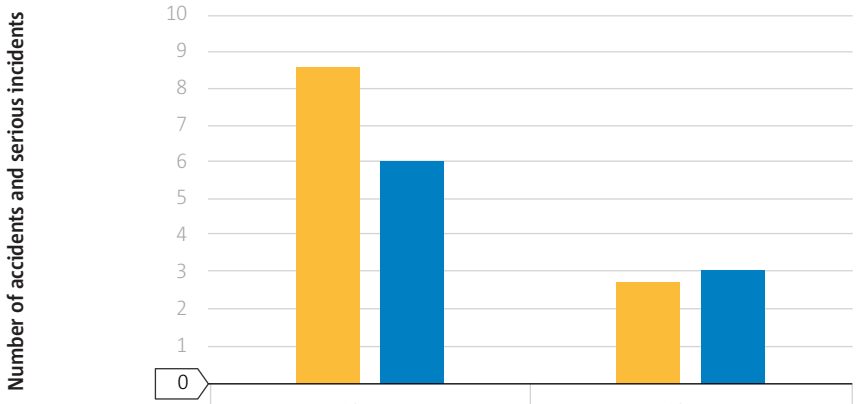


	Reciprocating	Turboshaft
Average 2011-2020	1.3	10
2021	0	9

Figure 65 Accidents and serious incidents by propulsion type involving commercial air transport helicopters

Helicopter certification specification (CS27/CS29)

Figure 66 shows the numbers of accidents and serious incidents per type of certified product (CS27 or CS29). Whereas the number of occurrences involving CS27 helicopters was lower in 2021 compared to the average of the decade 2011-2020, the 2021 figure was slightly higher than the average for CS29 helicopters.



	CS27	CS29
Average 2011-2020	8.6	2.7
2021	6	3

Figure 66 Accidents and serious incidents by certification specification (CS27/CS29) for commercial air transport operations

Safety risks for commercial air transport helicopters

The safety risks for commercial air transport helicopters are derived from accident and serious incident data from the EASA occurrence repository and the European Central Repository, covering the period 2017-2021 (64 occurrences).

The relative comparison between key risk areas for this domain is highlighted in Figure 67. The key risk areas are defined by their potential accident outcome and by the immediate precursors of that accident outcome. In line with the Commission Delegated Regulation for the ERCS[9], only one key risk area is allocated per occurrence.

From the data, it can be observed that the airborne collision accident scenario is the top key risk area, both in terms of numbers of occurrences and aggregated risk. Over the 5-year period analysed, 4 out of the 9 fatal accidents involving commercial air transport helicopters were airborne collisions. Among the analysed airborne collisions or occurrences that are precursors to an airborne collision (near misses, loss of separation), the involved helicopter went in conflict with a small aeroplane performing non-commercial operations.

Obstacle collisions in flight, aircraft upset, and terrain collisions form the other main key risk areas of the commercial air transport helicopters domain.

The key risk area other injuries includes the occurrence scenarios that do not fit into other key risk areas, but which can still cause actual or potential injury. Other injuries include those due to turbulence encounters, hoist operations, ground operators injuries, particularly persons being injured on the ground from falling loads, or from any part falling from an aircraft in flight.

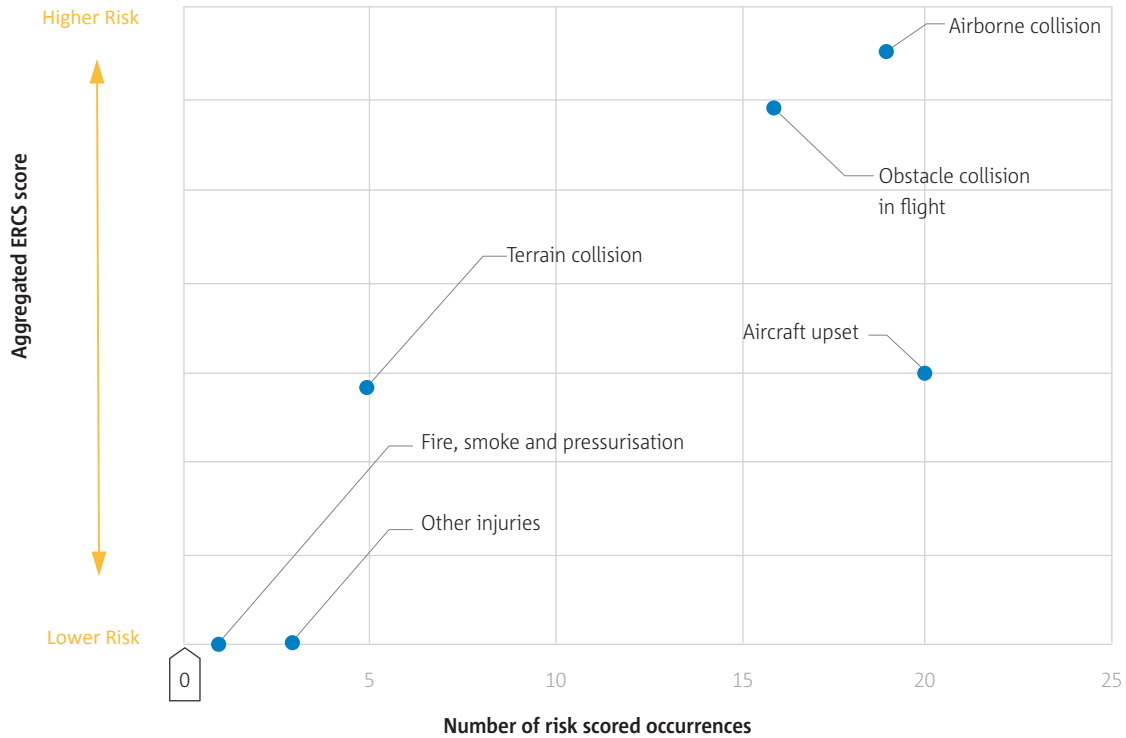


Figure 67 Key risk areas by aggregated ERCS score and number of risk-scored occurrences, involving commercial air transport helicopters

9 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

Figure 68 lists the safety issues identified from the occurrence data and shows a comparison between the numbers of occurrences per safety issue and their aggregated ERCS score. The number of occurrences provides an indication of how frequently the safety issue occurs, whereas the aggregated ERCS score provides an indication of the accumulated risk of the safety issue. The ERCS score is not used on its own because the finer granularity of the safety issue renders this indicator more vulnerable to the reactiveness of the data type used (only accidents and serious incidents).

In comparison to last year's annual safety review, the complete list of safety issues has been updated for the helicopter domain in order to have more relevant names, scope and definitions.

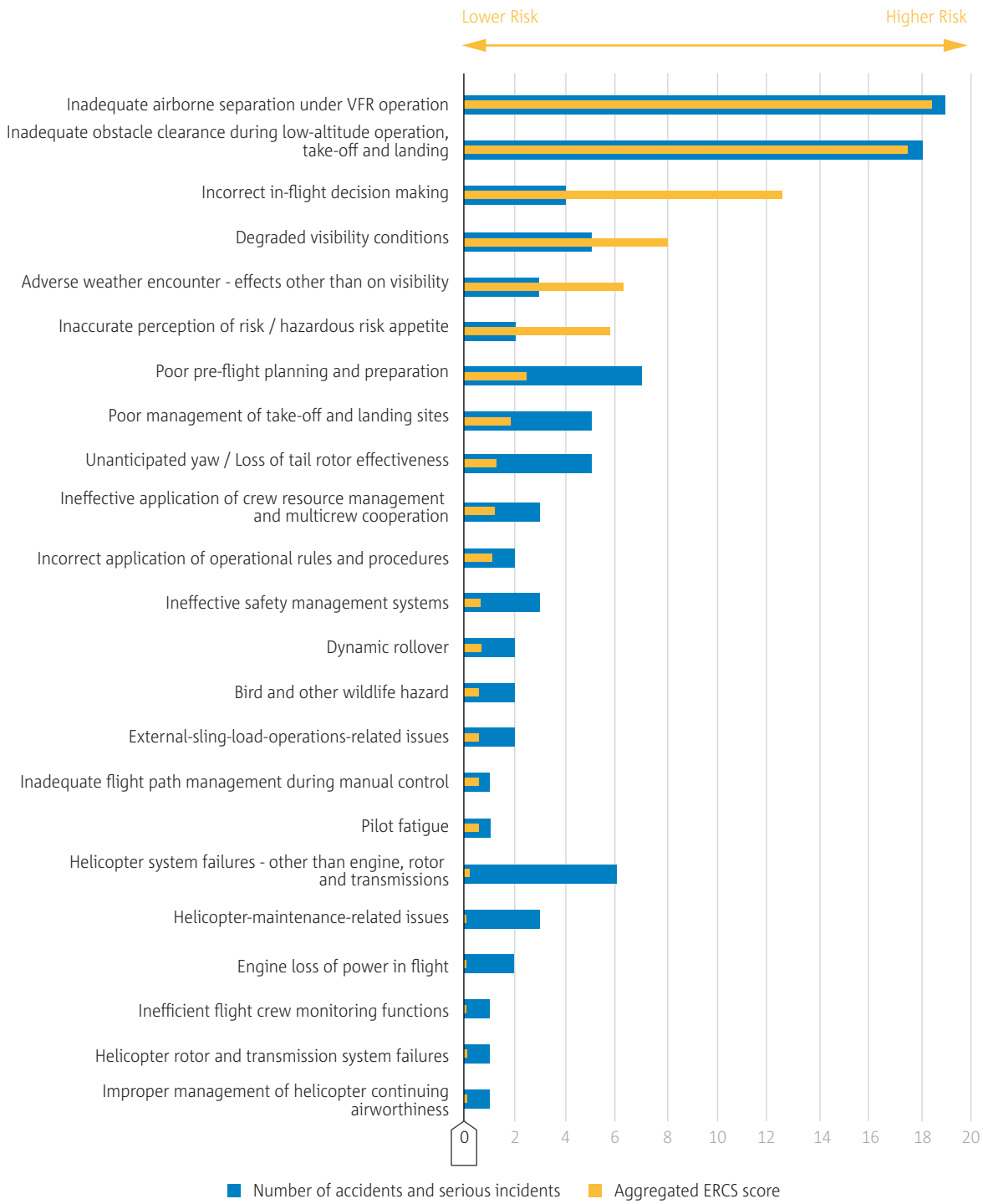


Figure 68 Safety issues by aggregated ERCS score and number of accidents and serious incidents involving commercial air transport helicopters

The data portfolio shown in Table 18 links the safety issues with the key risk areas to which they contribute. The key risk areas are listed at the top of the table and are prioritised from left to right based on the aggregated ERCS-risk score. The safety issues are listed on the left of the table and are also sorted from the top by decreasing aggregated ERCS risk score. The different colour bands denote high to low risk of the safety issues.

Based on the occurrence data, the inadequate airborne separation under VFR operation is the safety issue with the highest aggregated risk score and is a very strong contributor to the airborne collision outcome. The inadequate obstacle clearance during low-altitude operation, take-off and landing is the second top safety issue which contributed frequently to the key risk areas obstacle collision in flight, aircraft upset and terrain collision.

Table 18 Data portfolio for commercial air transport helicopters

Safety issue	Key Risk Areas (ERCS)					
	Airborne collision	Obstacle collision in flight	Aircraft upset	Terrain collision	Other injuries	Fire, smoke and pressurisation
Inadequate airborne separation under VFR operation	x					
Inadequate obstacle clearance during low-altitude operation, take-off and landing		x	o	o		
Incorrect in-flight decision making		o		o		
Degraded visibility conditions		o		o		
Adverse weather encounter - effects other than on visibility		o	o			
Inaccurate perception of risk / hazardous risk appetite			o	o		
Poor pre-flight planning and preparation		o	o	o		
Poor management of take-off and landing sites		o	o	o		
Unanticipated yaw / Loss of tail rotor effectiveness			x			
Ineffective application of crew resource management and multicrew cooperation		o		o		
Incorrect application of operational rules and procedures		o		o		
Ineffective safety management systems		o	o	o		
Dynamic rollover			o			
Bird and other wildlife hazard			o			
External-sling-load-operations-related issues				o	o	
Pilot fatigue				o		
Inadequate flight path management during manual control				o		
Helicopter system failures - other than engine, rotor and transmissions			x			o
Helicopter-maintenance-related issues			o			
Engine loss of power in flight			o			
Improper management of helicopter continuing airworthiness			o			
Helicopter rotor and transmission system failures			o			
Inefficient flight crew monitoring functions					o	

x = higher number of associated occurrences
o = lower number of associated occurrences

3.3 Specialised operations helicopters

This section covers the main safety statistics for EASA certified or validated helicopters performing specialised operations with an EASA MS as state of operator or state of registry.

Key statistics

The key statistics for this domain are in Table 19 and Table 20, which include a comparison of the number of fatal and non-fatal accidents and serious incidents for the 10-year period (2011-2020) compared with 2021. It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

The number of accidents in 2021 was lower than the average of the preceding 10-year period, whereas the number of serious incidents remained similar to the average for the same period. The numbers of fatalities and serious injuries are also below the average figures of the preceding decade.

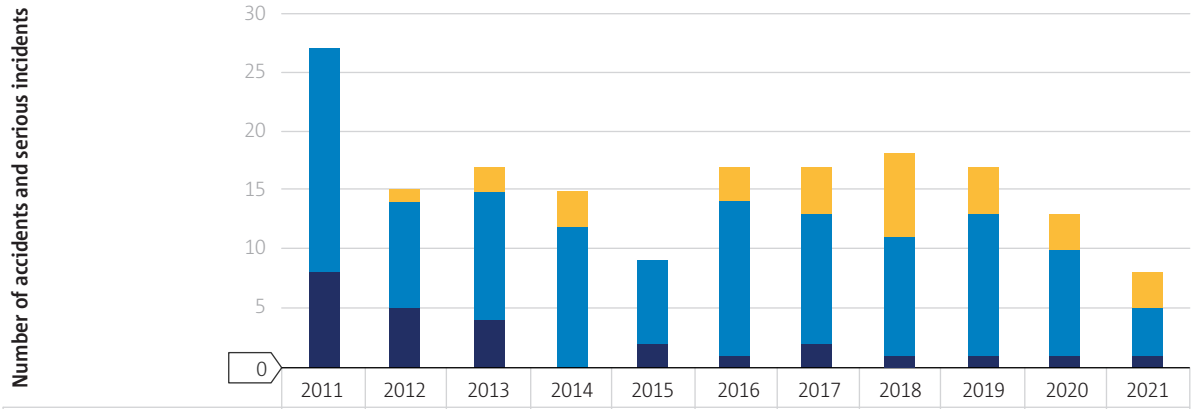
Table 19 Key statistics for specialised operations helicopters

2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
25	Fatal accidents	1	↓
113	Non-fatal accidents	4	↓
27	Serious incidents	3	=

Table 20 Fatalities and serious injuries involving specialised operations helicopters

	FATALITIES	SERIOUS INJURIES
2011 - 2020 total	45	45
2011 - 2020 max.	17	8
2011 - 2020 min.	0	1
2021	1	1

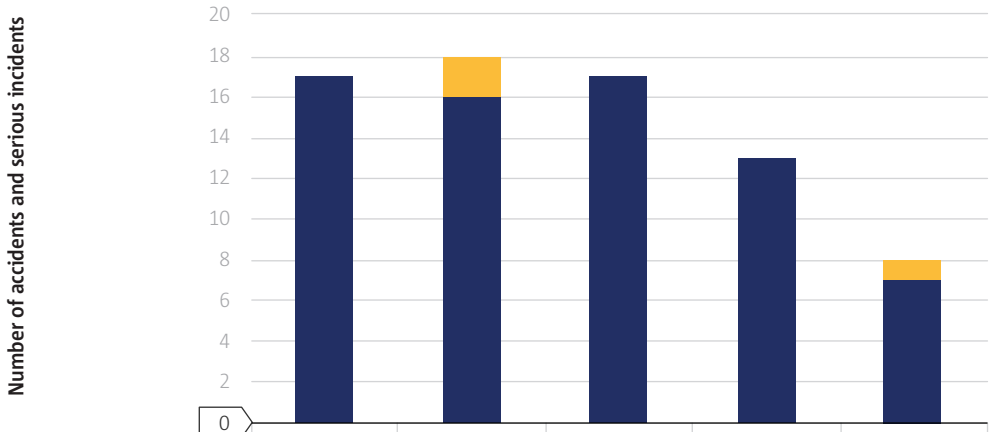
The numbers of accidents and serious incidents per year is shown in Figure 69. The total number of occurrences in 2021 is the lowest observed over the period analysed, continuing the decreasing trend which started in 2018. However, one fatal accident still occurred in 2021, as for the 3 preceding years. The fatal accident occurred during a sling load lifting operation, when due to the movement of the cargo hanging under the helicopter, a person on ground was stuck in the lifting device, lifted into the air and then fell to the ground causing fatal injury.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incident	0	1	2	3	0	3	4	7	4	3	3
Non-fatal accident	19	9	11	12	7	13	11	10	12	9	4
Fatal accident	8	5	4	0	2	1	2	1	1	1	1

Figure 69 Fatal accidents, non-fatal accidents and serious incidents per year involving specialised operations helicopters

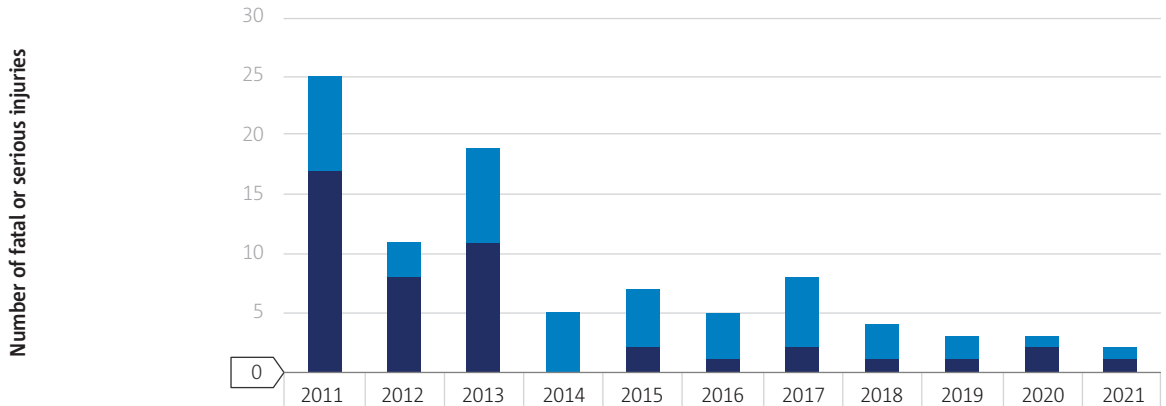
Figure 70 shows occurrences that have been risk scored using the ERCS methodology and categorised as higher or lower risk. An explanation of the ERCS and why it is useful is provided in the introduction to the review. The aggregated ERCS scores by higher risk and lower risk occurrences show a different pattern from the representation of accidents and serious incidents. This is because some occurrences classified as serious incidents have inherent risk profiles that may be equal or even exceed the risk of some accidents. Most of the accidents and serious incidents of the last five years were assessed of higher risk.



	2017	2018	2019	2020	2021
Lower Risk (ERCS)	0	2	0	0	1
Higher Risk (ERCS)	17	16	17	13	7

Figure 70 ERCS higher and lower risk occurrences per year involving specialised operations helicopters

The numbers of fatalities and serious injuries per year are shown in Figure 71. With one fatality and one serious injury, the figures for 2021 were among the lowest observed since 2011.

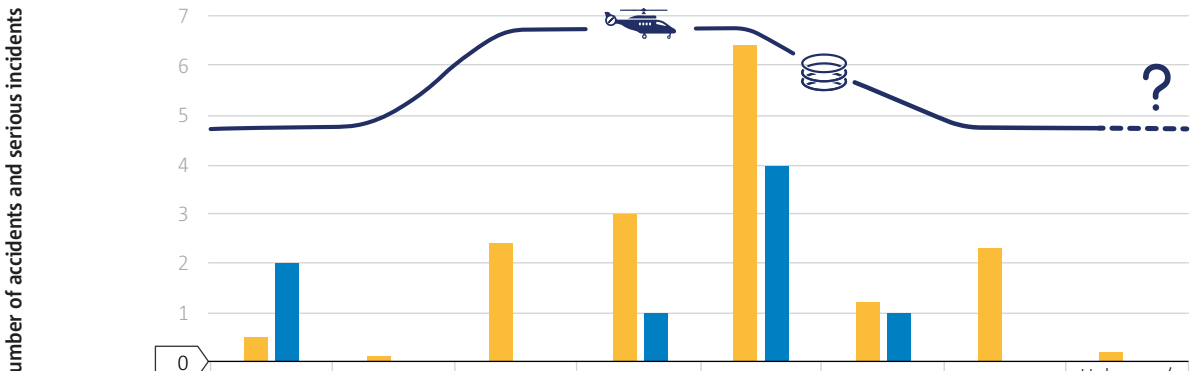


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	8	3	8	5	5	4	6	3	2	1	1
Fatalities	17	8	11	0	2	1	2	1	1	2	1

Figure 71 Fatal and serious injuries per year involving specialised operations helicopters

Phase of flight

Figure 72 shows the distribution 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 2021 happened during manoeuvring phases. It can be noticed that two occurrences in 2021 happened during the standing phase, which is above the average of the preceding decade.

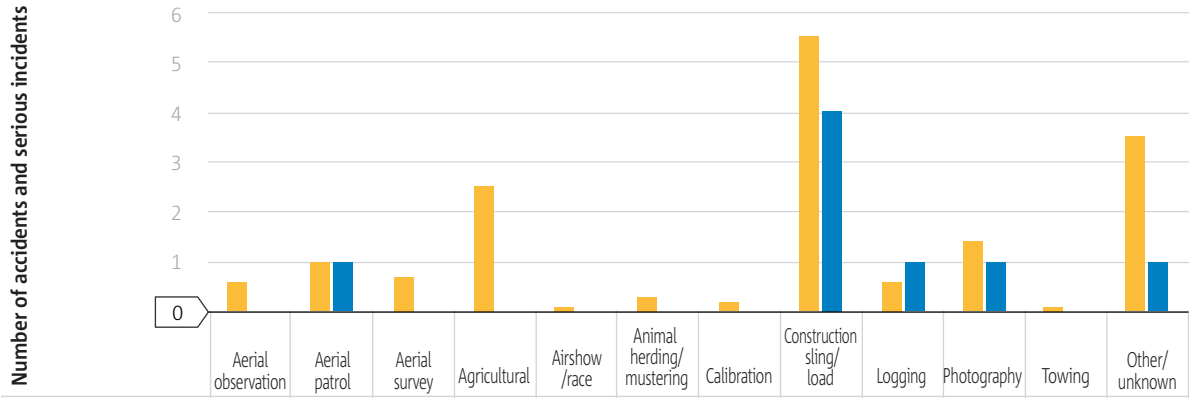


	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Unknown/ Blank
Average 2011-2020	0.5	0.1	2.4	3	6.4	1.2	2.3	0.2
2021	2	0	0	1	4	1	0	0

Figure 72 Accidents and serious incidents by phase of flight involving specialised operations helicopters

Operation type

Figure 73 shows the numbers of accidents and serious incidents per type of operation. In 2021, construction and sling-load operations were, once again, by far the most affected. The other identified operation types involved in an occurrence in 2021 were aerial patrol, logging and photography operations.

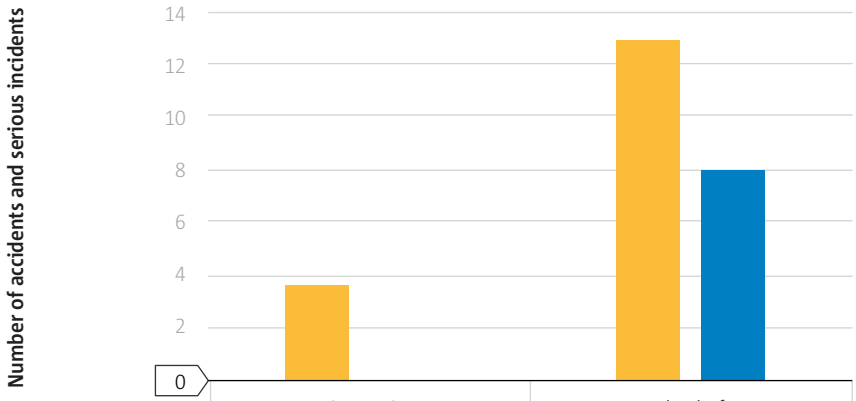


	Aerial observation	Aerial patrol	Aerial survey	Agricultural	Airshow /race	Animal herding/ mustering	Calibration	Construction sling/ load	Logging	Photography	Towing	Other/ unknown
Average 2011-2020	0.6	1	0.7	2.5	0.1	0.3	0.2	5.5	0.6	1.4	0.1	3.5
2021	0	1	0	0	0	0	0	4	1	1	0	1

Figure 73 Accidents and serious incidents by operation type involving specialised operations helicopters

Propulsion type

Figure 74 shows the numbers of accidents and serious incidents per propulsion type. The 2021 results reveal that no occurrences involved reciprocating engines helicopters. The number of occurrences involving turboshaft helicopters were also lower in 2021 than the average of the preceding decade.

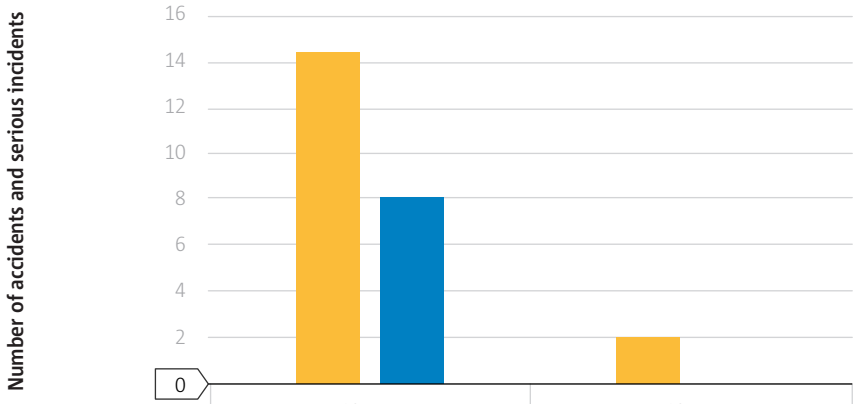


	Reciprocating	Turboshaft
Average 2011-2020	3.6	12.9
2021	0	8

Figure 74 Accidents and serious incidents by propulsion type involving specialised operations helicopters

Helicopter certification specification (CS27/CS29)

Figure 75 shows the numbers of accidents and serious incidents per type of certified product (CS27 or CS29). The number of occurrences involving CS27 helicopters decreased in 2021 when compared to the preceding decade average, but still represented the totality of the occurrences in 2021, as no CS29 helicopters were involved that year.



	CS27	CS29
Average 2011-2020	14.5	2
2021	8	0

Figure 75 Accidents and serious incidents by certification specification (CS27/CS29) for specialised operations

Safety risks for specialised operations helicopters

The safety risks for specialised operations helicopters are derived from accident and serious incident data from the EASA occurrence repository and the European Central Repository, covering the period 2017-2021 (74 occurrences).

The relative comparison between key risk areas for this domain are highlighted in Figure 76. The key risk areas are defined by their potential accident outcome and by the immediate precursors of that accident outcome. In line with the Commission Delegated Regulation for the ERCS[10], only one key risk area is allocated per occurrence.

From the data, it can be observed that the aircraft upset accident scenario is the top key risk area, both in terms of numbers of occurrences and aggregated risk. Over the 5-year period analysed, 5 out of the 6 fatal accidents involving specialised operations helicopters were aircraft upsets in flight.

Obstacle collisions in flight and other injuries are the two other main key risk areas of the specialised operations helicopters domain. The key risk area other injuries includes the occurrence scenarios that do not fit in to other key risk areas, but which can still cause actual or potential injury. Other injuries include those 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.

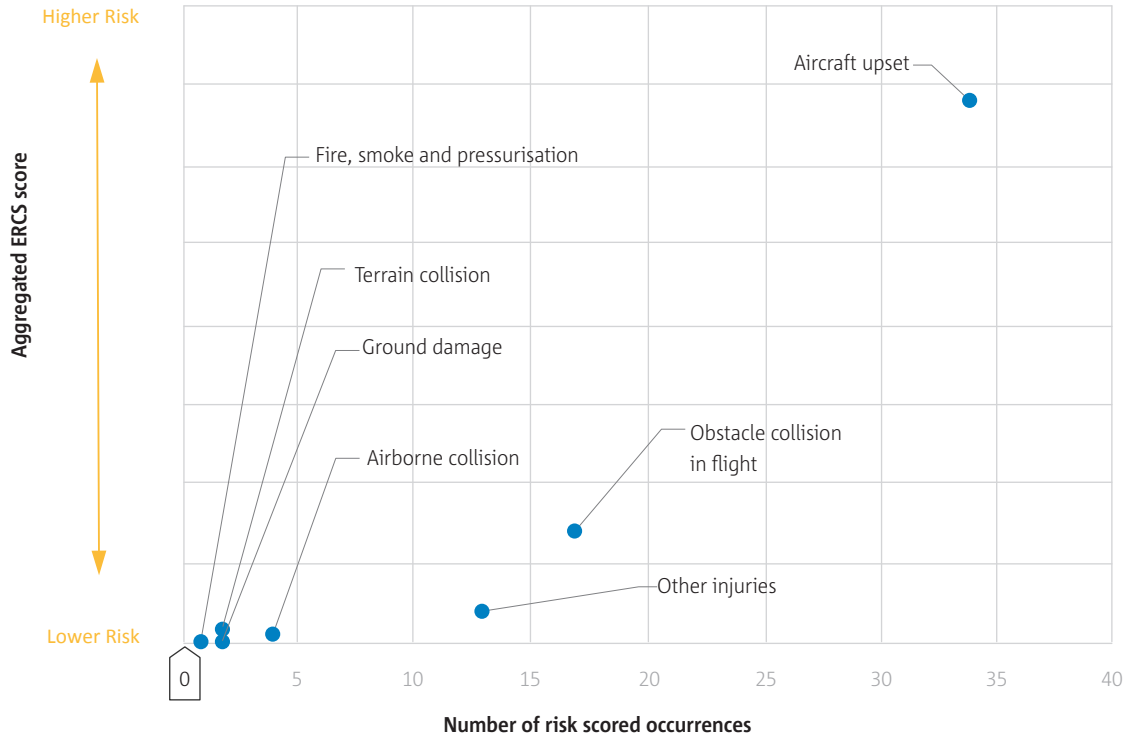


Figure 76 Key risk areas by aggregated ERCS score and number of risk-scored occurrences, involving specialised operations helicopters

10 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

Figure 77 lists the safety issues identified from the occurrence data and shows a comparison between the number of occurrences per safety issue and the accompanying aggregated ERCS score. The number of occurrences provides an indication of how frequently the safety issue occurs, whereas the aggregated ERCS score provides an indication of the accumulated risk of the safety issue. The ERCS score is not used on its own because the finer granularity of the safety issue renders this indicator more vulnerable to the reactiveness of the data type used (only accidents and serious incidents).

In comparison to the 2021 annual safety review, the complete list of safety issues has been updated for the helicopter domain with more relevant names, scope and definitions.

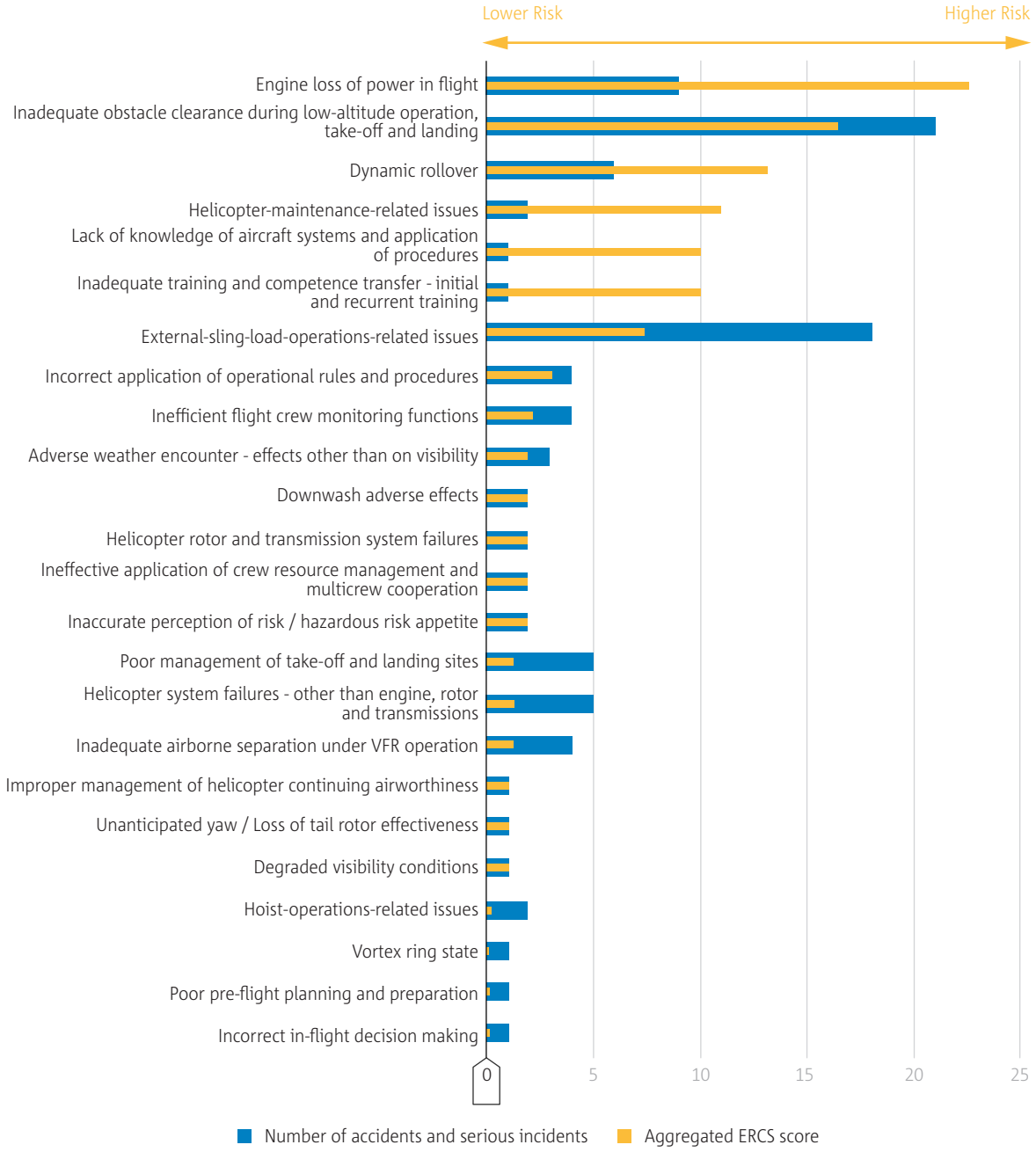


Figure 77 Safety issues by aggregated ERCS score and numbers of accidents and serious incidents involving specialised operations helicopters

The data portfolio shown in Table 21 links the safety issues with the key risk areas to which they contribute. The key risk areas are listed at the top of the table and are prioritised from left to right based on the aggregated ERCS-risk score. The safety issues are listed on the left of the table and are also sorted from the top by decreasing aggregated ERCS risk score. The different colour bands denote group safety issues from high to low risk.

Based on the occurrence data, engine power loss in flight is the safety issue with the highest aggregated risk score and is a very strong contributor to the aircraft upset accident outcome. Engine power losses and the subsequent issues with aircraft handling following this type of failure caused 8 accidents over the last 5 years, 2 of them with a fatal outcome.

The inadequate obstacle clearance during low-altitude operation, take-off and landing is the second highest safety issue, which contributed in particular to the key risk area obstacle collision in flight. This safety issue was frequently identified in the case of collisions with power lines during take-off, landing and low altitude operations.

Table 21 Data portfolio for specialised operations helicopters

Safety issue	Key Risk Areas (ERCS)						
	Aircraft upset	Obstacle collision in flight	Other injuries	Terrain collision	Airborne collision	Ground damage	Fire, smoke and pressurisation
Engine loss of power in flight	x						
Inadequate obstacle clearance during low-altitude operation, take-off and landing	o	x		o		o	
Dynamic rollover	x					o	
Helicopter-maintenance-related issues	o						
Inadequate training and competence transfer - initial and recurrent training	o						
Lack of knowledge of aircraft systems and application of procedures	o						
External-sling-load-operations-related issues	x	o	x	o			
Incorrect application of operational rules and procedures	o	o					
Inefficient flight crew monitoring functions	o	o			o		
Adverse weather encounter - effects other than on visibility	o	o					
Inaccurate perception of risk / hazardous risk appetite		o					
Ineffective application of crew resource management and multicrew cooperation		o					
Helicopter rotor and transmission system failures	o						
Downwash adverse effects			o				

Poor management of take-off and landing sites	o	o	o			o	
Helicopter system failures - other than engine, rotor and transmissions	o	o	o				o
Inadequate airborne separation under VFR operation					x		
Degraded visibility conditions				o			
Unanticipated yaw / Loss of tail rotor effectiveness	o						
Improper management of helicopter continuing airworthiness	o						
Hoist-operations-related issues			o				
Incorrect in-flight decision making	o						
Poor pre-flight planning and preparation		o					
Vortex ring state	o						

x = higher number of associated occurrences
o = lower number of associated occurrences

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.

Key statistics

The key statistics for this domain are in Table 22 and Table 23, which include a comparison of the number of fatal and non-fatal accidents and serious incidents for the 10-year period (2011-2020) compared with 2021. It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

Whereas the number of non-fatal accidents and serious incidents in 2021 were lower or equal to the average of the preceding decade, the number of fatal accidents was higher than the 10-year period. The number of fatalities in 2021 was also higher than the average of the preceding 10 years.

Table 22 Key statistics for non-commercial operations helicopters

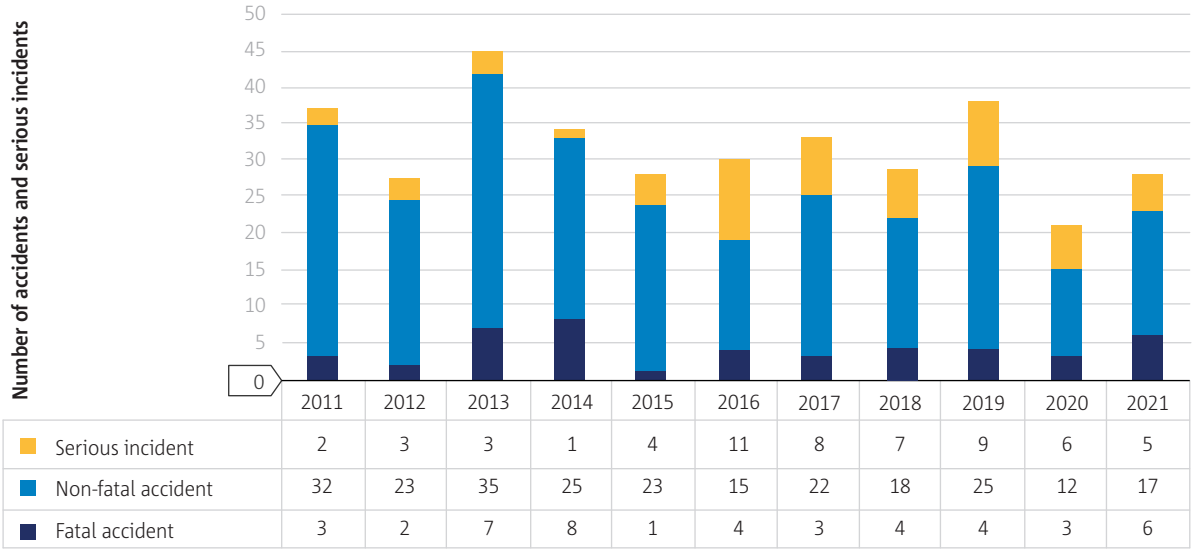
2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
39	Fatal accidents	6	↑
230	Non-fatal accidents	17	↓
54	Serious incidents	5	=

Table 23 Fatalities and serious injuries involving non-commercial operations helicopters

	FATALITIES	SERIOUS INJURIES
2011 - 2020 total	85	44
2011 - 2020 max.	20	11
2011 - 2020 min.	1	0
2021	11	9

The numbers of accidents and serious incidents per year is shown in Figure 78. After the year 2020 which resulted in the lowest figures observed since 2011, the number of accidents increased in 2021 compared to the year before. The figures should be interpreted cautiously as it is difficult to evaluate to which extent the non-commercial helicopter activity has recovered in 2021 compared to 2020 where the activity was significantly impacted by the Covid-19 pandemic. For the fatal accidents, 2021, with 6 occurrences, is the worst year since 2014 (8 occurrences).

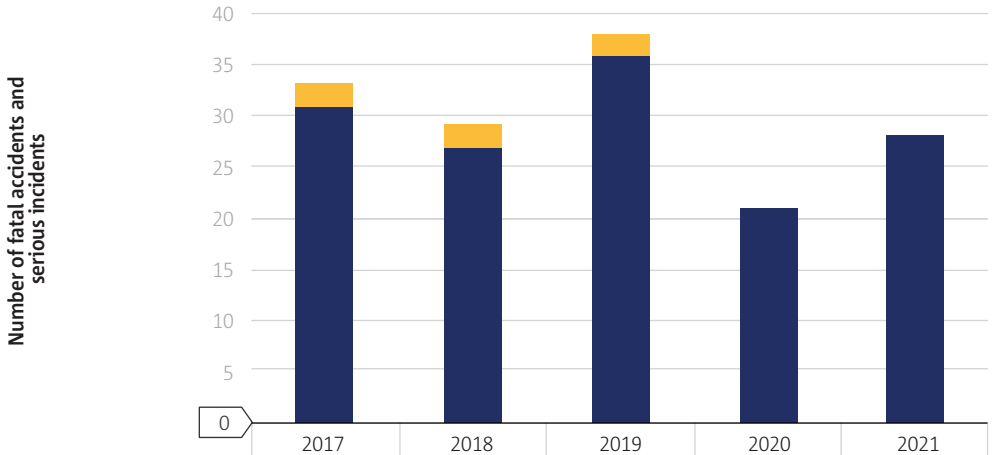
Among the 6 fatal accidents in 2021 there were 2 collisions with terrain, 2 collisions with trees, 1 collision with power lines, and 1 loss of control in flight resulting in a crash.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incident	2	3	3	1	4	11	8	7	9	6	5
Non-fatal accident	32	23	35	25	23	15	22	18	25	12	17
Fatal accident	3	2	7	8	1	4	3	4	4	3	6

Figure 78 Fatal accidents, non-fatal accidents and serious incidents per year involving non-commercial operations helicopters

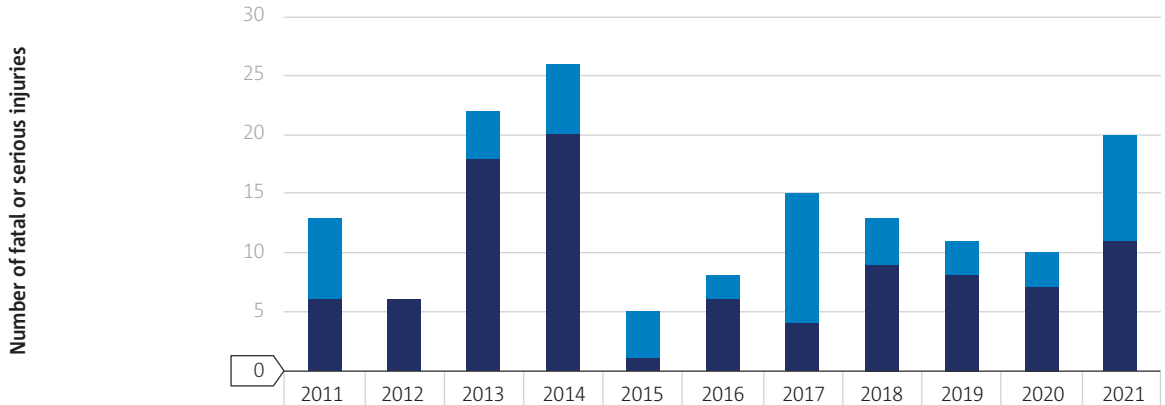
Figure 79 shows occurrences that have been risk scored using the ERCS methodology and categorised as higher or lower risk. An explanation of the ERCS and why it is useful is provided in the introduction to the review. The aggregated ERCS scores by higher risk and lower risk occurrences show a different pattern from the representation of accidents and serious incidents. This is because some occurrences classified as serious incidents have inherent risk profiles that may be equal or even exceed the risk of some accidents. Most of the accidents and serious incidents of the last five years were assessed of higher risk.



	2017	2018	2019	2020	2021
Lower Risk (ERCS)	2	2	2	0	0
Higher Risk (ERCS)	31	27	36	21	28

Figure 79 ERCS higher and lower risk occurrences per year involving non-commercial operations helicopters

The numbers of fatalities and serious injuries per year are shown in Figure 80. With 11 fatalities, 2021 was the third most fatal year for non-commercial helicopters operations since 2011, after 2013 and 2014. The number of serious injuries in 2021 was the second highest number of the analysed time period, after the year 2017.

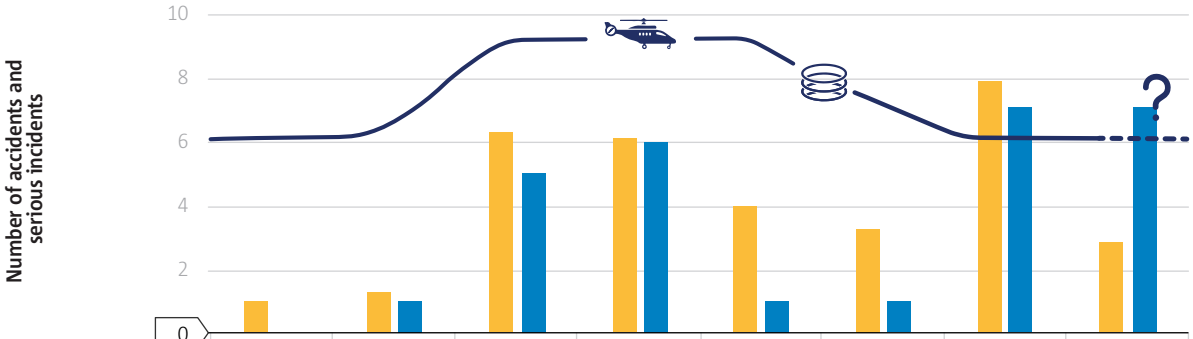


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	7	0	4	6	4	2	11	4	3	3	9
Fatalities	6	6	18	20	1	6	4	9	8	7	11

Figure 80 Fatal and serious injuries per year involving non-commercial operations helicopters

Phase of flight

Figure 81 shows the distribution of accidents and serious incidents by flight phase. Among the occurrences for which the flight phase was identified, the landing, en route and take-off phases were the most frequent, which is also the case for 10-year average figures. However, it should be noticed that for 25% of the occurrences of 2021, the flight phase could not be identified from the data collected so far.

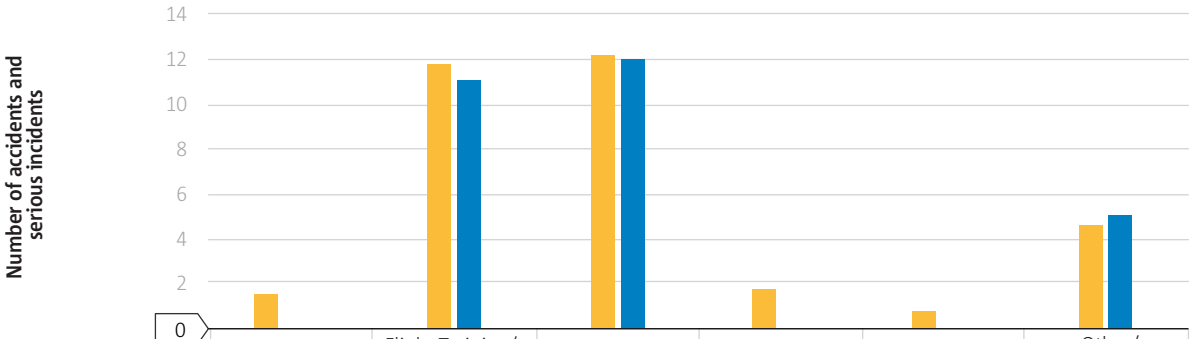


	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Unknown/ Blank
Average 2011-2020	1	1.3	6.3	6.1	4	3.2	7.9	2.8
2021	0	1	5	6	1	1	7	7

Figure 81 Accidents and serious incidents by phase of flight involving non-commercial operations helicopters

Operation type

Figure 82 shows the numbers of accidents and serious incidents per type of operation. In 2021, 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. Nevertheless, it should be highlighted that the exact nature of the operation is unknown at this stage for some occurrences.

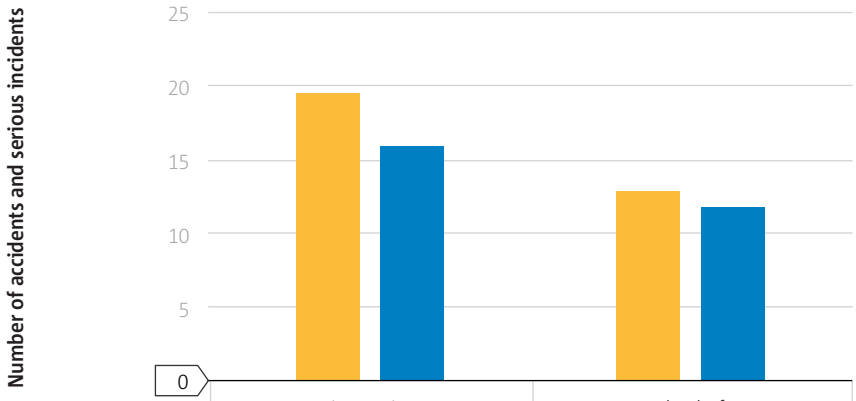


	Business	Flight Training/ Instructional	Pleasure	Relocation	Test Flight	Other/ unknown
Average 2011-2020	1.5	11.8	12.2	1.7	0.8	4.6
2021	0	11	12	0	0	5

Figure 82 Accidents and serious incidents by operation type involving non-commercial operations helicopters

Propulsion type

Figure 83 shows the numbers of accidents and serious incidents per propulsion type. In 2021, the relative distribution between reciprocating engine helicopters and turboshaft helicopters remained close to that observed during the previous decade, although the figures decreased in absolute values.

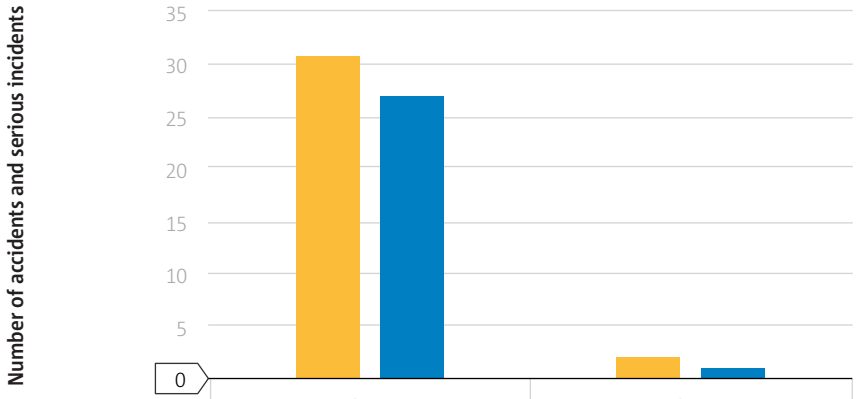


	Reciprocating	Turboshaft
Average 2011-2020	19.6	13
2021	16	12

Figure 83 Accidents and serious incidents by propulsion type involving non-commercial operations helicopters

Helicopter certification specification (CS27/CS29)

Figure 84 shows the numbers of accidents and serious incidents per type of certified product (CS27 or CS29). Almost all certified helicopters involved in non-commercial operations occurrences were CS27 products. A similar split was still observed in 2021.



	CS27	CS29
Average 2011-2020	30.7	1.9
2021	27	1

Figure 84 Accidents and serious incidents by certification specification (CS27/CS29) for non-commercial operations

Safety risks for non-commercial operations helicopters

The safety risks for non-commercial helicopters are derived from accident and serious incident data from the EASA occurrence repository and the European Central Repository, covering the period 2017-2021 (149 occurrences).

The relative comparison between key risk areas for this domain is highlighted in Figure 76. The key risk areas are defined by their potential accident outcome and by the immediate precursors of that accident outcome. In line with the Commission Delegated Regulation for the ERCS[11], only one key risk area is allocated per occurrence.

From the data, it can be observed that the aircraft upset accident scenario is by far the top key risk area, both in terms of numbers of occurrences and aggregated risk. Over the 5-year period analysed, 9 out of the 20 fatal accidents involving non-commercial operations helicopters were aircraft upsets in flight.

Obstacle collisions in flight and terrain collisions are the two other main key risk areas of the non-commercial operations helicopters domain. The key risk area other injuries includes the occurrence scenarios that do not fit in to other key risk areas, but which can still cause actual or potential injury. Other injuries include those due to turbulence encounters, hoist operations, ground operators injuries, particularly persons being injured on the ground from falling loads, or from any part falling from an aircraft in flight.

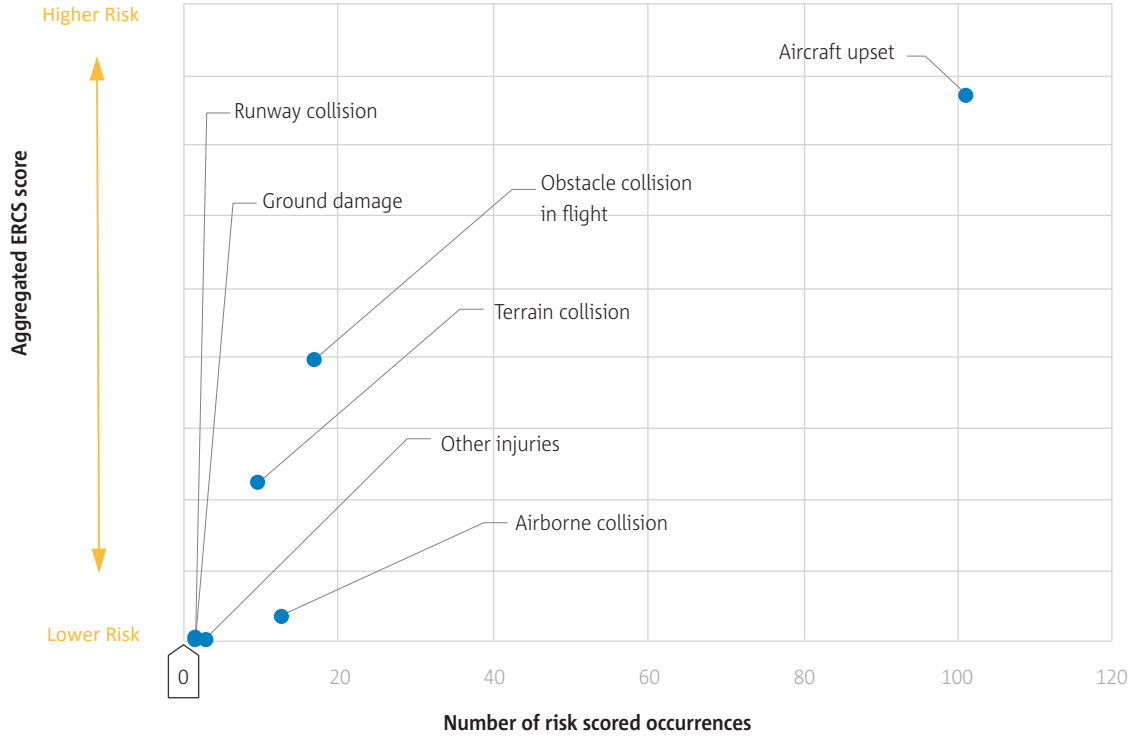


Figure 85 Key risk areas by aggregated ERCS score and number of risk-scored occurrences, involving non-commercial operations helicopters

11 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

Figure 86 lists the safety issues identified from the occurrence data and shows a comparison between the number of occurrences per safety issue and the accompanying aggregated ERCS score. The number of occurrences provides an indication of how frequently the safety issue occurs, whereas the aggregated ERCS score provides an indication of the accumulated risk of the safety issue. The ERCS score is not used on its own because the finer granularity of the safety issue renders this indicator more vulnerable to the reactiveness of the data type used (only accidents and serious incidents).

In comparison to the safety review of last year, following the inclusion of a safety risk portfolio for this domain in EPAS Volume III, the complete list of safety issues has been updated for the helicopter domain in order to have more relevant names, scope and definitions.

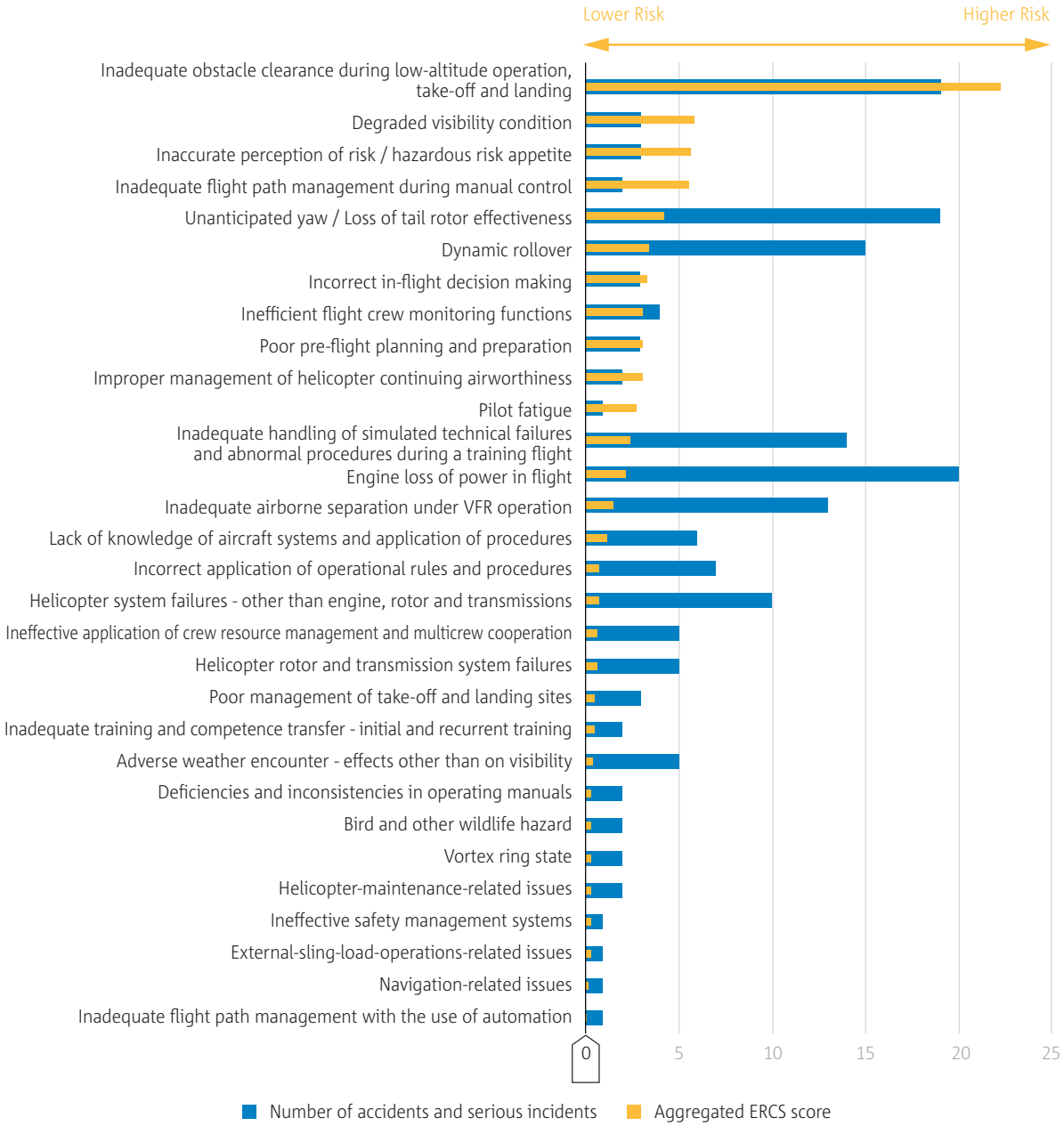


Figure 86 Safety issues by aggregated ERCS score and numbers of accidents and serious incidents involving non-commercial operations helicopters

The data portfolio shown in Table 24 links the safety issues with the key risk areas to which they contribute. The key risk areas are listed at the top of the table and are prioritised from left to right based on the aggregated ERCS-risk score. The safety issues are listed on the left of the table and are also sorted from the top by decreasing aggregated ERCS risk score. The different colour bands denote group safety issues from high to low risk.

Based on the occurrence data, the inadequate obstacle clearance during low-altitude operation, take-off and landing is the safety issue with the highest aggregated risk score and is strongly contributes to obstacle collision in flight outcome.

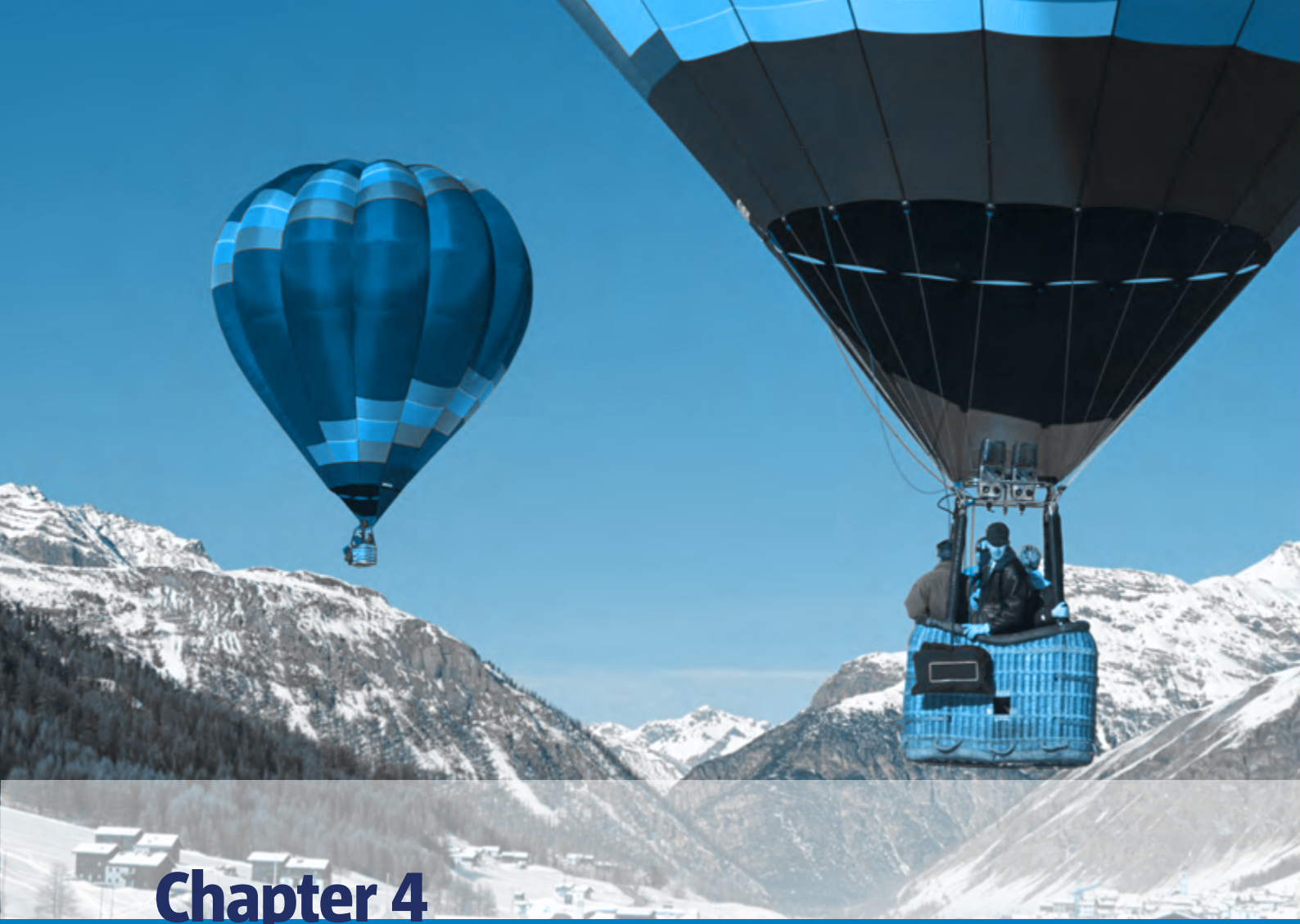
For the top key risk area aircraft upset, the safety issues contributing the most frequently to this outcome are the unanticipated yaw / loss of tail rotor effectiveness, the dynamic rollovers and the engine loss of power in flight. In the particular case of training flights, the inadequate handling of simulated technical failures and abnormal procedures such as autorotation trainings are a clear indication that high risk training manoeuvres are a cause of concern.

Table 24 Data portfolio for non-commercial operations helicopters

Safety issue	Key Risk Areas (ERCS)						
	Aircraft upset	Obstacle collision in flight	Terrain collision	Airborne collision	Collision on runway	Other injuries	Ground damage
Inadequate obstacle clearance during low-altitude operation, take-off and landing	o	x	o				
Degraded visibility conditions		o	o				
Inaccurate perception of risk / hazardous risk appetite	o	o	o				
Inadequate flight path management during manual control	o	o					
Unanticipated yaw / Loss of tail rotor effectiveness	x						
Dynamic rollover	x		o				
Incorrect in-flight decision making	o	o	o				
Inefficient flight crew monitoring functions	o	o	o				
Poor pre-flight planning and preparation	o						
Improper management of helicopter continuing airworthiness			o				
Pilot fatigue		o					
Inadequate handling of simulated technical failures and abnormal procedures during a training flight	x	o					
Engine loss of power in flight	x						
Inadequate airborne separation under VFR operation	o			x			
Lack of knowledge of aircraft systems and application of procedures	x		o				

Incorrect application of operational rules and procedures	o		o	o		o	o
Helicopter system failures - other than engine, rotor and transmissions	x					o	
Ineffective application of crew resource management and multicrew cooperation	o		o				o
Helicopter rotor and transmission system failures	x						
Poor management of take-off and landing sites		o	o				o
Inadequate training and competence transfer - initial and recurrent training	o						
Adverse weather encounter - effects other than on visibility	o						o
Helicopter-maintenance-related issues	o						
Vortex ring state	o						
Bird and other wildlife hazard	o						
Deficiencies and inconsistencies in operating manuals	o						
External-sling-load-operations-related issues		o					
Ineffective safety management systems			o				
Navigation-related issues				o			
Inadequate flight path management with the use of automation			o				

x = higher number of associated occurrences
o = lower number of associated occurrences



Chapter 4
Balloons

The scope of this chapter covers hot air balloon operations where the state of registry is an EASA Member State. 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. As a consequence of the UK's departure from the EASA system, in order that the data of 2021 can be compared to the preceding ten years on an equal basis, occurrence data originating from the UK is no longer included in the Annual Safety Review.

The chapter provides the key statistics for balloon operations and a data portfolio, which provides an overview of the main safety risks for these types of operations at the European level, based on occurrence data. For the first time the European Common Repository (ECR) will be used as the data source for the key statistics. The human factors/human performance chapter as well as the chapter on safety risks will use the EASA database as the data 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.

Key Statistics

The key statistics for this domain are in Table 25 and Table 26 and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the 10-year period (2011-2020) and the last year (2021). It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

Table 25 shows a comparison between the 10-year average vs. 2021. It shows that the number of fatal accidents is slightly increasing but non-fatal accidents are slightly decreasing compared to the 10-year average, but the number of serious incidents is not known at the time of this writing.

Table 26 presents the number of fatalities and serious injuries for 2021 vs. the 10-year average. Both the number of fatalities as well as serious injuries have decreased in 2021 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 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.

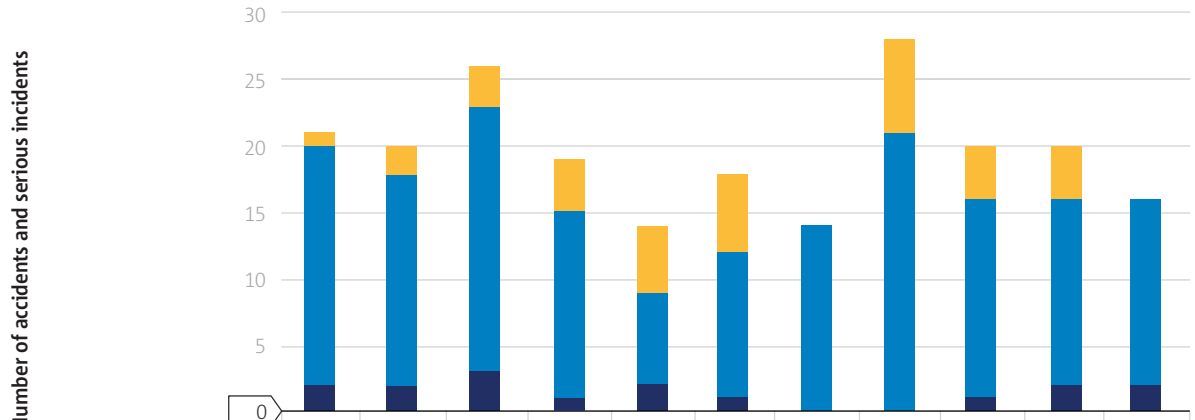
Table 25 Key statistics for balloons

2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
14	Fatal accidents	2	↑
150	Non-fatal accidents	14	↓
36	Serious incidents	0	0

Table 26 Fatalities and serious injuries involving balloons

	FATALITIES	SERIOUS INJURIES
2011 - 2020 total	16	152
2011 - 2020 max.	4	20
2011 - 2020 min.	0	6
2021	2	19

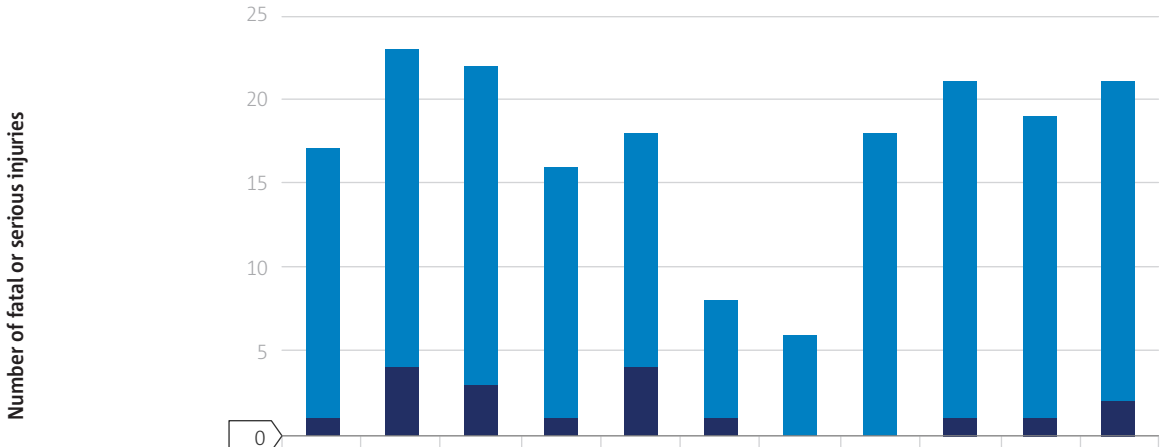
Figure 87 plots the number of fatal accidents, non-fatal accidents, and serious incidents from 2011 until 2021. Last year was somewhat like 2014 and 2017 apart from the fact that in 2017 there were no fatal accidents. A slight downward trend in the total figures can also be observed.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	1	2	3	4	5	6	0	7	4	4	0
Non-fatal accidents	18	16	20	14	7	11	14	21	15	14	14
Fatal accidents	2	2	3	1	2	1	0	0	1	2	2

Figure 87 Fatal accidents, non-fatal accidents and serious incidents per year involving balloons

Figure 88 shows the number of fatalities and serious injuries in a similar downward trend as Figure 87. 2021 was similar as in 2019, both in number of fatalities and serious injuries.

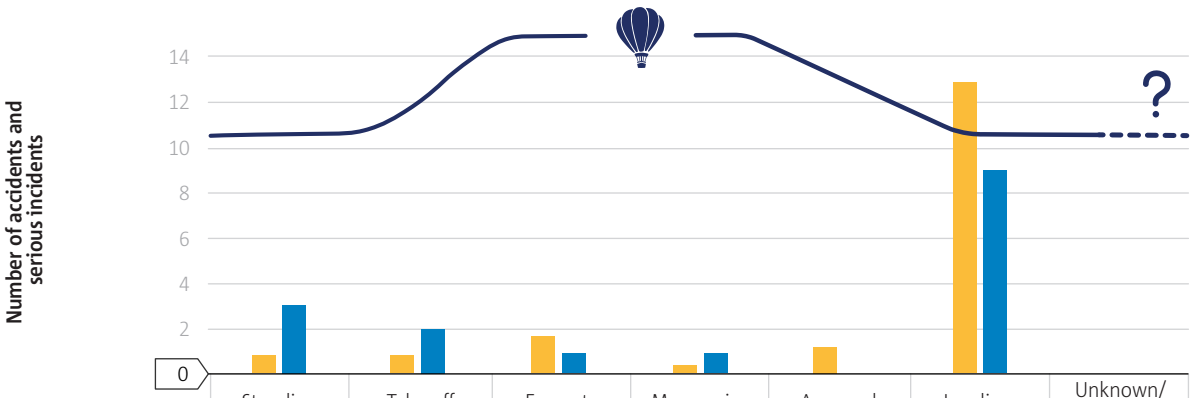


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	16	19	19	15	14	7	6	18	20	18	19
Fatalities	1	4	3	1	4	1	0	0	1	1	2

Figure 88 Fatalities and serious injuries involving balloons

Phase of flight

Most balloon accidents and serious incidents occur during the landing phase of the flight, as shown in Figure 89. It can also be observed that the number of recorded landing accidents and serious incidents is approximately 20% lower than the 10-year average. However, there is an increase in other flight phases, such as during standing, take-off and manoeuvring. For balloons, the flight phase standing covers the period where the balloon is filled with hot air, but the basket is still heavy.

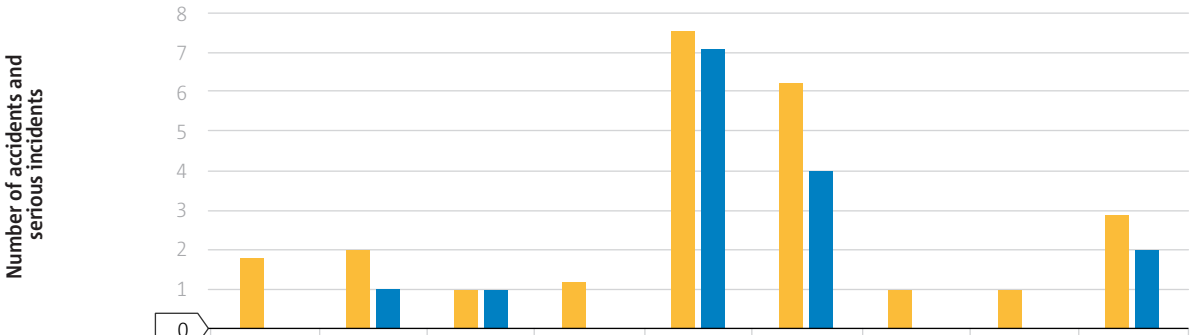


	Standing	Take-off	En route	Manoevring	Approach	Landing	Unknown/ Blank
Average 2011-2020	0.9	0.9	1.7	0.4	1.2	12.9	0
2021	3	2	1	1	0	9	0

Figure 89 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 90. Note that activities such as competitions and record flights are considered to be part of the airshow/race category. Passenger accidents increased slightly in 2021 compared with the 10-year average but pleasure flights are significantly fewer compared to the previous ten years.

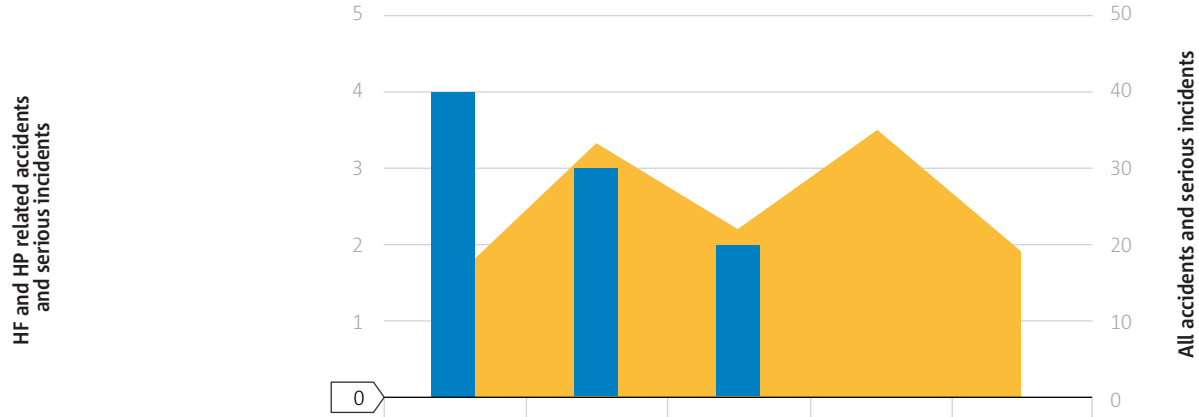


	Airshow/ race	Business	Flight Training/ Instructional	Other	Passenger	Pleasure	Photography	Demonstration	Blank/ Unknown
Average 2011-2020	1.8	2.0	1.0	1.2	7.5	6.2	1.0	1.0	2.9
2021	0	1	1	0	7	4	0	0	2

Figure 90 Accidents and serious incidents involving balloons, by operation type

Human factors and human performance

One in 10 accidents and serious incident reports involving balloons identify human factors (HF) or human performance (HP) issues and these are labelled as personnel occurrences in the ECCAIRS taxonomy. Looking at the figures for the past five years, the number of identifiable HF or HP issues is remaining low.



	2017	2018	2019	2020	2021
Accidents and serious incidents	16	33	22	35	19
HF/HP accidents and serious incidents	4	3	2	0	0

Figure 91 Human factors and human performance accidents and serious incidents involving balloon operations

The application of HF or HP codes at a high level can be seen in Figure 92. Issues relating to situational awareness and sensory events, as well as task performance events, are more commonly experienced, reported or discernible following an accident or serious incident than the factors that cause them. Sensory events are those where the way that humans sense their environment misleads them.

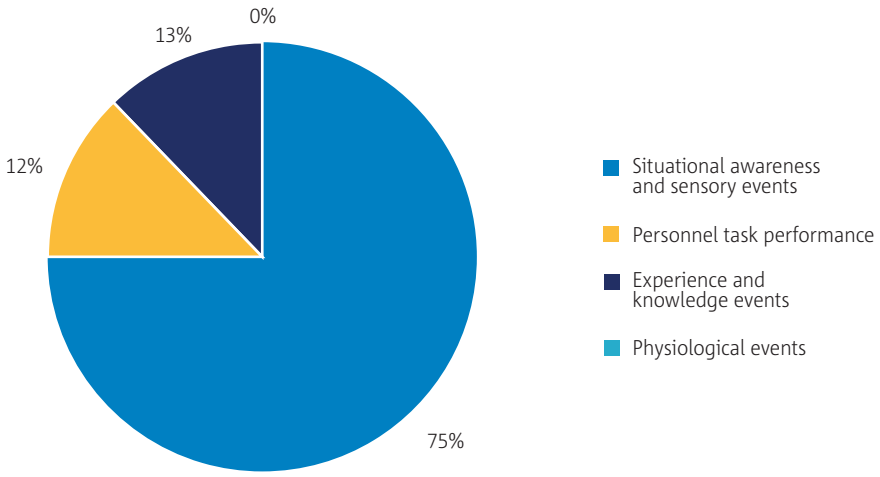


Figure 92 High level human factors and human performance event codes applied to accidents and serious incidents involving balloon operations

Figure 93 compares the number of accidents and serious incidents with the aggregated ERCS risk score of those occurrences, using detailed HF and HP event codes. It can be seen that some types of event have a greater risk than others, as indicated where the aggregated risk score is far higher than the number of accidents and serious incidents (attention and vigilance vs perception).

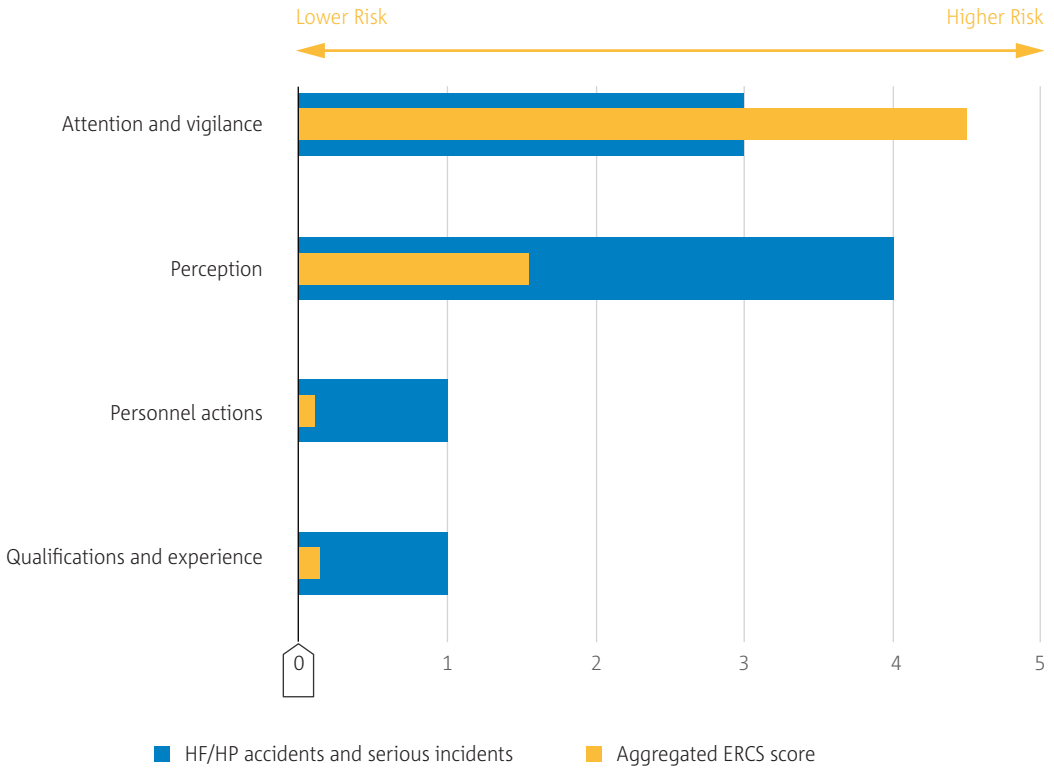


Figure 93 Detailed human factors and human performance event codes by aggregated ERCS score and number of accidents and serious incidents involving all balloon operations

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 2017-2021 (95 occurrences).

The main key risk areas for this domain are highlighted in Figure 94 and are defined by their potential accident outcome and by the immediate precursors of that accident outcome. The main key risk area in ballooning is obstacle collision in flight. With 26 occurrences over the last five years the data shows that powerline collisions or collisions with trees and buildings are the main issues. This is illustrated further in Figure 95.

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 a better preparation of the passengers for the imminent touchdown. 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 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 (34) 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 key risk area. There is one occurrence in the fire and smoke area for the past five years and it resulted in a fatal outcome.

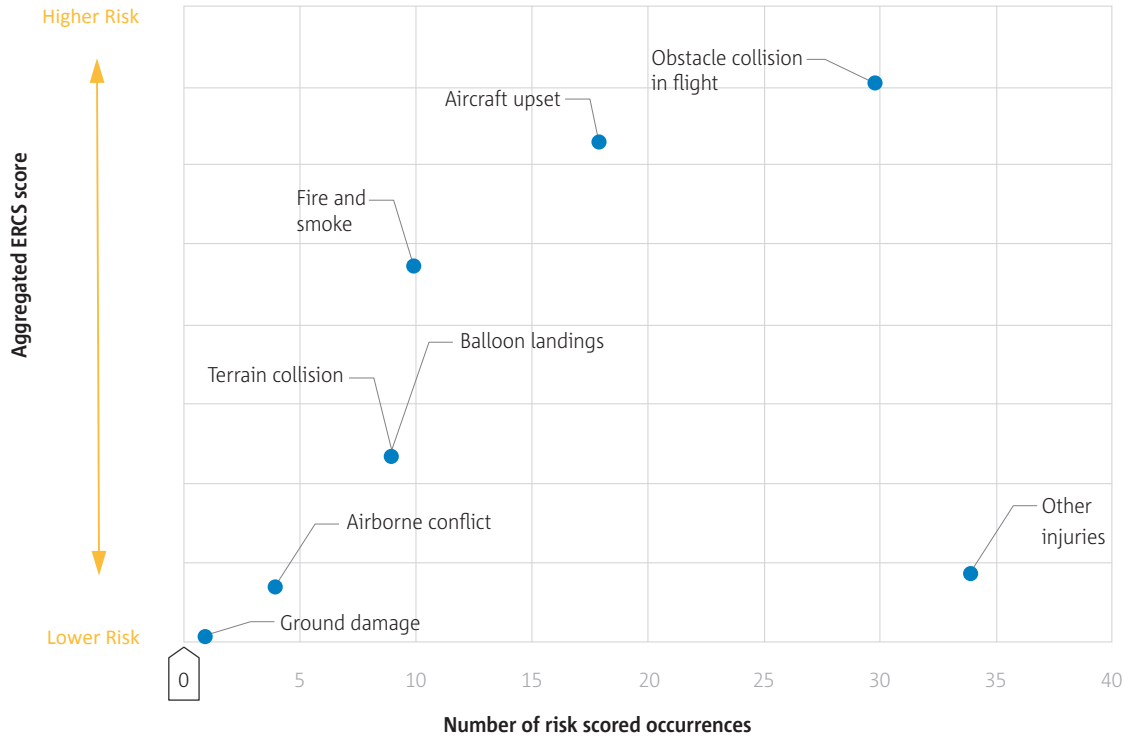


Figure 94 Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving balloons

Figure 95 lists the safety issues identified from the occurrence data and shows a comparison between the number of occurrences per safety issue and their aggregated ERCS score. Note that one single occurrence can be associated with more than one identified safety issue. A yellow bar in the graph that is considerably longer when compared with the underlying blue bar indicates a low number of occurrences contributing to a high risk.

The figure shows that the highest risks in ballooning are powerline collisions and the lack of presence and use of pilot restraints. The fifth issue in the figure is the collision with buildings and trees. That issue is the highest in terms of number of occurrences but bares low risk. The fourth issue in the list is the control of flight path and inertia. Fuel systems and aging structures refer to the same accident. The aging structures issue was raised last year due to the fact that many balloons are kept in storage for a long time. This can affect the integrity of the balloon if the storage facility used is insufficient.

It is also worth mentioning that there are other issues in the data portfolio which are not quantified. Issues like pressure to fly and system reliability, that capture equipment and structural failures on board the balloon, have been identified as safety issues, but data is currently not available to support them. They are, however, considered relevant, especially the aging structures issue as the taxonomy does not currently support the coding of such events. It is important that balloon operators consider the condition of their aircraft before flying and ensure safe and dry storage of the aircraft, and that all parts are within set time or material limits according to their approved airworthiness limitations. It is also known that pressure to fly can be significant in ballooning as the pilot usually does not get paid unless he/she flies. Every flight needs to be carefully prepared with special attention to the weather forecast and development en route.

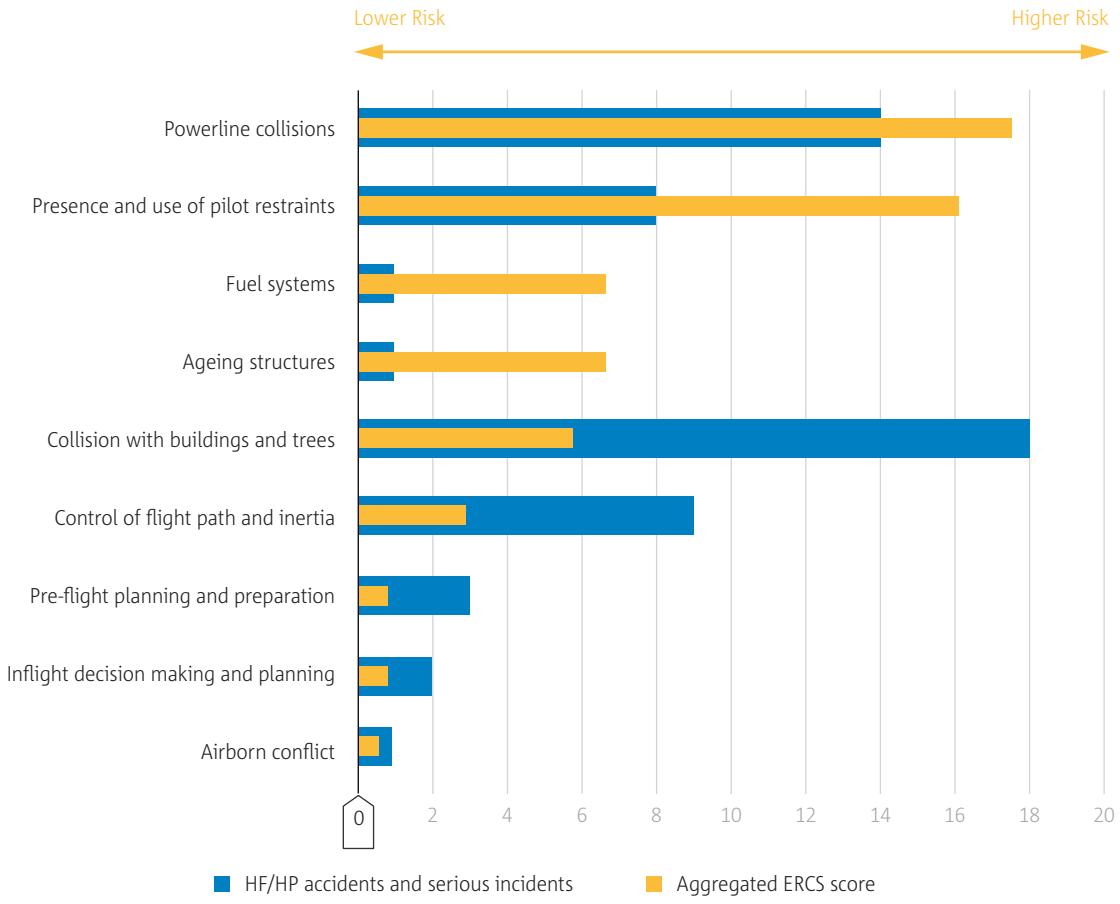


Figure 95 Safety issues by aggregated ERCS score and numbers of accidents and serious incidents involving balloons

The data portfolio shown in Table 27 links the safety issues with the key risk areas to which they contribute. The key risk areas are listed at the top of the table and are prioritised from the left to right based on the aggregated ERCS risk score. The safety issues are listed on the left of the table and are also sorted from the top by decreasing aggregated ERCS risk score. The different colour bands denote high to low risk of the safety issues.

Table 27 Data portfolio for balloons

Safety issue	Key Risk Areas (ERCS)						
	Obstacle collision	Balloon landings	Aircraft upset	Fire and smoke	Other injuries	Airborne conflict	Terrain collision
Powerline collisions	x				o		
Presence and use of pilot restraints	x	x	x				
System reliability				o			
Ageing structures				o			
Collision with buildings and trees	x	o	o				x
Control of flight path and inertia	x				o	o	x
Pre-flight planning and preparation	o		o				o
Inflight decision making and planning	o		o				
Airborne conflict						o	

x = stronger contributor to the key risk area
o = weaker contributor to the key risk area

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. As a consequence of the UK's departure from the EASA system, in order that the data of 2021 can be compared to the preceding ten years on an equal basis, occurrence data originating from the UK is no longer included in the Annual Safety Review.

The chapter provides the key statistics for sailplanes and a data portfolio, which provides an overview of the main safety risk for these types of operations at the European level based on available occurrence data. For the first time the European Common Repository (ECR) will be used as the data source for the key statistics. The human factors/human performance chapter as well as the chapter on safety risks will use the EASA occurrence database as the data contains more relevant information for its purpose.

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 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 gliding community, with the leadership of the European Gliding Union (EGU), has been actively involved in EASA's work 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.

Key statistics

The key statistics for this domain are in Table 28 and Table 29 and include a comparison of the number of accidents (fatal and non-fatal) and serious incidents for the 10-year period (2011-2020) and the last year (2021). It also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe. Table 28 shows a clear downward trend in number of fatal and non-fatal accidents, but the number of serious incidents is going up compared to the 10-year average. Table 29 lays out the figures on number of fatalities and serious injuries. In 2021 there were 17 fatalities which is lower than the minimum value for the preceding 10 years. Compared to the 10-year average, the number of fatalities were reduced by 43% and the number of serious injuries by 35%.

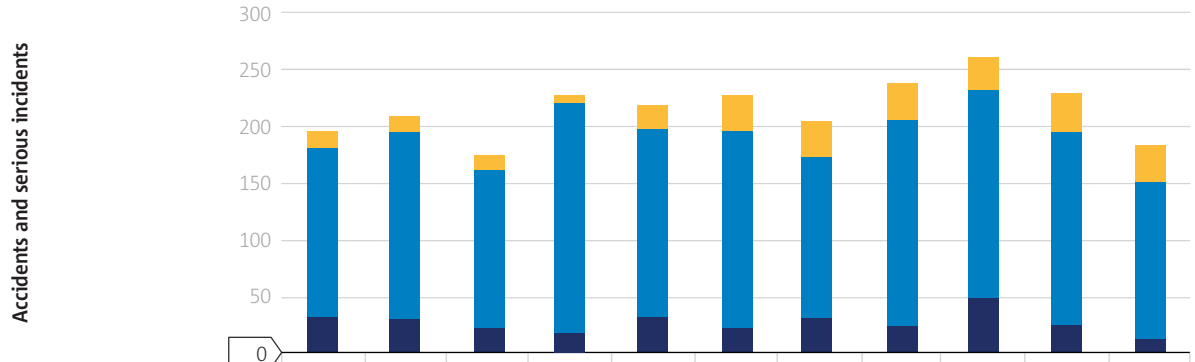
Table 28 Key statistics for sailplanes

2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
279	Fatal accidents	14	↓
1677	Non-fatal accidents	137	↓
227	Serious incidents	32	↑

Table 29 Fatalities and serious injuries involving sailplanes

	FATALITIES	SERIOUS INJURIES
2011 - 2020 total	299	338
2011 - 2020 max.	42	63
2011 - 2020 min.	21	20
2021	17	22

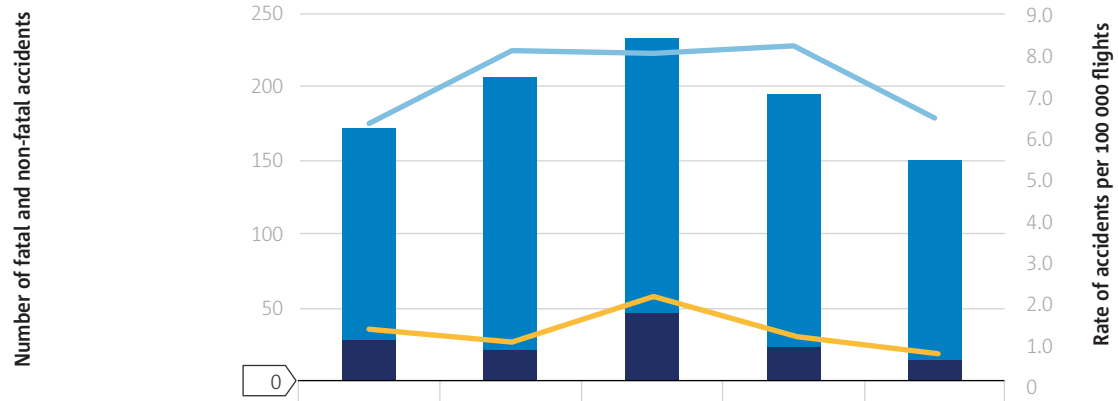
Figure 96 provides an overview of both fatal and non-fatal accidents and serious incidents from 2011 to 2021. The figure shows a stable trend over the period, however, for the past three years there has been a significant downward trend in number of fatal and non-fatal accidents.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	14	12	13	7	21	32	32	32	28	36	32
Non-fatal accidents	149	166	140	202	167	174	143	183	184	169	137
Fatal accidents	32	29	22	18	31	21	29	23	48	25	14

Figure 96 Fatal and non-fatal accidents and serious incidents per year involving sailplanes

Figure 97 provides an overview of both fatal and non-fatal accidents and estimated rates during the period 2017-2021. The rates applied are based on the annual GAMA/AOPA survey. Based on these rates it can be observed that during the pandemic year 2020 the estimated number of flights dopped about 10%. When factored with the number of fatal, and specifically non-fatal accidents in 2020 the non-fatal accident rate increases. In 2021 the number of flights is estimated to have increased by 4% from the previous year so the rates are decreasing. These figures, however, seem also to indicate that in 2020, especially when the restrictions were lifted, the mains spike of accidents occurred.



	2017	2018	2019	2020	2021
Non-fatal accidents	143	183	184	169	137
Fatal accidents	29	23	49	25	14
Fatal accident rate	1.3	1.0	2.1	1.2	0.7
Non-fatal accident rate	6.3	8.1	8.0	8.2	6.4

Figure 97 Numbers and rates of fatal and non-fatal accidents per year involving sailplanes

Figure 98 shows comparison between the years 2019 to 2021. The figure clearly shows a jump in the number of accidents in May 2020 when COVID-19 restrictions were lifted. In comparison to 2019 and 2021, the number of accidents is more evenly spread between months while in 2020 the main spike is from May till the end of August.

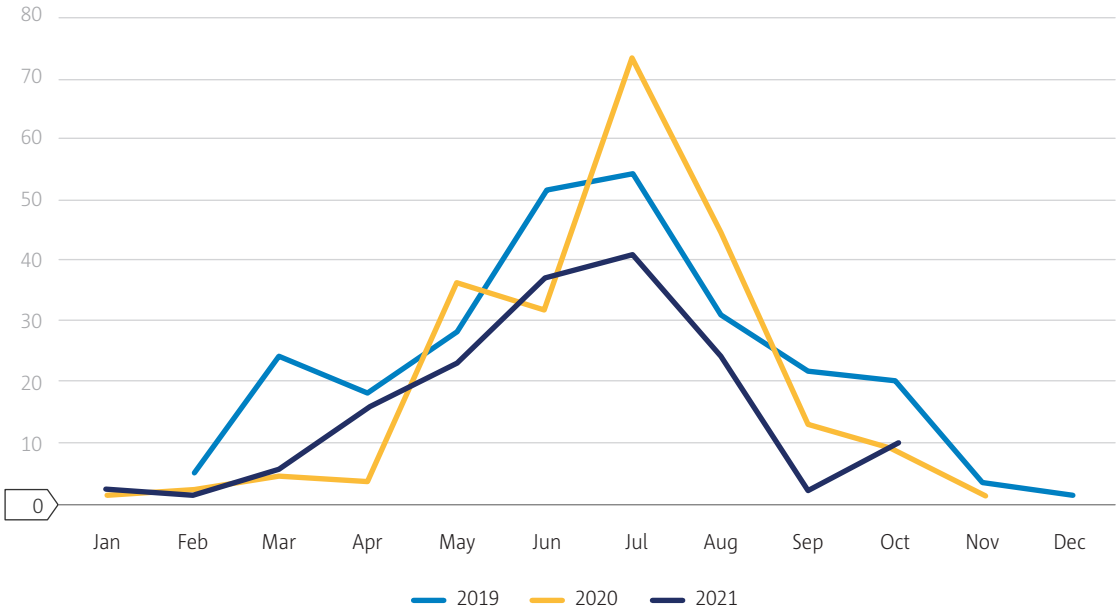
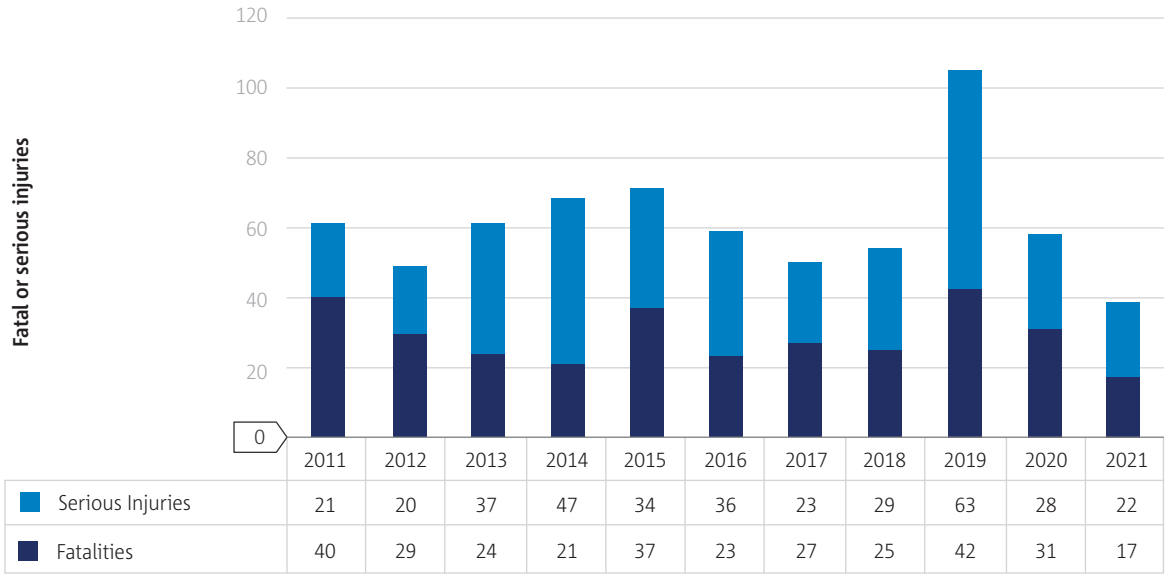


Figure 98 Comparison of number of accidents involving sailplanes per month from 2019-2021

Figure 99 shows a downward trend in number of fatalities and serious injuries, except for 2019 that was unusually high compared to other years within the period. Last year records the lowest number of fatalities compared with the previous 10 years. The figure also shows that the number of reported serious injuries are the lowest since 2012.



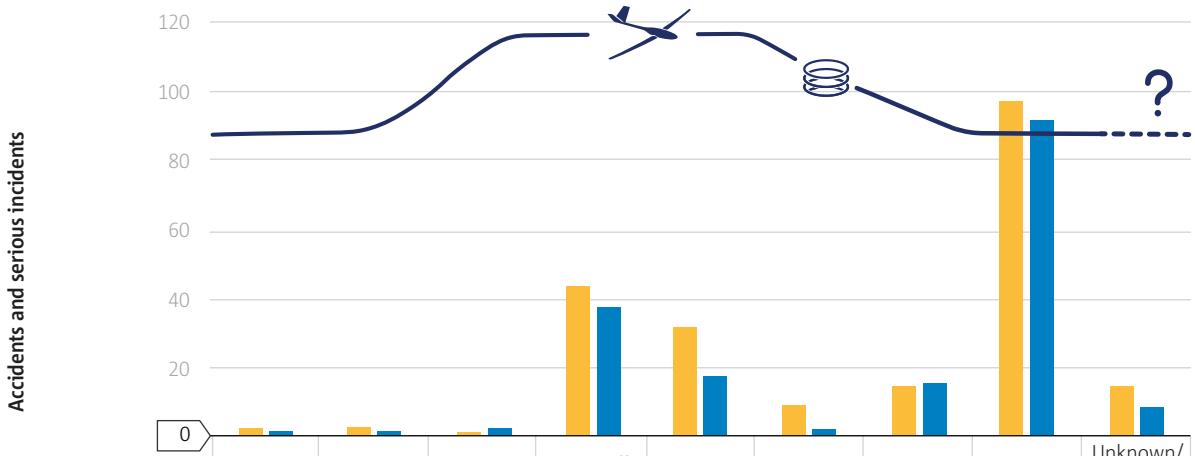
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	21	20	37	47	34	36	23	29	63	28	22
Fatalities	40	29	24	21	37	23	27	25	42	31	17

Figure 99 Fatal and serious injuries per year 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 100 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 injuries are fairly rare. 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.

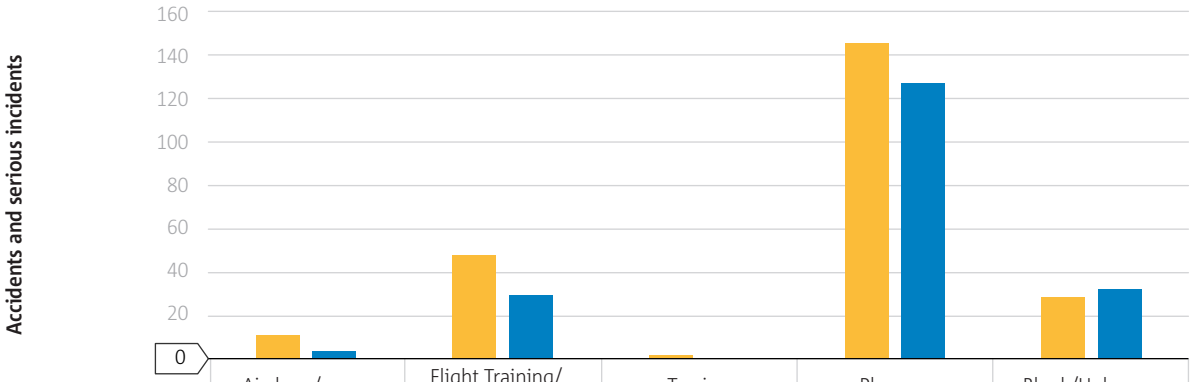


	Standing	Taxi	Tow	Take-off	En route	Manoevring	Approach	Landing	Unknown/ Blank
Average 2011-2020	2.1	3	0.8	43.9	32.8	9.7	15.2	97	15.2
2021	2	2	3	38	18	3	16	92	9

Figure 100 Accidents and serious incidents by phase of flight involving sailplanes

Operation type

Most sailplane accidents and serious incidents occurred during pleasure/private flights. Accidents during flight training come next but in 2021 there was a significant reduction of such 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.

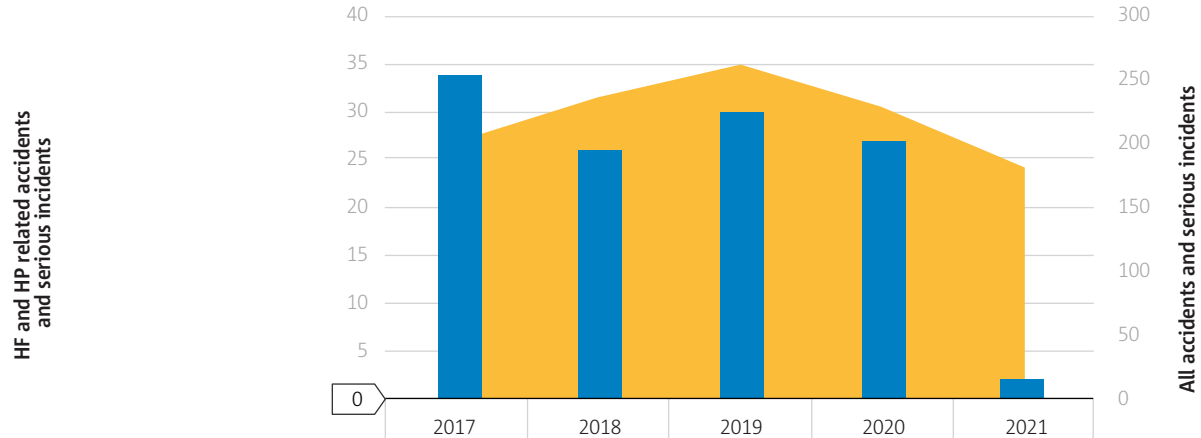


	Airshow/race	Flight Training/ Instructional	Towing	Pleasure	Blank/Unknown
Average 2011-2020	10.5	47.6	0.7	145.2	28.5
2021	4	30	0	127	32

Figure 101 Accidents and serious incidents by operation type involving sailplanes

Human factors and human performance

Approximately 11% of non-commercially operated sailplanes accident and serious incident reports identify human factors (HF) or human performance (HP) issues, these are labelled as personnel events in the ECCAIRS taxonomy. The figures for 2017 – 2020 are relatively stable in terms of the number of HF/HP issues slightly decreasing, whereas the figures for 2021 are showing a significant drop. This is because HF and HP issues are often not recorded within accident and serious incident reports until the final report is published. In addition, there are often less data available to investigators owing to the lack of recording devices on board the aircraft in question.



	2017	2018	2019	2020	2021
Accidents and serious incidents	204	238	261	230	183
HF/HP accidents and serious incidents	34	26	30	27	2

Figure 102 Human factors and human performance accidents and serious incidents involving sailplanes

The application of HF or HP codes at a high level can be seen in Figure 103. As with many of the domains in this review, situational awareness, personnel task performance and sensory events are the most coded high-level HF and HP event types. Physiological events remain less recognised, experienced, or coded.

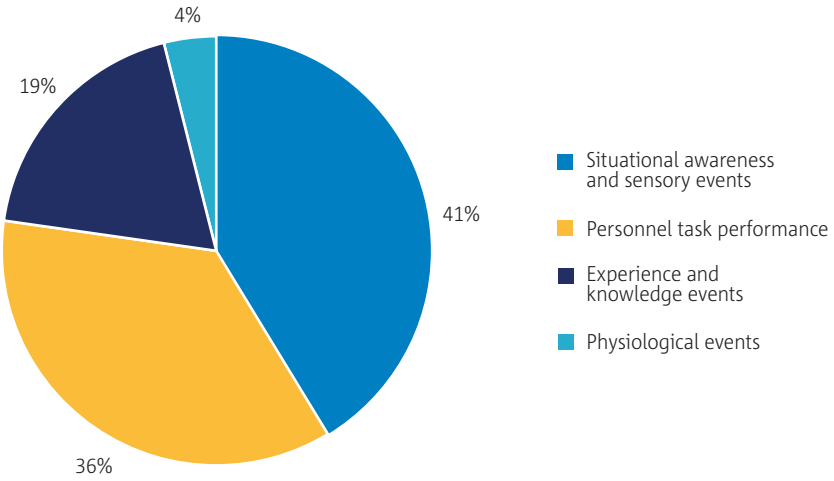


Figure 103 High level human factors and human performance event codes applied to accidents and serious incidents involving sailplanes

Figure 104 compares the numbers of accidents and serious incidents with the aggregated ERCS risk score of those incidents, using detailed HF and HP event codes. It can be seen that some events have a greater risk than others, as indicated where the aggregated risk score is far higher than the number of accidents and serious incidents. Impairment and incapacitation, as along with qualifications and experience stand out as the HF and HP event types having the highest aggregated risk score.

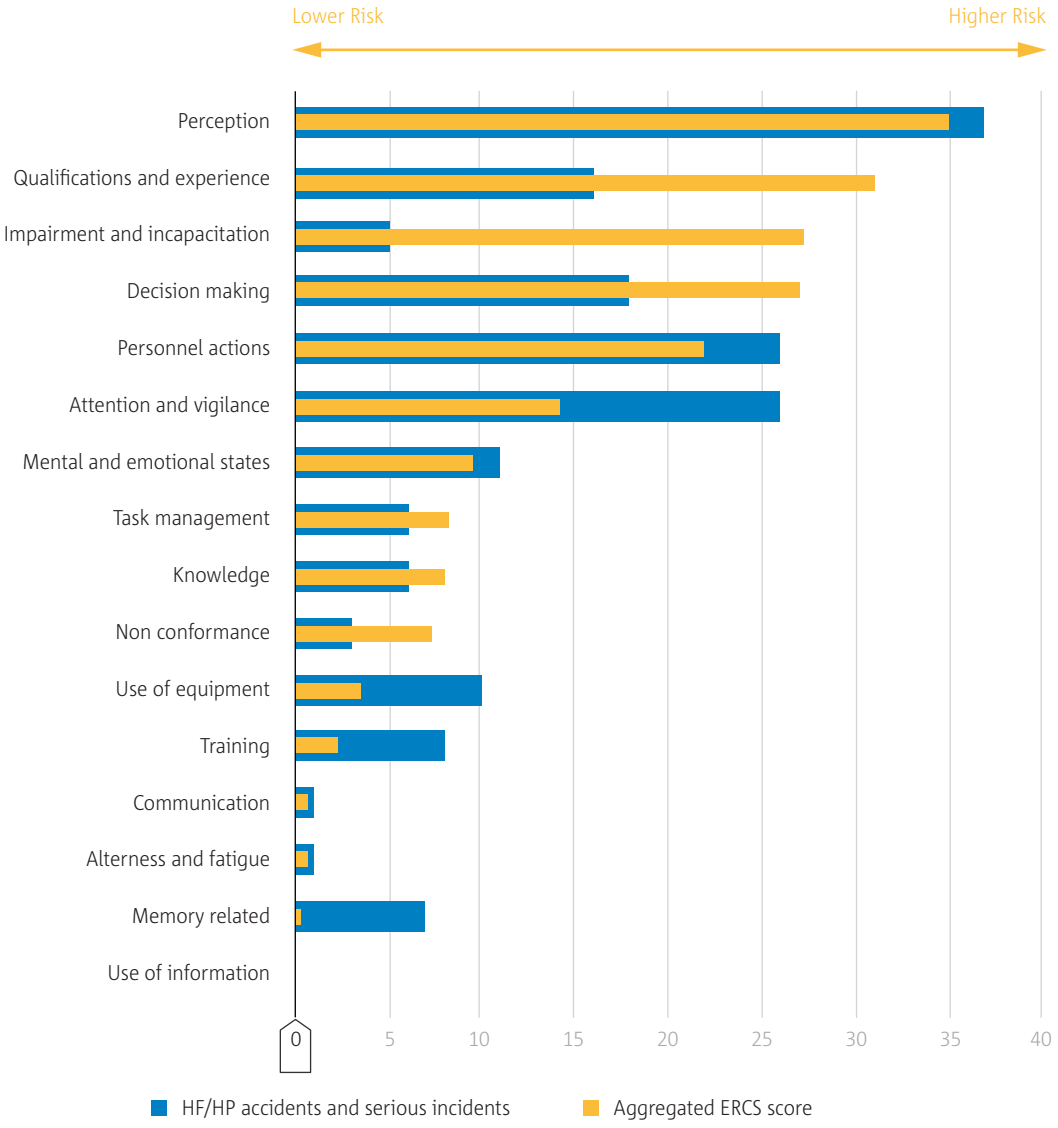


Figure 104 Detailed human factors and human performance event codes by aggregated ERCS score and numbers of accidents and serious incidents involving sailplanes

Safety risks for sailplanes

The safety risks for sailplanes identified by EASA are derived from accident and serious incident data from the EASA occurrence repository, covering the period 2017-2021 (850 occurrences). The following paragraphs refer to accidents and serious incidents that have been risk scored using the ERCS methodology and divided into higher and lower risk. An explanation of the ERCS and why it is useful is provided in the introduction to this annual review.

The main key risk areas for this domain are highlighted in Figure 105 and are defined by their potential accident outcome. Figure 105 shows that aircraft upset bares with it the far highest risk with the potential of loss of life. Aircraft upset or loss of control can occur in all phases of the flight. It is most common during incomplete winch launches during take-off, steep turns during approach and stalling due to sudden wind change during landing. Excursions, however, are very low in risk despite the many occurrences. The main safety issues for excursions are off-field and landing on airfield. Terrain collision numbers are also quite high and they relate to how closely sailplanes are flown to mountain ridges and hills. Obstacle collision in flight relates to the collision with trees and other structures during take-off, approach, and landing phases of the flight. Lastly it is worth mentioning the airborne collision key risk area. Sailplanes can be very hard to spot by other aircraft due to their slim design and their white colour. Collisions occur both between two sailplanes but as well with other motorised small aircraft. It is therefore important that all pilots have on board a system that enables them to be aware of other traffic around them and never assume that other pilots are seeing them. Regular location reports on the local radio frequency also contribute to minimizing that risk.

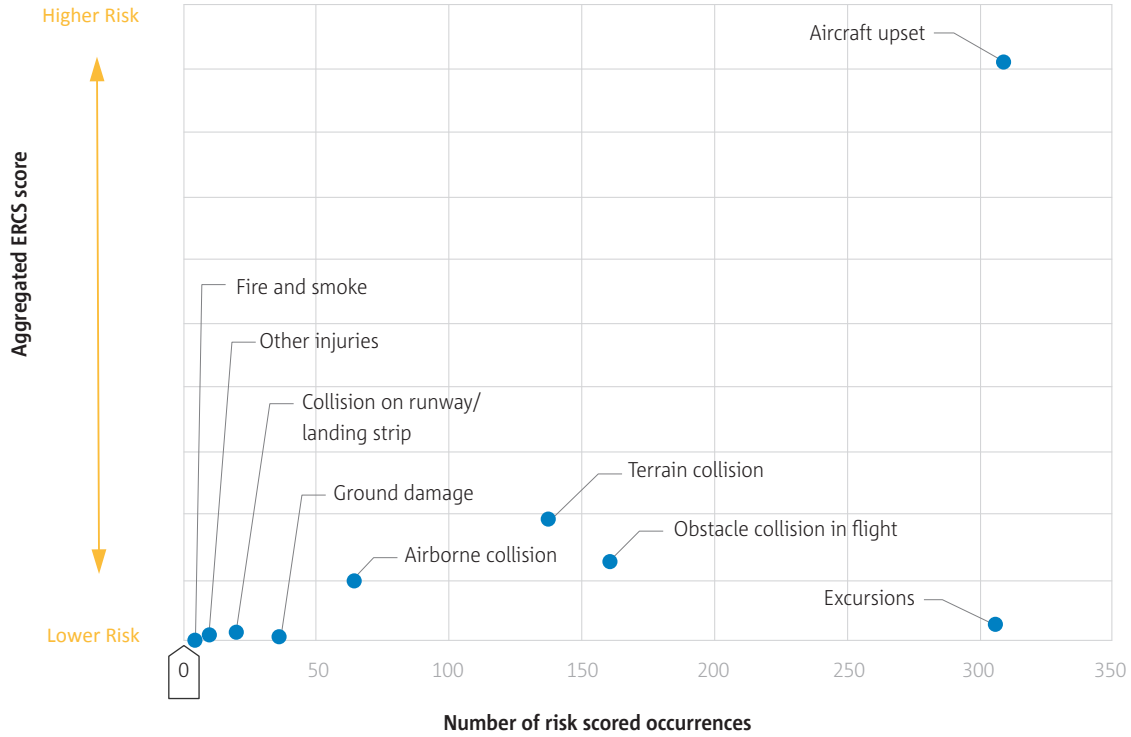


Figure 105 Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving sailplanes

The identified safety issues in Figure 105 show the number of occurrences behind the safety issue but as well the aggregated ERCS risk score for the same occurrences. Note that each occurrence can be reflected in more than one safety issue.

When exploring the identified safety issues shown in Figure 106 it can be observed, based on the reported occurrences, that inappropriate flight control input issues bear the highest number of occurrences and the highest risk as well. This implies that the issue is strongly contributing to a loss of control, or the aircraft upset key risk area. Off-field landings is the next highest risk. It is somewhat higher than the number of occurrences, however, the risk is mainly related to the aircraft damage even though some injuries are resulting from these landings. The third highest risk involves strongly related issues, which are aerotow and incomplete winch launch. The main risk during an aerotow take-off has to do with the coordination between the towing and sailplane pilots. For example, if the sailplane pilot does not keep a correct track behind the towing aircraft it can result in a loss of control of the towing aircraft. Winch launches run the risk of the wing hitting the ground during the take-off run causing the aircraft to cartwheel and crash. The take-off angle during a winch launch is also critical to maintaining the structural load within limits. Airborne conflict is mostly related to other traffic in the vicinity, and the need for the pilot and aircraft to be seen and see others, while regularly reporting your location on the radio. The experience, training and competence of pilots does play a role in some of the accidents and serious incidents resulting in, for example, inappropriate flight control inputs, inflight decision making and planning and handling of technical failures. This is also reflected in reactions to high wind encounter and under/overshoot occurrences.

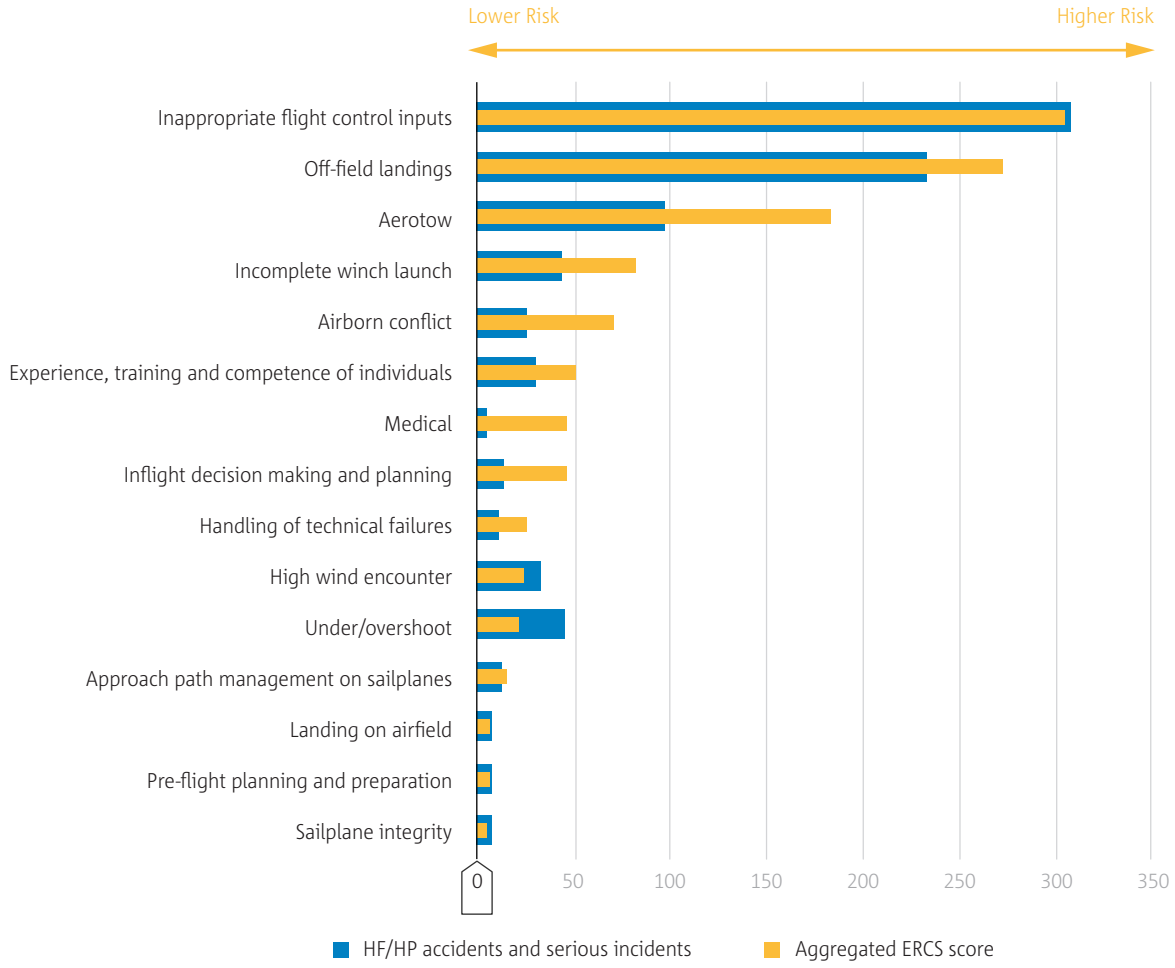


Figure 106 Identified safety issues showing number of occurrences and the aggregated ERCS risk score

The data portfolio presents the main key risk areas and their relationship to the identified safety issues. All occurrences in the data are risk scored using the European Risk Classification Scheme (ERCS). The key risk areas are sorted by the aggregated ERCS score from left to right and the safety issues are sorted by the aggregated ERCS score from top to bottom. The different colour bands denote high to low risk for the safety issues.

Table 30 Data portfolio for sailplanes

Safety issue	Key Risk Areas (ERCS)								
	Aircraft upset	Terrain collision	Obstacle collision in flight	Airborne collision	Excursion	Collision on runway	Other injuries	Ground damage	Fire and smoke
Inappropriate flight control inputs	x	x	x	o	x	o	o	o	
Off-field landings	x	x	x	o	x	o	o	o	
Aerotow	x	o	x	o	x	o	o	o	o
Incomplete winch launch	x	o	o	o	o	o	o		
Airborne conflict				x					
Experience, training and competence of individuals	x	o	o	o	o		o	o	
Medical	o	o							
Inflight decision making and planning	x	o	o	o	o				
Handling of technical failures	o	o	o		o				
High wind encounter	x	o	o		o	o		o	
Under/overshoot	o	x	x		x	o		o	
Approach path management on sailplanes	o		o		o	o			
Landing on airfield	o		o	o	o				
Pre-flight planning and preparation	o		o	o	o				
Sailplane integrity	o								

x = higher number of associated occurrences
o = lower number of associated occurrences

Chapter 6

Aerodromes and ground handling

This chapter covers aerodrome and ground handling operations in EASA Member States. 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. As a consequence of the United Kingdom's departure from the EASA system, in order that the data of 2021 can be compared to the preceding ten years on an equal basis, occurrence data originating from the UK is no longer included in the Annual Safety Review.

It is worth noting that the accidents and serious incidents in this chapter are those related to aerodrome and ground handling operations in a general context. This means that the aerodrome infrastructure, aerodrome operations or ground handling operation itself may or may not have contributed to a given occurrence but could have a role in preventing similar occurrences in the future. Accidents relating to occupational health and safety, with no element of aviation safety, are not included.

In addition to key statistics for the aerodromes and ground handling domain, a data portfolio for aerodrome and ground handling operations is provided.

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

Key Statistics

The key statistics for this domain are shown in Table 31 and Table 32. This includes accidents and serious incidents related to aerodrome infrastructure, aerodrome procedures and ground handling operations at aerodromes that are located in the EASA Member States. This means that the data includes not only aerodromes that fall under the scope of the Basic Regulation and need to apply EU rules, but also includes aerodromes that fall under the scope of national regulations. In line with the lower traffic, the numbers of fatal and non-fatal accidents in 2021 were lower than the average of the preceding decade, however the number of serious incidents was higher than the decade average.

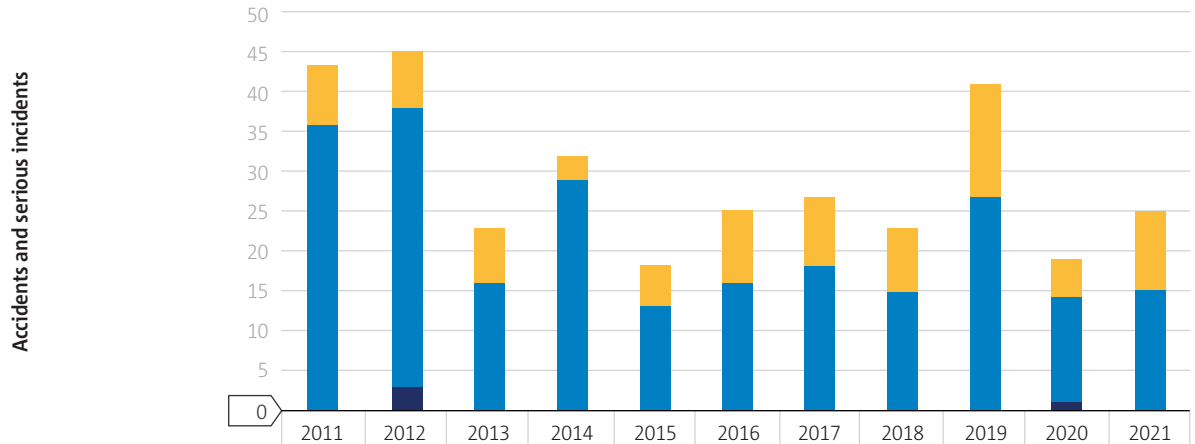
Table 31 Key statistics for aerodromes and ground handling

2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
4	Fatal accidents	0	↓
218	Non-fatal accidents	15	↓
74	Serious incidents	10	↑

Table 32 Fatalities and serious injuries for aerodromes and ground handling operations

	FATALITIES	SERIOUS INJURIES
2011 - 2020 total	6	22
2011 - 2020 max.	5	4
2011 - 2020 min.	0	0
2021	0	3

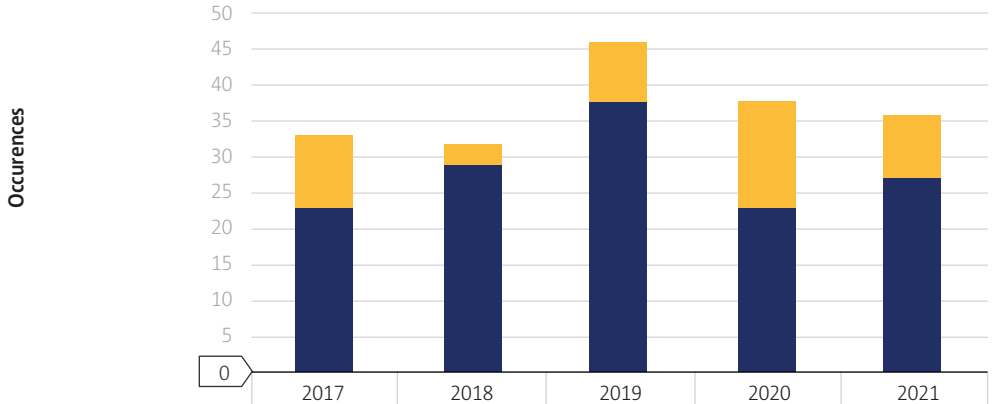
Figure 107 shows the number of accidents and serious incidents per year.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	7	7	7	3	5	9	9	8	14	5	10
Non-fatal accidents	36	35	16	29	13	16	18	15	27	13	15
Fatal accidents	0	3	0	0	0	0	0	0	0	1	0

Figure 107 Fatal accidents, non-fatal accidents and serious incidents per year involving aerodromes and ground handling

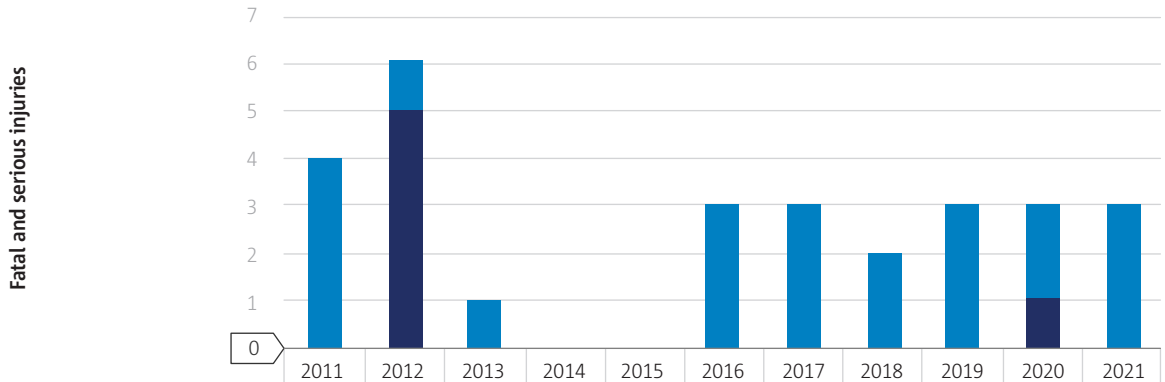
In the aerodromes and ground handling domain, EASA has reviewed the related occurrences in the EASA database for 2017-2021 with regards to risk. All accidents and serious incidents within the scope have been risk assessed using the European Risk Classification Scheme (ERCS) methodology and have been assigned an ERCS score. An explanation of the ERCS and why it is useful is provided in the introduction to this annual review. The numbers of accidents and serious incidents per year, together with the associated ERCS score, is shown in Figure 108. The aggregated ERCS scores by higher risk and lower risk occurrences show a different pattern than the representation of accidents and serious incidents. This is because some occurrences classified as serious incidents have inherent risk profiles that may be equal or even exceed the risk of some accidents. The number and distribution of occurrences in 2021 were similar to 2017 and 2020.



	2017	2018	2019	2020	2021
Lower Risk (ERCS)	10	3	8	15	9
Higher Risk (ERCS)	23	29	38	23	27

Figure 108 Numbers of ERCS higher risk and lower risk occurrences per year involving aerodromes and ground handling

The number of fatalities and serious injuries per year is shown in Figure 109. There were 3 serious injuries in 2021, the same number as in 2016, 2017 and 2019. As the numbers are so low, it is not meaningful to do any trend analysis.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious Injuries	4	1	1	0	0	3	3	2	3	2	3
Fatalities	0	5	0	0	0	0	0	0	0	1	0

Figure 109 Fatal and serious injuries per year involving aerodromes and ground handling

Number of EASA MS certified aerodromes

The Basic Regulation (EU) 2018/1139 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 2021, 542 aerodromes are within the scope of the Basic Regulation, of which, 398 have been certified, while 127 aerodromes have been granted an exemption in accordance with Article 2(1)(e) and Article 2(7) of Regulation (EU) 2018/1139 (the EASA Basic Regulation), due to low traffic volumes. Figure 110 shows the number of aerodromes per EASA Member State that are certified in accordance with the European aviation safety rules or that are exempted due to low traffic volumes. It should be noted that although ground handling services are regulated through the EASA Basic Regulation, the delegated acts laying down the detailed rules for the operation and oversight of ground handling services are yet to be adopted. These acts are being developed within EASA rulemaking task RMT.0728.

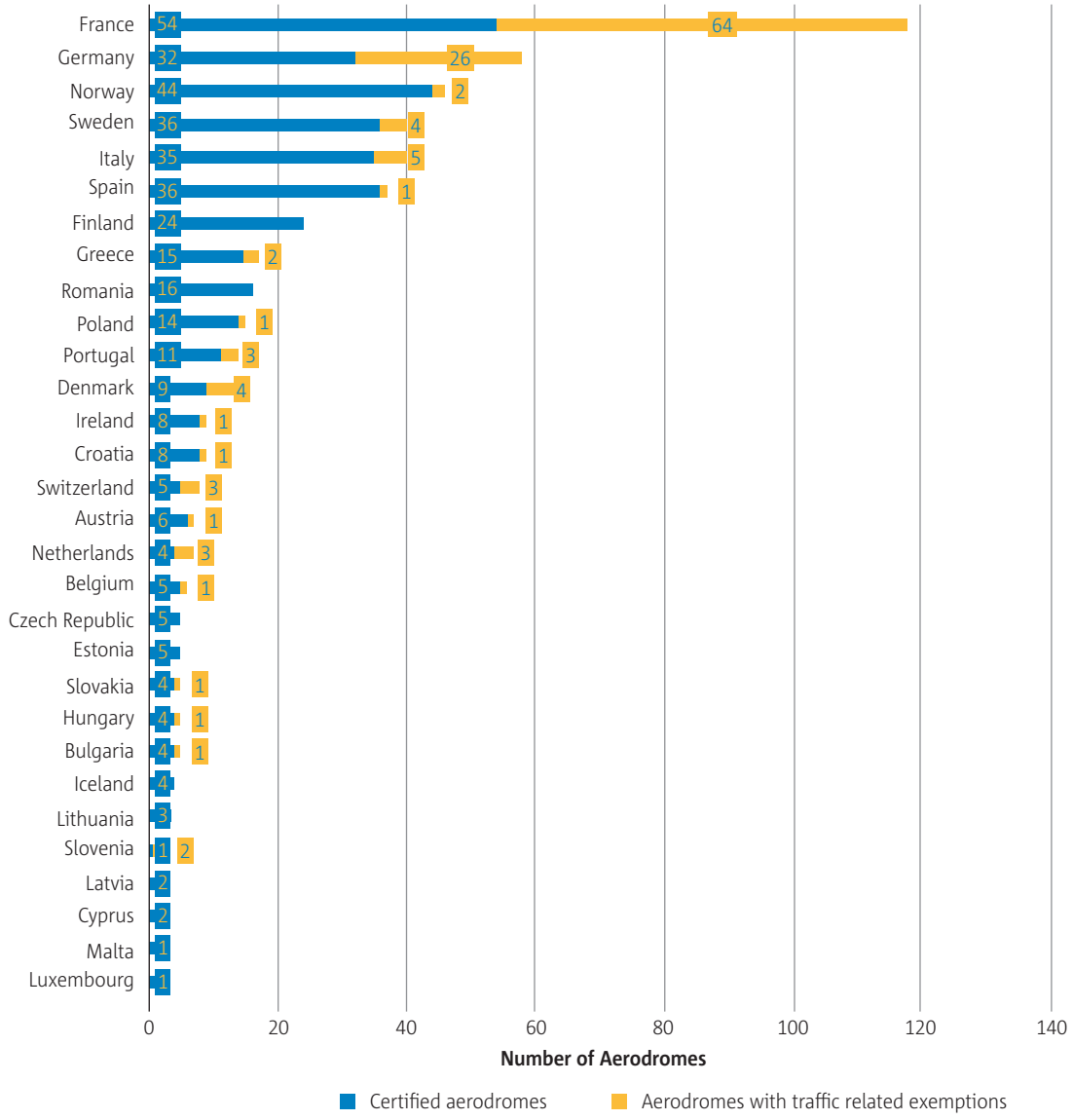
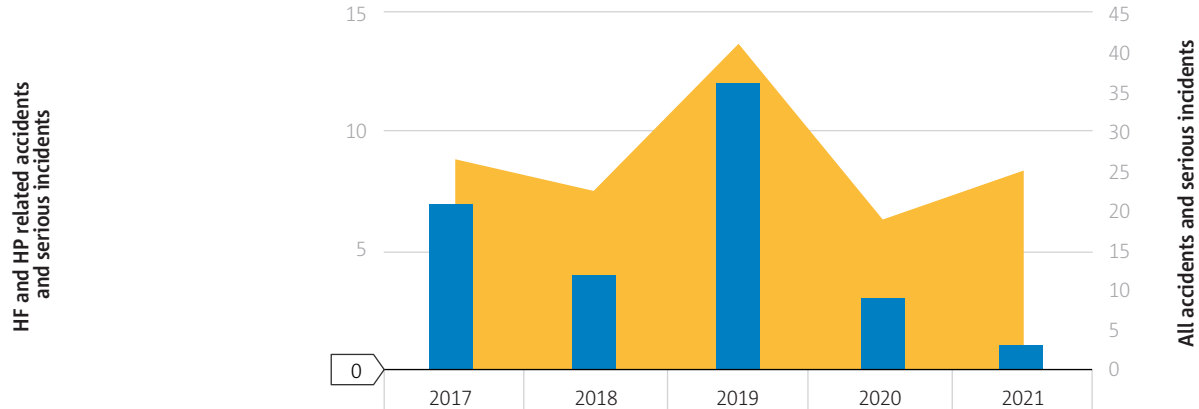


Figure 110 Aerodromes within the scope of Regulation (EU) 139/2014 (EASA ADR) by EASA Member State

Human factors and human performance

20% of accident and serious incident reports in the aerodromes and groundhandling domain identify human factors (HF) or human performance (HP) issues. Both HF and HP issues are labelled as personnel occurrences in the ECCAIRS taxonomy. Looking at the figures for the past five years, 2019 shows a particular increase in accidents and serious incidents and in HF/HP causal factors. The figure for 2021 should be viewed as preliminary and is likely to increase, since HF or HP issues are often not recorded within accident and serious incident reports until the final investigation report has been published.



	2017	2018	2019	2020	2021
Accidents and serious incidents	27	23	41	19	25
HF/HP accidents and serious incidents	7	4	12	3	1

Figure 111 Human factors and human performance accidents and serious incidents involving aerodromes and ground handling

The application of HF or HP codes at a high level can be seen in Figure 112. Situational awareness and personnel task performance are the most common category of HF or HP issue applied to accidents and serious incidents involving aerodromes and ground handling, followed by sensory events. These may be more easily discernible in an investigation than the factors that cause them.

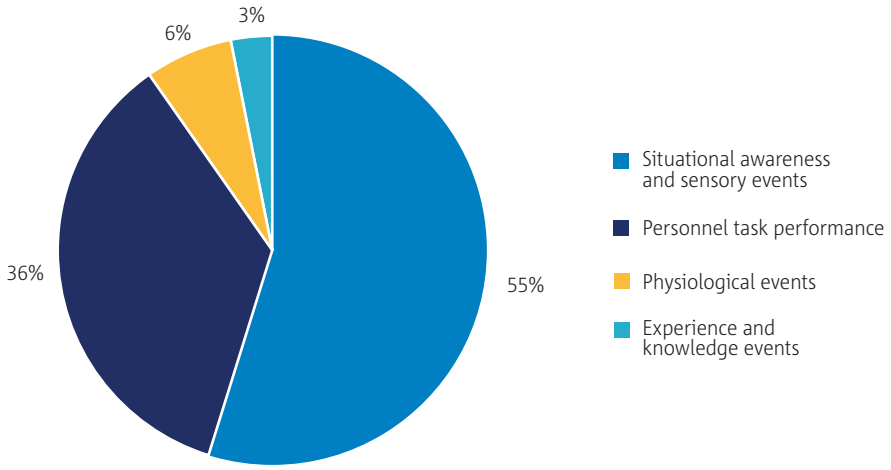


Figure 112 Human factors and human performance accidents and serious incidents involving aerodromes and ground handling

Figure 113 compares the numbers of accidents and serious incidents with the aggregated ERCS risk score of those occurrences, using detailed HF and HP event codes. Some events carry a greater risk than others, as indicated where the aggregated risk score is far higher than the number of accidents and serious incidents. Even though perception is an issue frequently reported, it carries lesser risk than the communication, as seen in the graph below.

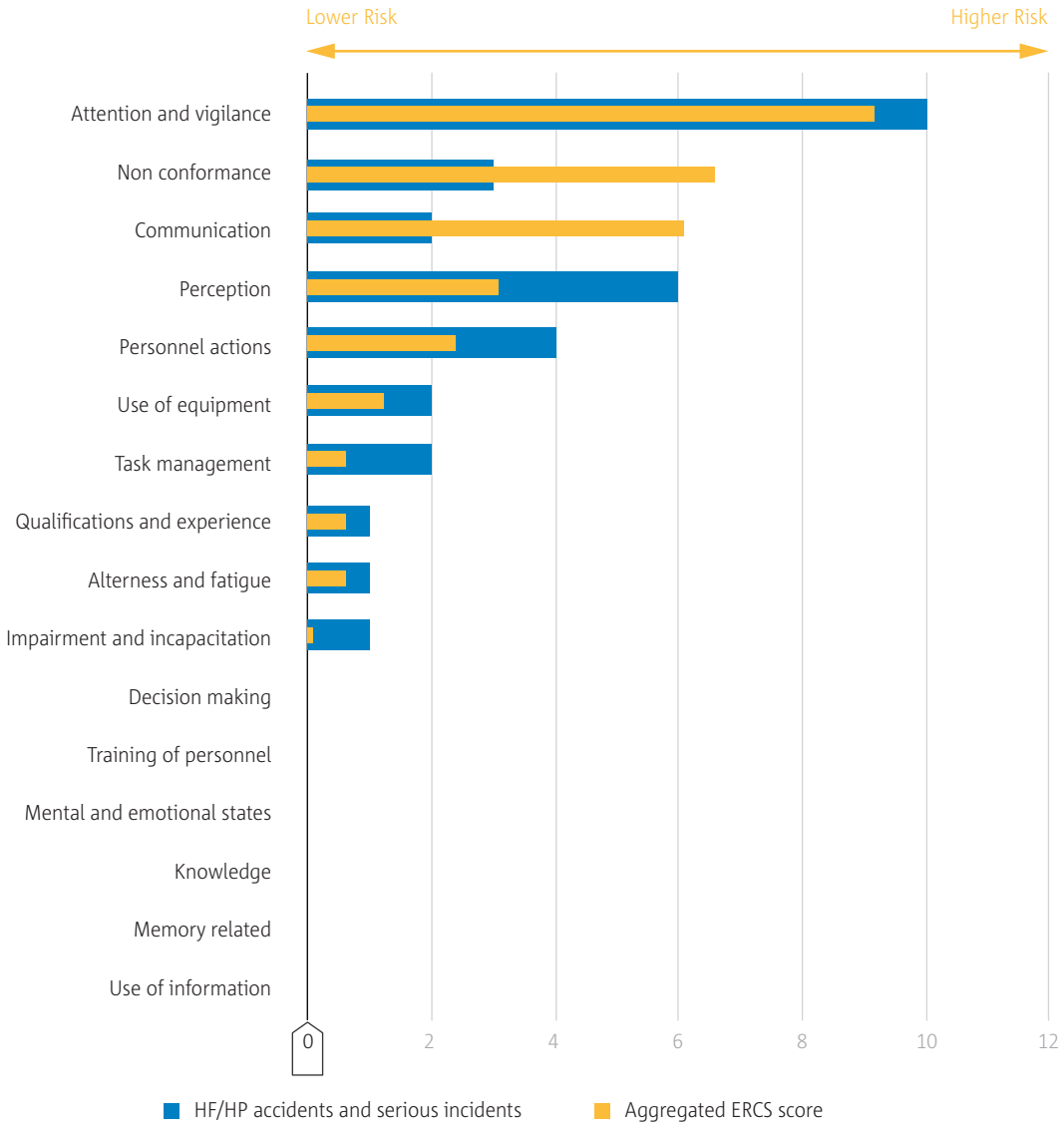


Figure 113 Detailed human factors and human performance event codes by aggregated ERCS score and number of accidents and serious incidents involving aerodromes and ground handling

Safety risks for aerodromes and ground handling

The safety risks for aerodromes and ground handling are derived from accident and serious incident data from the EASA occurrence repository and the European Central Repository, covering the period 2017-2021 (185 occurrences).

The main key risk areas for this domain are highlighted in Figure 114 and are defined by their potential accident outcome and by the immediate precursors of that accident outcome.

The most frequent key risk area for aerodrome and ground handling related accidents and serious incidents is ground damage, followed by aircraft upset and other injuries. In terms of aggregated risk, aircraft upset is the top key risk area, followed by ground damage and fire, smoke and pressurisation thereafter.

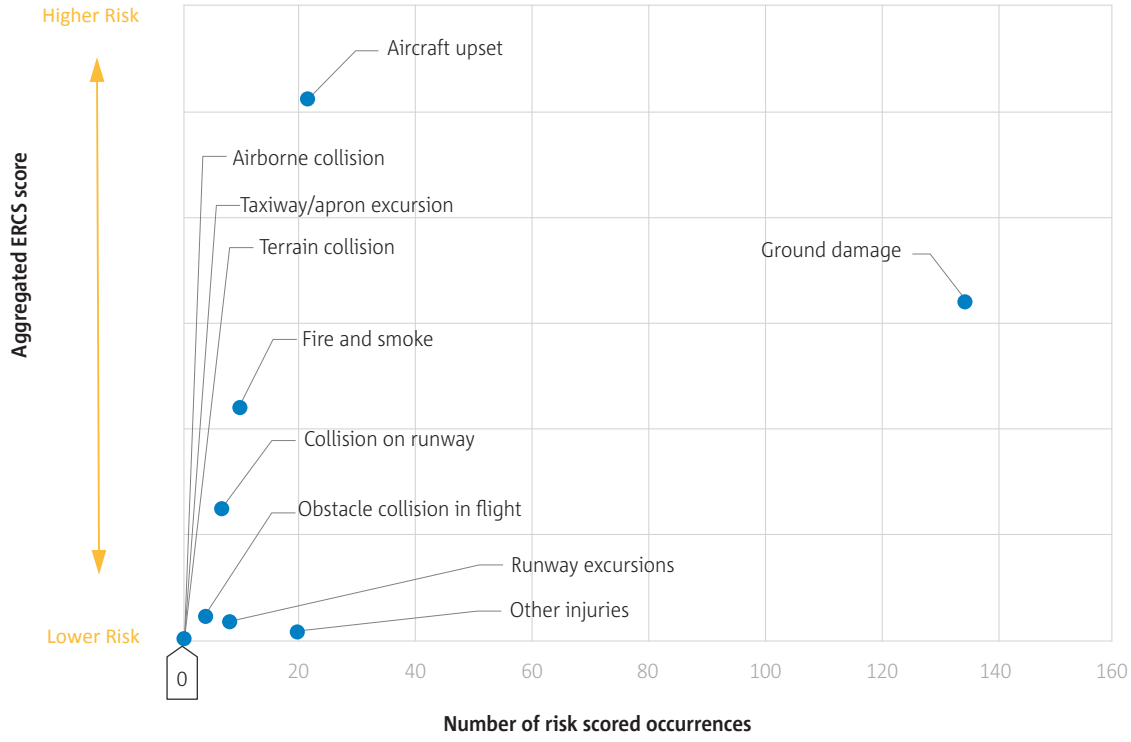


Figure 114 Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving aerodromes and ground handling

Figure 115 shows a comparison between the number of occurrences per safety issue and their aggregated ERCS score. A yellow bar in the graph that is considerably longer in comparison with the underlying blue bar indicates a low number of occurrences contributing to a high risk.

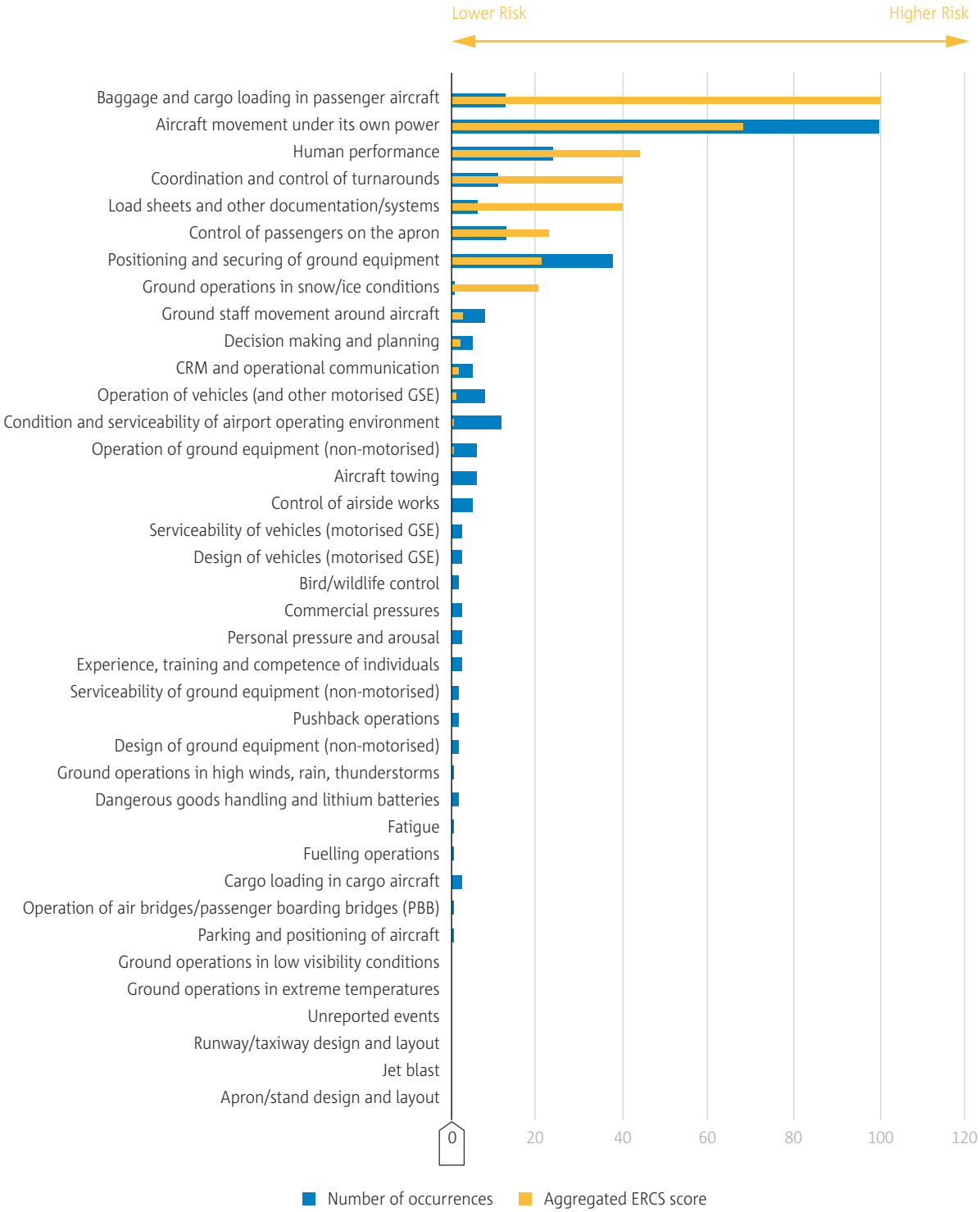


Figure 115 Safety issues by aggregated ERCS score and numbers of occurrences involving aerodromes and ground handling

The data portfolio is shown in Table 33 and links the safety issues with the key risk areas to which they contribute. The key risk areas are listed at the top of the table and are prioritised from left to right based on the aggregated ERCS-risk score. The safety issues are listed on the left of the table and are also sorted from the top by decreasing aggregated ERCS risk score. The different colour bands denote high to low risk of the safety issues. Baggage and cargo loading in passenger aircraft is the safety issue with the highest potential risk, and this issue is under assessment within the European safety risk management (SRM) process.

Table 33 Data portfolio for aerodromes and ground handling

Safety issue	Key Risk Areas (ERCS)											
	Aircraft upset	Ground damage	Fire, smoke, pressurisation	Collision on runway	Obstacle collision in flight	Runway excursion	Other injuries	Airborne collision	Security	Taxiway/apron excursion	Terrain collision
Baggage and cargo loading in passenger aircraft	x		o								
Aircraft movement under its own power	o	x		x	o	x	o				
Human performance	x	x	o	o			o				
Coordination and control of turnarounds	x	o	o				o				
Load sheets and other documentation/ systems	x										
Control of passengers on the apron	o		o				o				
Positioning and securing of ground equipment	o	x		o	o	o					
Ground operations in snow/ice conditions	o										
Ground staff movement around aircraft	o	o		o	o		o				
Decision making and planning	o	o		o							
CRM and operational communication	o	o	o	o			o				
Operation of vehicles (and other motorised GSE)		x									
Condition and serviceability of airport operating environment	o	x				o	o				
Operation of ground equipment (non-motorised)	o	x									
Aircraft towing		x									
Control of airside works	o	o				o	o				

Design of vehicles (motorised GSE)		o									
Serviceability of vehicles (motorised GSE)		o									
Bird/wildlife control	o										
Experience, training and competence of individuals	o	o					o				
Personal pressure and arousal	o	o									
Commercial pressures	o	o									
Design of ground equipment (non-motorised)		o									
Pushback operations		o									
Serviceability of ground equipment (non-motorised)		o									
Ground operations in high winds, rain, thunderstorms		o									
Dangerous goods handling and lithium batteries			o								
Fuelling operations			o								
Fatigue		o									
Cargo loading in cargo aircraft	o		o								
Operation of air bridges/passenger boarding bridges (PBB)		o									
Apron/stand design and layout											
Jet blast											
Runway/taxiway design and layout	o	o		o	o		o				
Unreported events											
Ground operations in extreme temperatures											
Ground operations in low visibility conditions											
Parking and positioning of aircraft											

x = stronger contributor to the key risk area
o = weaker contributor to the key risk area

Chapter 7
ATM/ANS

This chapter covers accidents and serious incidents related to the provision of air traffic management/ 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. As a consequence of the UK's departure from the EASA system, in order that the data of 2021 can be compared to the preceding ten years on an equal basis, occurrence data originating from the UK is no longer included in the Annual Safety Review.

Accidents and serious incidents in this chapter involve at least one commercial air transport (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 are related to the provision of services by ATM/ANS providers, henceforth referred to as ATM/ANS related occurrences. Occurrences in which the ATM system may or may not have contributed to the given occurrence but may have played a role in preventing or mitigating similar occurrences in the future are considered.

Within ATM/ANS related occurrences lies a subset known as ATM/ANS contribution. ATM/ANS contribution comprises occurrences where the provision of services by the ATM/ANS was a contributing factor in the occurrence or played a role in aggravating the occurrence encountered by the aircraft. The ATM/ANS contribution occurrences are accidents and serious incidents that were reported with the attribute that ATM was directly involved or indirectly involved.

The chapter introduces the key statistics on ATM/ANS occurrences and concludes with the data portfolio, providing an overview of the main safety risks in the ATM/ANS domain from a data perspective.

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

Key statistics

The key statistics for this domain are in Table 34 and Table 35. They include a comparison of the number of fatal and non-fatal accidents and serious incidents for the 10-year period 2011-2020 and the last year (2021), splitting the data into ATM/ANS related or ATM/ANS contribution accidents and serious incidents. Table 36 also includes a comparison of the fatalities and serious injuries sustained in those accidents during the same timeframe.

Table 34 shows that in 2021, no ATM/ANS related fatal accidents occurred, and 2 ATM/ANS related non-fatal accidents took place in EASA MS. This means no change compared to 2020 for fatal accidents and a decrease by one occurrence for ATM/ANS related non-fatal accidents. As can be seen in Table 35, in the last 10 years, there have been no fatal accidents with ATM/ANS contribution. Considering the average of the last 10 years, the number of ATM/ANS related serious incidents in 2021 was lower than in the previous years with 13 recorded serious incidents. The number of serious incidents with ATM/ANS contribution was lower than those in the previous, years with 4 serious incidents in 2021.

Table 34 Key statistics for ATM/ANS related accidents and serious incidents

2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
9	Fatal accidents	0	↓
47	Non-fatal accidents	2	↓
307	Serious incidents	13	↓

Table 35 Key statistics for ATM/ANS contribution accidents and serious incidents

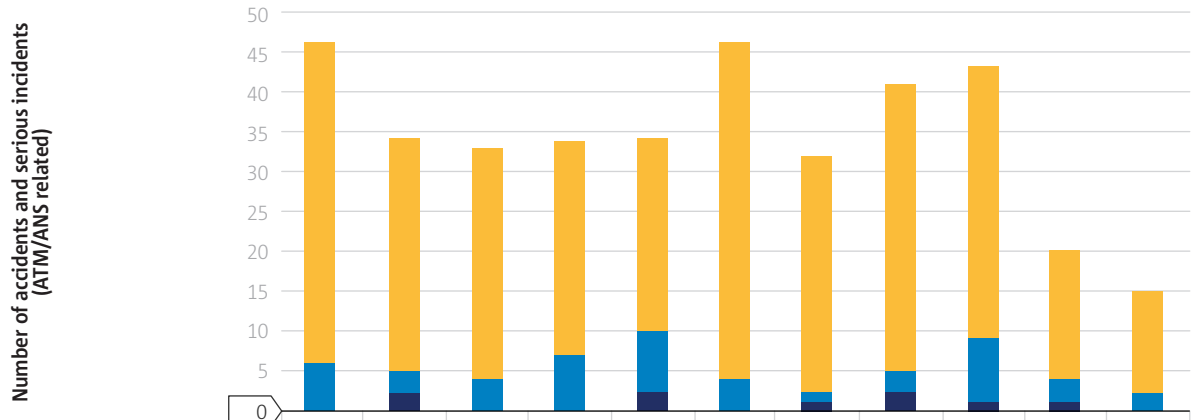
2011 - 2020 TOTAL	TIMESPAN	2021	2021 VS 2011-2020
0	Fatal accidents	0	=
6	Non-fatal accidents	0	↓
121	Serious incidents	4	↓

As shown in Table 36, no ATM/ANS related fatalities and no fatalities with ATM/ANS contribution were recorded in 2021. While 3 ATM/ANS related serious injuries were recorded, no serious injuries with ATM/ANS contribution were reported for 2021.

Table 36 Number of fatalities and serious injuries involving ATM/ANS

	FATALITIES		SERIOUS INJURIES	
	ATM RELATED	ATM CONTRIBUTION	ATM RELATED	ATM CONTRIBUTION
2011-2020 total	34	0	42	3
2011-2020 max.	8	0	8	1
2011-2020 min.	4	0	1	1
2021	0	0	3	0

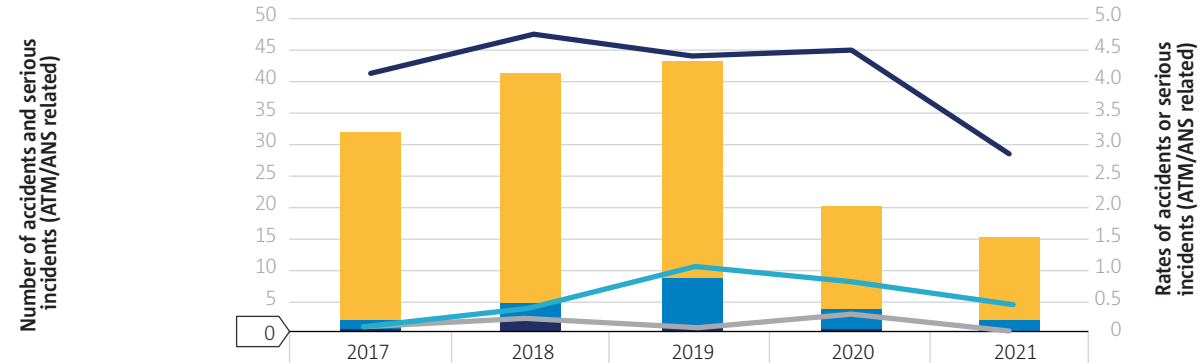
Figure 116 shows the numbers of accidents and serious incidents for 2011-2021. In the last 10 years, 9 ATM/ANS related fatal accidents have occurred. These accidents mainly involved helicopters. None of the accidents was related to an occurrence where ATM/ANS was a contributing or aggravating factor.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	40	29	29	27	24	42	30	36	34	16	13
Non-fatal accidents	6	3	4	7	8	4	1	3	8	3	2
Fatal accidents	0	2	0	0	2	0	1	2	1	1	0

Figure 116 Accidents and serious incidents per year (ATM/ANS related)

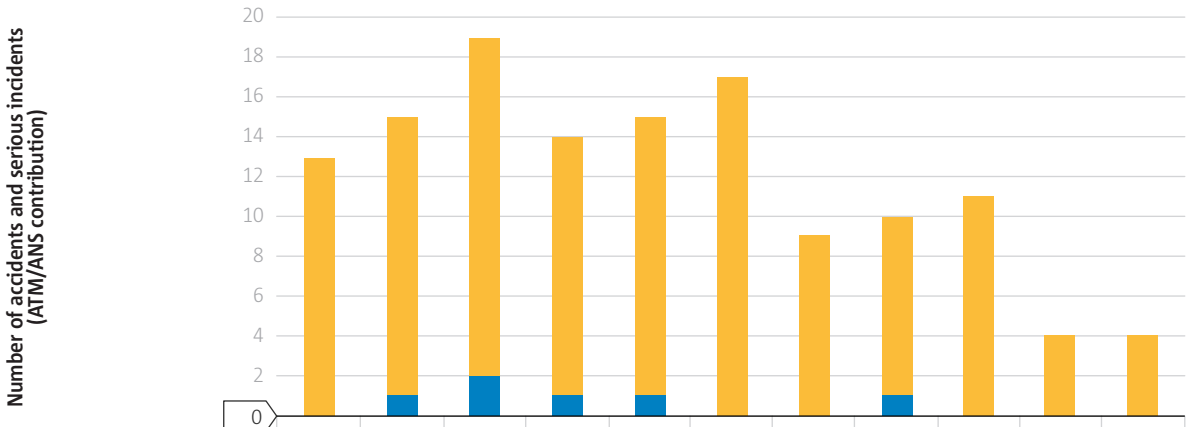
Figure 117 shows that the rate of ATM/ANS related fatal accidents in the EASA MS has remained between 0 and 0.3 accidents per million IFR flights over the last 3 years, with a drop for 2021. The ATM/ANS-related non-fatal accidents rate decreased slightly from 2019 to 2021. A similar pattern can be observed for the rate of serious incidents, that is plateauing from 2019 to 2020 and decreases in 2021.



	2017	2018	2019	2020	2021
Serious incidents	30	36	34	16	13
Non-fatal accidents	1	3	8	3	2
Fatal accidents	1	2	1	1	0
Fatal accident rates	0.1	0.3	0.1	0.3	0.0
Non-fatal accident rate	0.1	0.4	1.0	0.8	0.4
Serious incident rate	4.1	4.7	4.4	4.5	2.8

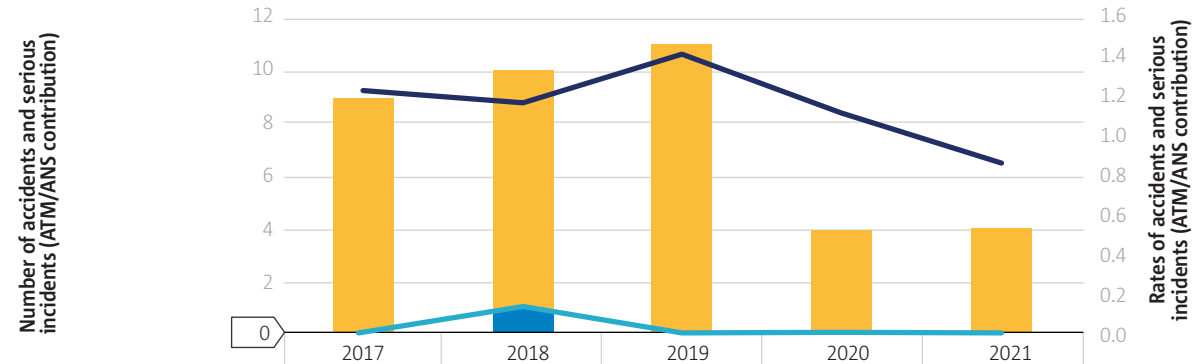
Figure 117 Numbers and rates of accidents and serious incidents per year (ATM/ANS related)

Figure 118 shows no fatal accidents in 2021 and the preceding period 2011-2020, where ATM/ANS was a contributing or aggravating factor. The number of serious incidents with ATM/ANS contribution has stabilised from 2020 to 2021 with 4 occurrences each, which is a decrease compared to the previous years. There were no non-fatal accidents in 2021. This continued the improvement of the last years, as the number of non-fatal accidents fluctuated between 0 and 2 from 2011 to 2018. The rate of serious incidents with ATM/ANS contribution, as seen in Figure 119 decreased since 2019.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Serious incidents	13	14	17	12	12	16	9	7	11	4	4
Non-fatal accidents	0	1	2	1	1	0	0	1	0	0	0
Fatal accidents	0	0	0	0	0	0	0	0	0	0	0

Figure 118 Accidents and serious incidents per year (ATM/ANS contribution)

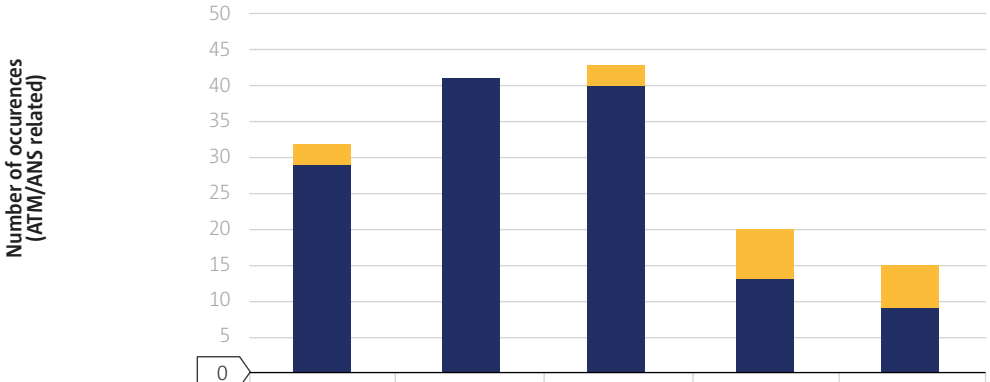


	2017	2018	2019	2020	2021
Serious incidents	39	9	11	4	4
Non-fatal accidents	0	1	0	0	0
Fatal accidents	0	0	0	0	0
Accident rate	0.0	0.1	0.0	0.0	0.0
Serious incident rate	1.2	1.2	1.4	1.1	0.9

Figure 119 Numbers and rates of accidents and serious incidents per year (ATM/ANS contribution)

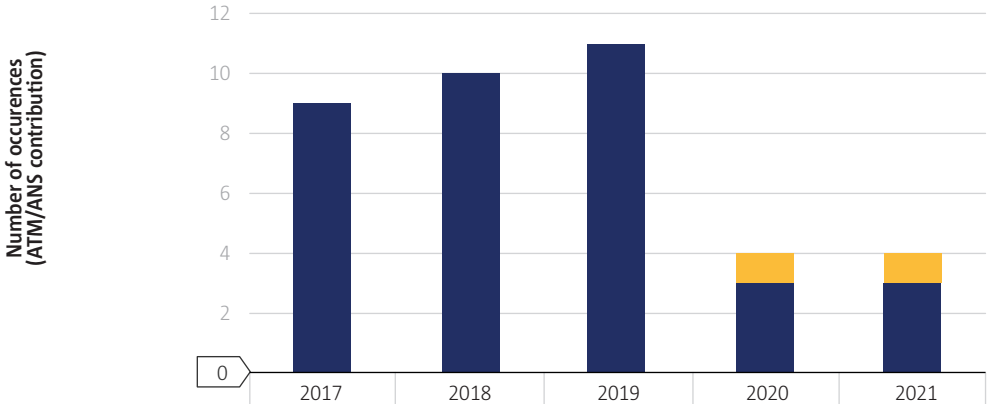
The following paragraphs refer to accidents and serious incidents that have been risk scored using the ERCS methodology and divided into higher and lower risk. An explanation of the ERCS and its purpose is provided in the introduction to this annual review. The aggregated ERCS scores by higher risk and lower risk occurrences show a different pattern from the representation of accidents and serious incidents. This is because some occurrences classified as serious incidents have inherent risk profiles that may be equal or even exceed the risk of some accidents.

Figure 120 and Figure 121 show the distribution of aggregated higher and lower risk for ATM/ANS related events and occurrences with ATM/ANS contribution respectively in the last 5 years. The number of higher risk occurrences that are ATM/ANS related have continued to decrease in 2021 after a drop in 2020, while the number of lower risk occurrences increased slightly in 2020 and 2021. The higher risk occurrences with ATM/ANS contribution decreased in 2020 and remained at the same level in 2021. Nevertheless, this might be attributed to the traffic decrease in the pandemic years.



	2017	2018	2019	2020	2021
Lower risk (ERCS)	3	0	3	7	6
Higher risk (ERCS)	29	41	40	13	9

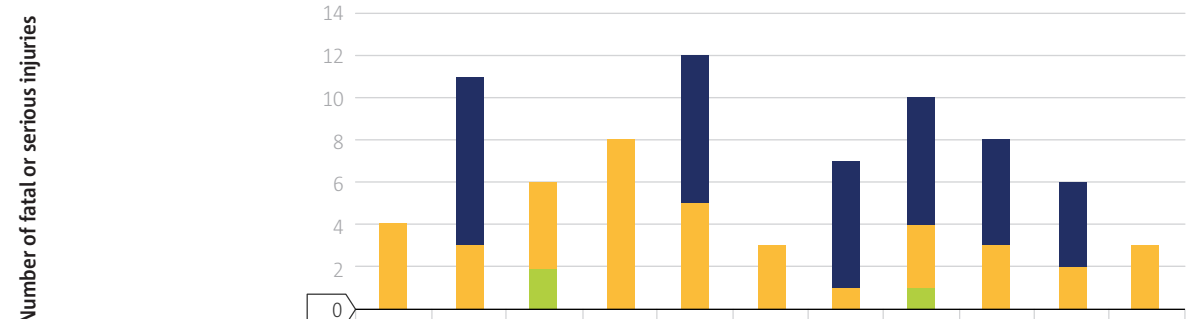
Figure 120 ERCS higher and lower risk occurrences per year (ATM/ANS related)



	2017	2018	2019	2020	2021
Lower risk (ERCS)	0	0	0	1	1
Higher risk (ERCS)	9	10	11	3	3

Figure 121 ERCS higher and lower risk occurrences per year (ATM/ANS contribution)

The numbers of fatalities and serious injuries per year are shown in Figure 122. 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 2021, there were no ATM/ANS related occurrences nor occurrences with ATM/ANS contribution that resulted in fatalities.

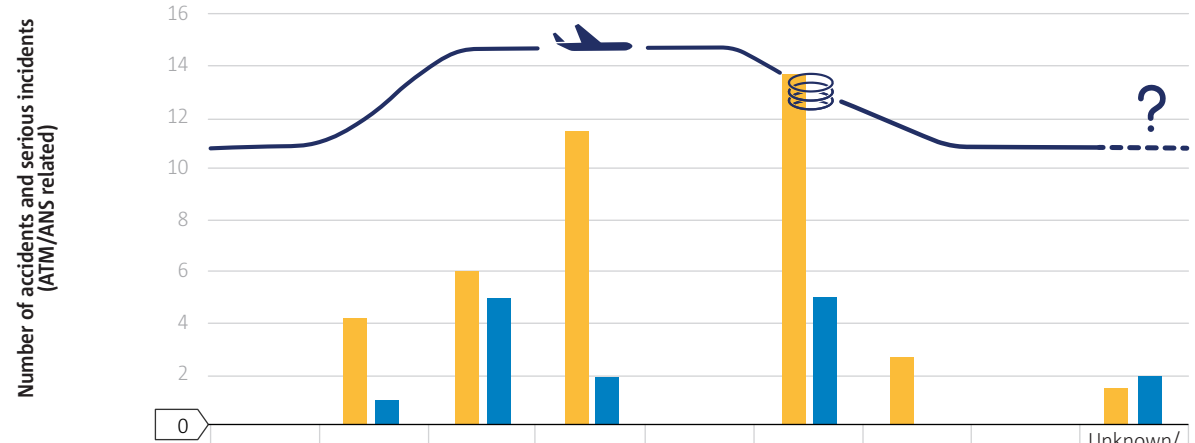


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Fatalities (ATM related)	0	8	0	0	7	0	6	6	5	4	0
Fatalities (ATM contribution)	0	0	0	0	0	0	0	0	0	0	0
Serious injuries (ATM related)	4	3	4	8	5	3	1	3	3	2	3
Serious injuries (ATM contribution)	0	0	2	0	0	0	0	1	0	0	0

Figure 122 Fatalities and serious injuries (ATM/ANS Related and ATM/ANS contribution)

Phase of flight

The majority of the ATM/ANS related accidents and serious incidents in 2021 took place during the approach and take off phase to the same extent, followed by the en route and taxi phase, as shown in Figure 123. In 2020 the order of the affected flight phases changed, putting the en route phase further down the line; this pattern also continues in 2021. No occurrences during the landing phase were reported in 2021.



	Standing	Taxi	Take-off	En route	Manoevring	Approach	Landing	Tow	Unknown/ blank
Average 2011-2020		4.2	6.1	11.5	0.2	13.7	2.7	0.1	1.5
2021	0	1	5	2	0	5	0	0	2

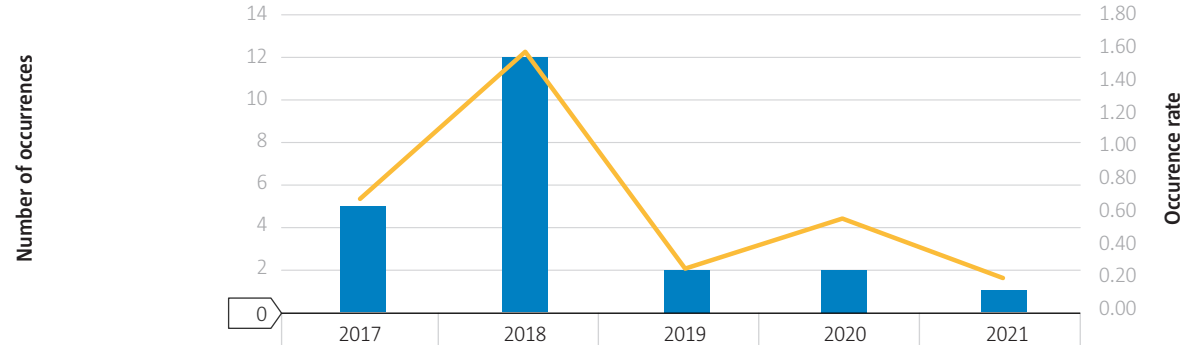
Figure 123 ATM/ANS related accidents and serious incidents, by phase of flight

Airborne collisions and near collisions involving unmanned aircraft

The potential for an airborne collision between an unmanned aircraft system (UAS) and other aircraft is an area of growing safety concern, due to the increasing accessibility of UAS. In 2019, the Commission Implementing Regulation (EU) 2019/947 setting out the rules and procedures for the operation of unmanned aircraft was published.

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 and accurate information on unauthorised UAS flying in the environment becomes available, the issues for the ATM/ANS domain, relating to this type of aircraft will become more apparent.

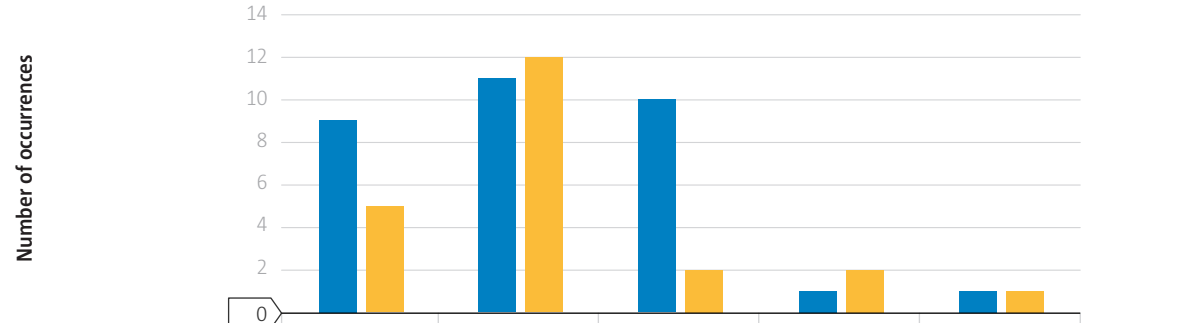
Figure 124 shows the occurrence rate is calculated by taking the number of IFR flights in the MS area and the number of UAS occurrence into account. In this chapter an UAS occurrence refers to accidents and serious incidents where at least one UAS was involved, and the event resulted in an airborne collision or near airborne collision with an UAS. The decrease in the number of IFR flights is reflected in the increase in the occurrence rate in 2020. In 2021, one of drone collisions and near collisions was recorded.



	2017	2018	2019	2020	2021
Number of occurences	5	12	2	2	1
Occurence rate	0.68	1.57	0.26	0.56	0.22

Figure 124 Number and rate of drone collisions and near collisions

Figure 125 compares UAS and other aircraft involved in airborne collisions and near collisions. Since 2018 the number of accidents and serious incidents involving drones decreased, and in 2021 one of such occurrences was recorded.

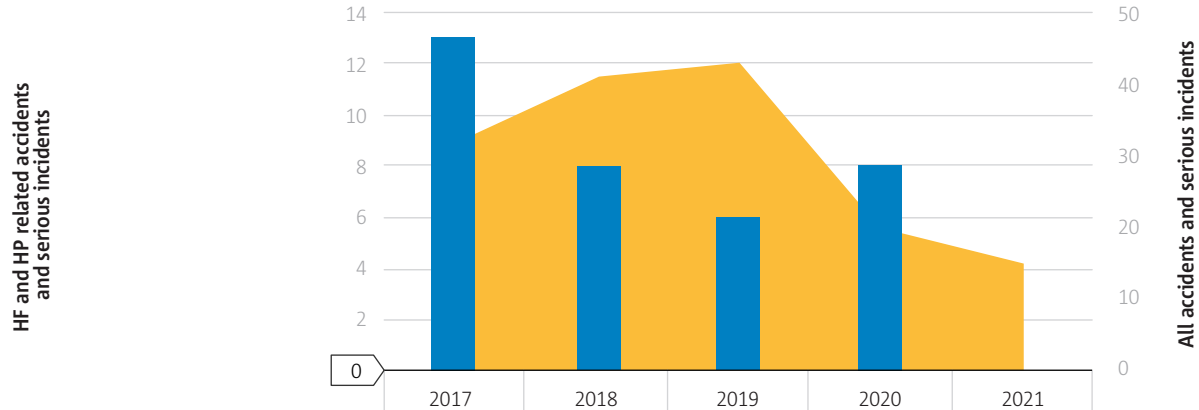


	2017	2018	2019	2020	2021
Other aircraft	9	11	10	1	1
UAS	5	12	2	2	1

Figure 125 Airborne collisions and near collisions, involving drones and other aircraft

Human factors and human performance

Up to one third of ATM/ANS accident and serious incident reports identify human factors (HF) or human performance (HP) issues, labelled as personnel occurrences in the ECCAIRS taxonomy. Looking at the figures for the past five years, a drop from 2017 to 2018 can be observed, since then the number of occurrences that identified human factors or human performance issues levelled between 6 and 8 occurrences. In 2021 no occurrence was recorded, however this result should be viewed as preliminary and is likely to increase, since HF or HP issues are often not recorded within accident and serious incident reports until the final investigation report is published.



	2017	2018	2019	2020	2021
Accidents and serious incidents	32	41	43	20	15
HF/HP accidents and serious incidents	13	8	6	8	0

Figure 126 Human factors and human performance accidents and serious incidents involving ATM/ANS

The application of HF or HP codes at a high level for the last 5 years can be seen in Figure 127. Clearly, task performance issues are more easily discernible following an accident or incident than the factors that cause them.

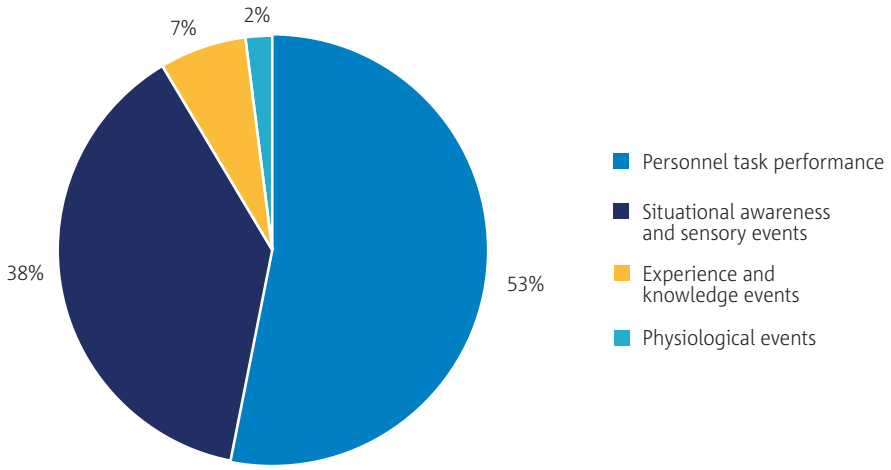


Figure 127 High level human factors and human performance event codes applied to accidents and serious incidents involving ATM/ANS

Figure 128 compares the numbers of accidents and serious incidents with the aggregated ERCS risk score of those occurrences, using detailed HF and HP event codes. The figure indicates that some types of events have a greater risk than others, as shown where the aggregated risk score is far higher than the number of accidents and serious incidents. In particular mental and emotional states stand out as HP event types with higher aggregated risk scores than the number of occurrences would generally suggest.

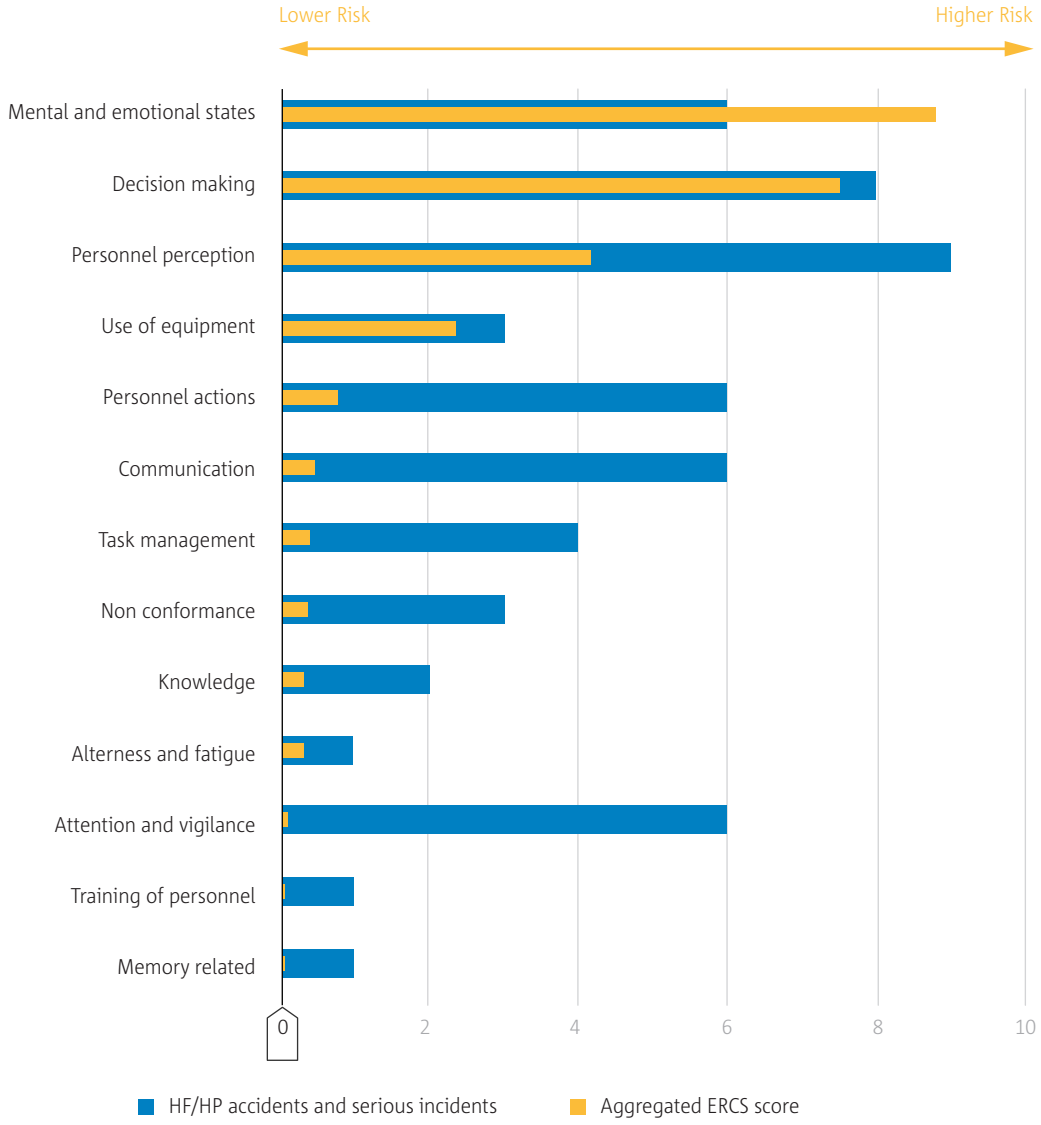


Figure 128 Detailed human factors and human performance event codes by aggregated ERCS score and number of accidents and serious incidents involving ATM/ANS

Safety risks for ATM/ANS

The safety risks for ATM/ANS are derived from accident and serious incident data from the EASA occurrence repository and the European Central Repository, covering the 5 – year period 2017-2021.

The main key risk areas for this domain are highlighted in Figure 129 and are defined by their potential accident outcome and by the immediate precursors of that accident outcome.

To identify the top key risk areas in the ATM/ANS domain, the ERCS risk scores of ATM/ANS related accidents and serious incidents in the past 5 years were assessed and aggregated. ERCS risk scores are used as a proxy of the risk associated with the safety issue, based exclusively on the occurrences reported and linked to these safety issues. The result of this review is illustrated in Figure 129. The X-axis represents the aggregation of the number of accidents and serious incidents per key risk area, while the Y-axis represents the aggregation of the ERCS risk scores for the aforementioned events per key risk area.

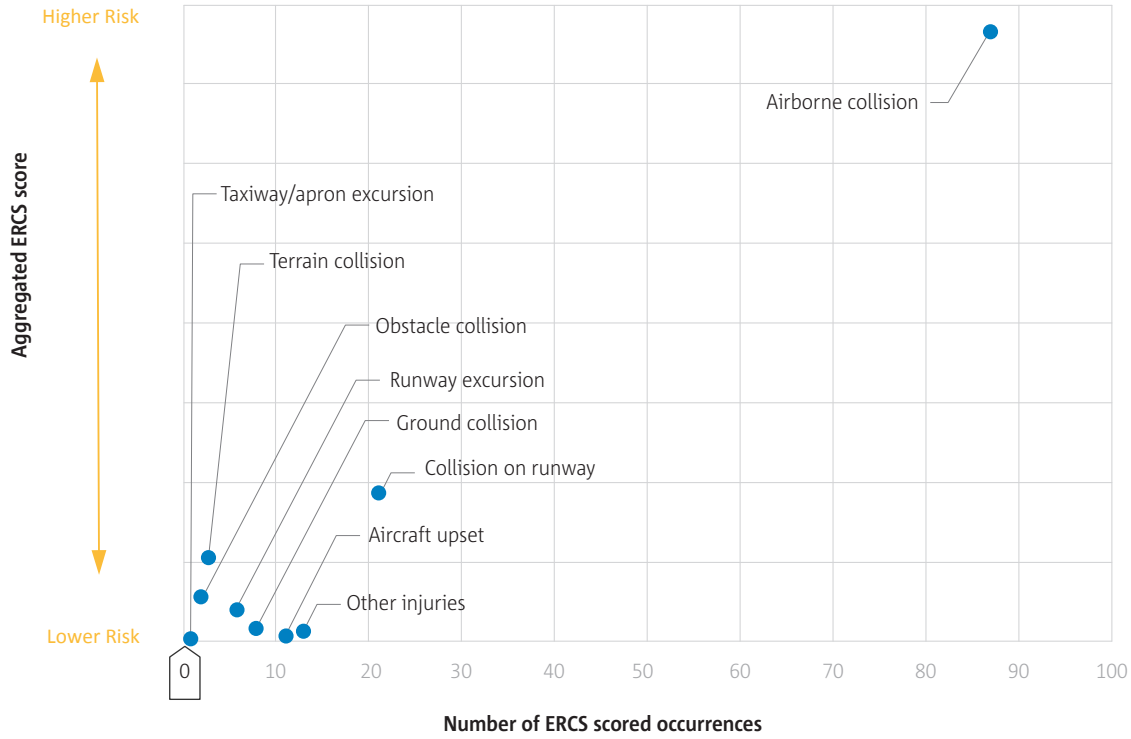


Figure 129 Key risk areas by aggregated ERCS score and number of risk-scored ATM/ANS occurrences

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

The top key risk areas the ATM/ANS domain are defined as:

- **Airborne collision** 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.

- **Collision on runway** 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.

In addition to identifying the top key risk areas, key safety issues in the ATM/ANS domain were also identified from the data. To generate the data portfolio, the accidents and serious incidents in the data set were mapped to the list of safety issues, along with their associated ERCS score. A yellow bar in the graph that is considerably longer in comparison with the underlying blue bar indicates a low number of occurrences contributing to a high risk. The results of this mapping exercise can be found in Figure 130.

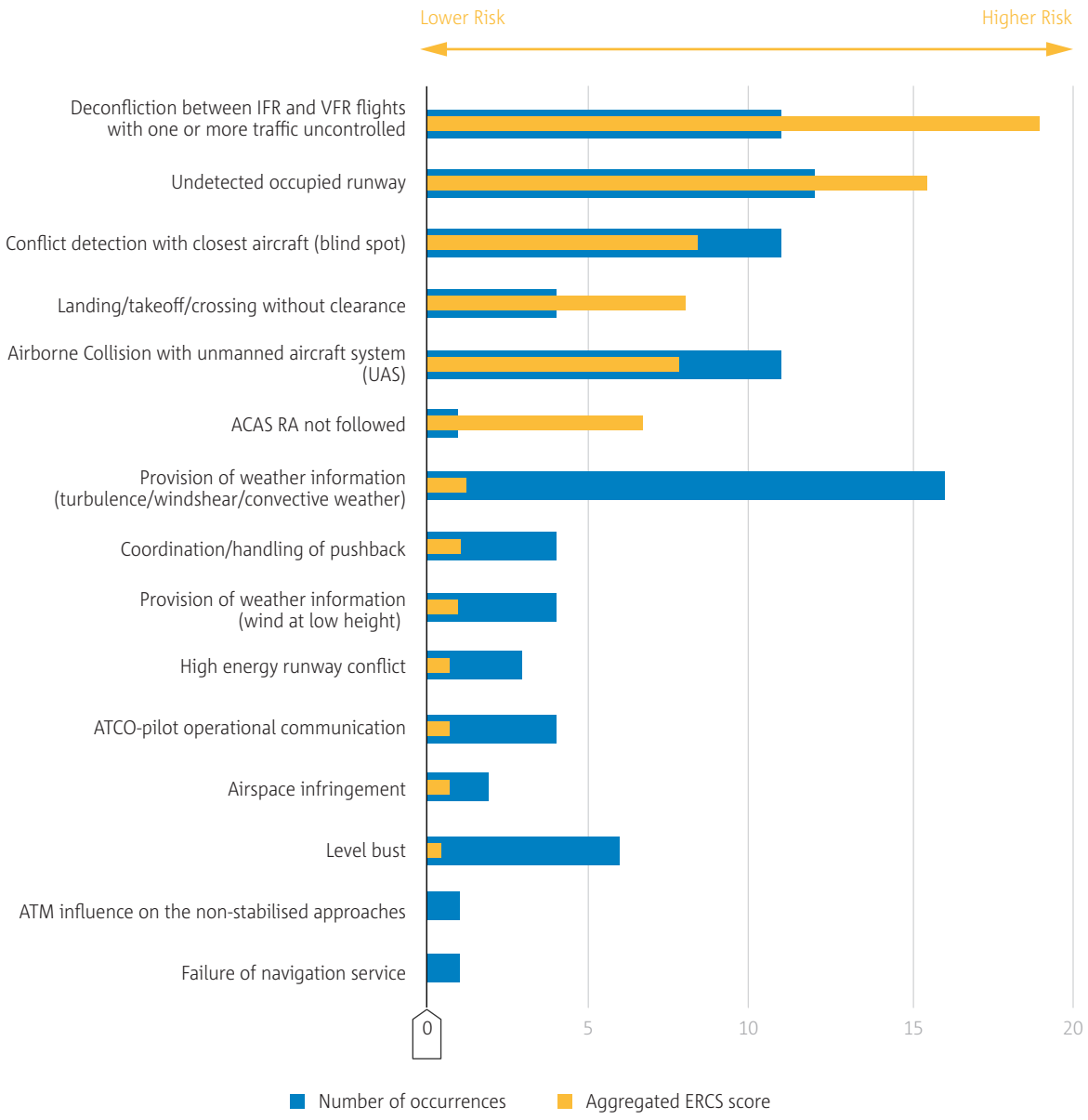


Figure 130 Safety issues by aggregated ERCS score and numbers of accidents and serious incidents for ATM/ANS safety issues

The safety issues with highest risk score identified in Figure 133, based on the data, are deconfliction of IFR and VFR flights and undetected occupied runway. In 2020, these were also the safety issues with the highest risk score. The most prominent change for safety issues since the last year's review is that conflict detection with closest aircraft (blind spot) and landing/take off/ crossing without clearance moved further up in the list as they increased in terms of aggregated ERCS score in comparison with the previous years.

The data portfolio shown in Table 37 links the safety issues with the key risk areas to which they contribute. The key risk areas are listed at the top of the table and are prioritised from left to right based on the aggregated ERCS risk score. The safety issues are listed on the left of the table and are also sorted from the top by decreasing aggregated ERCS risk score. The different colour bands denote high to low risk of safety issues. For the airborne collision key risk area there are several main contributing safety issues but the one with the highest aggregated ERCS score are deconfliction between IFR and VFR flights with one or more traffic uncontrolled and conflict detection with closest aircraft (blind spot). The key risk area collision on runway has as the main contributing safety issue undetected occupied runway.

Table 37 Data portfolio for ATM/ANS

Safety issue	Key Risk Areas (ERCS)									
	Airborne collision	Collision on runway	Runway excursion	Terrain collision	Other Injuries	Obstacle collision in flight	Ground collision	Aircraft upset	Taxiway/ apron excursion
Deconfliction between IFR and VFR flights with one or more traffic uncontrolled	x								
Undetected occupied runway		x							
Conflict detection with closest aircraft (blind spot)	x								
Landing/takeoff/crossing without clearance	o	o							
Airborne Collision with unmanned aircraft system (UAS)	x								
ACAS RA not followed	o								
Provision of weather information (turbulence/windshear/convective weather)	o				x			o	
Coordination/handling of pushback			o				o		
Provision of weather information (wind at low height)			o					o	
High energy runway conflict		o							
ATCO-pilot operational communication	o							o	
Airspace infringement	o								
Level bust	x					o			
ATM influence on the non-stabilised approaches			o						
Failure of navigation service								o	

x = higher number of occurrences
o = lower number of occurrences

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 2016-2021 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 the 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. As a consequence of the UK's departure from the EASA system, in order that the data of 2021 can be compared to the preceding ten years on an equal basis, occurrence data originating from the UK is no longer included in the Annual Safety Review.

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 would be the case if there were follow-up reports, the record will be counted as 1. However, if there are reports from two different reporting entities about the same occurrence, then the record will be counted as 2. The traffic data used in this chapter were provided by Eurocontrol. The geographical scope is 30 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 2016-2021, in parallel with the evolution of the level of traffic in Europe.

Annual evolution over the period 2016-2021

The total number of reports collected in the ECR over the period 2016-2021 is shown in Figure 131, and the number of cumulated airport movements in Europe for the same time period is illustrated in Figure 132. Reporting rates were then calculated by normalising the volumes of reports with the airport movements, as shown in Figure 133.

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 15.4 to 21.2 reports per 1 000 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 the volumes reported in 2017. Consequently, the overall reporting rate continued to increase significantly over the last 2 years, to reach 32.5 reports/1000 airport movements, which is doubled compared to 2016.

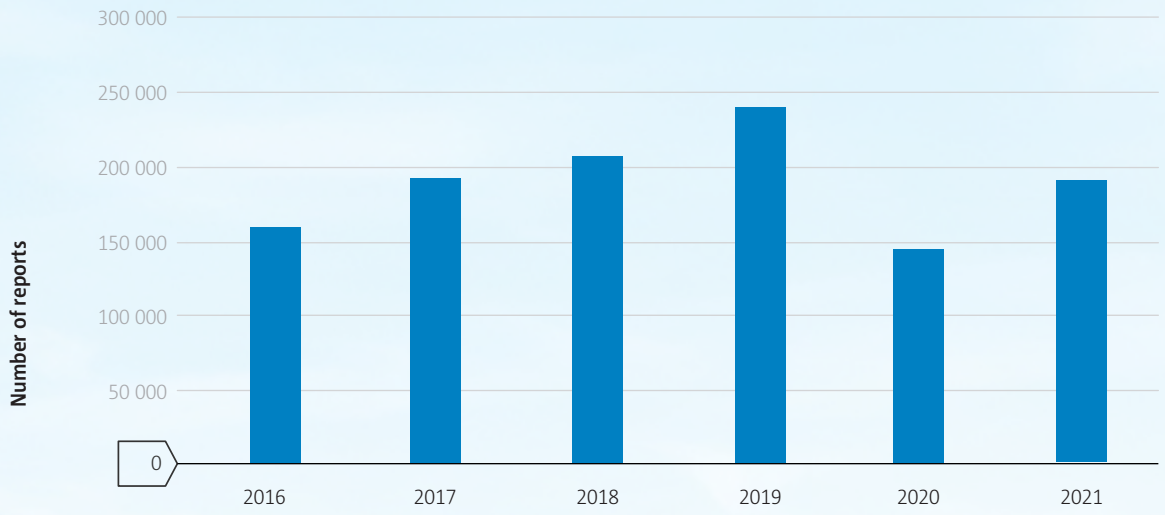


Figure 131 Number of reports collected in the European Central Repository (ECR) per year

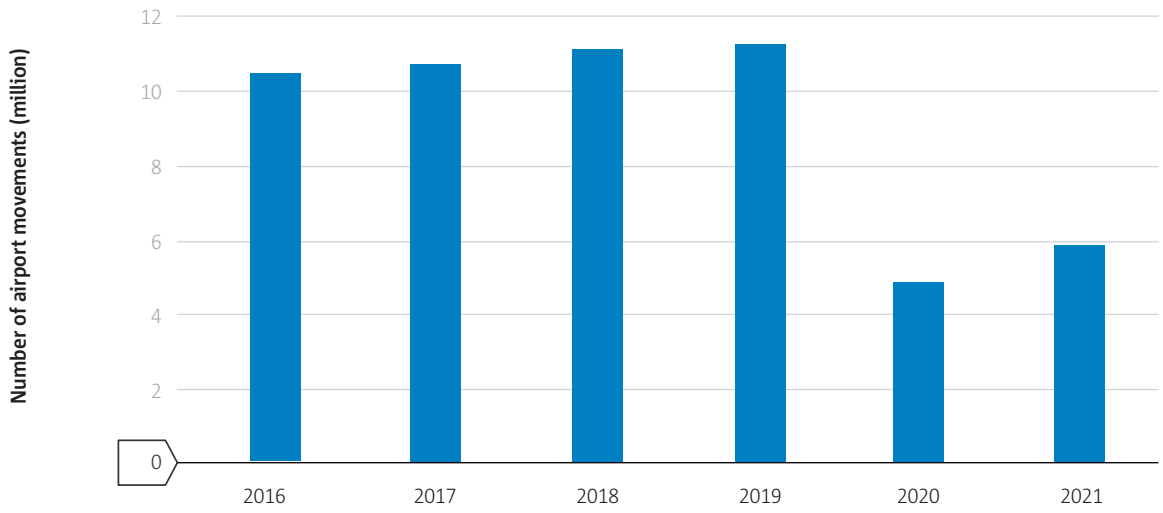


Figure 132 Number of airport movements per year, for all EASA MS (except Iceland)

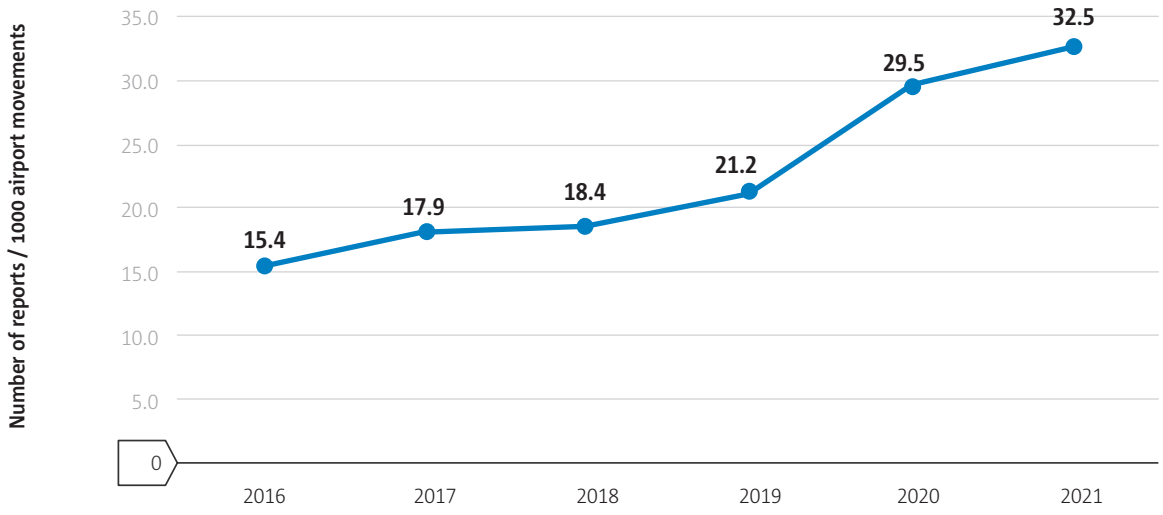


Figure 133 Reporting rate (number of reports/1000 airport movements) per year

Monthly variation for each year

Figure 134 shows the number of reports by month for each year over the period 2016-2021. For the years 2016-2019, a seasonal variation can be observed with a peak in the summer months, which follows the same pattern as the traffic seasonality shown in Figure 135.

The steady increase of reporting levels is also clearly visible. 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 of traffic, as shown in Figure 135. In 2021, whereas the first months of the year showed 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.

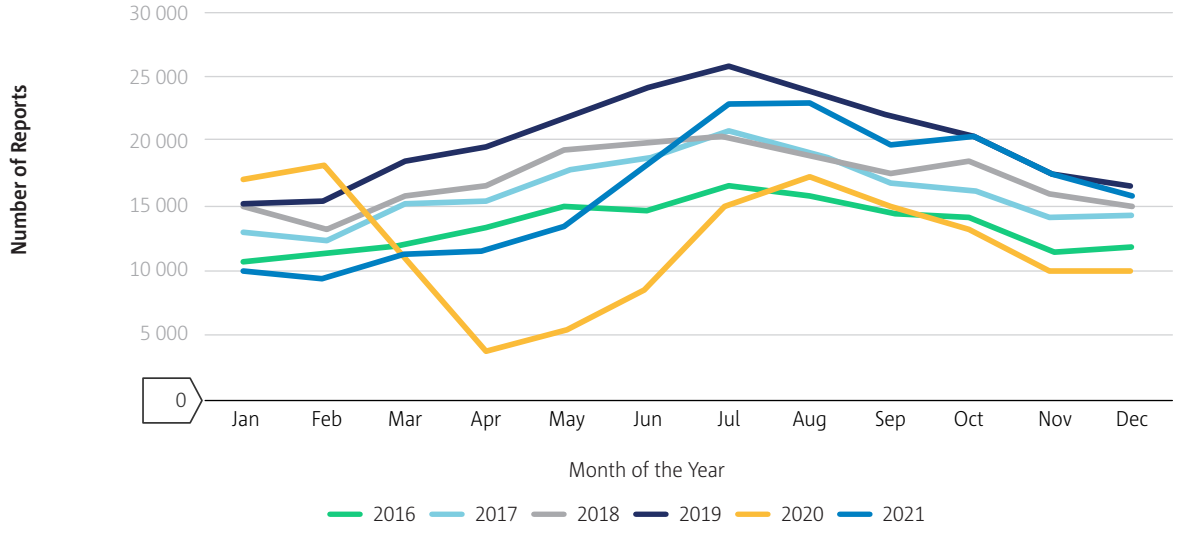


Figure 134 Number of reports collected in the ECR per month per year

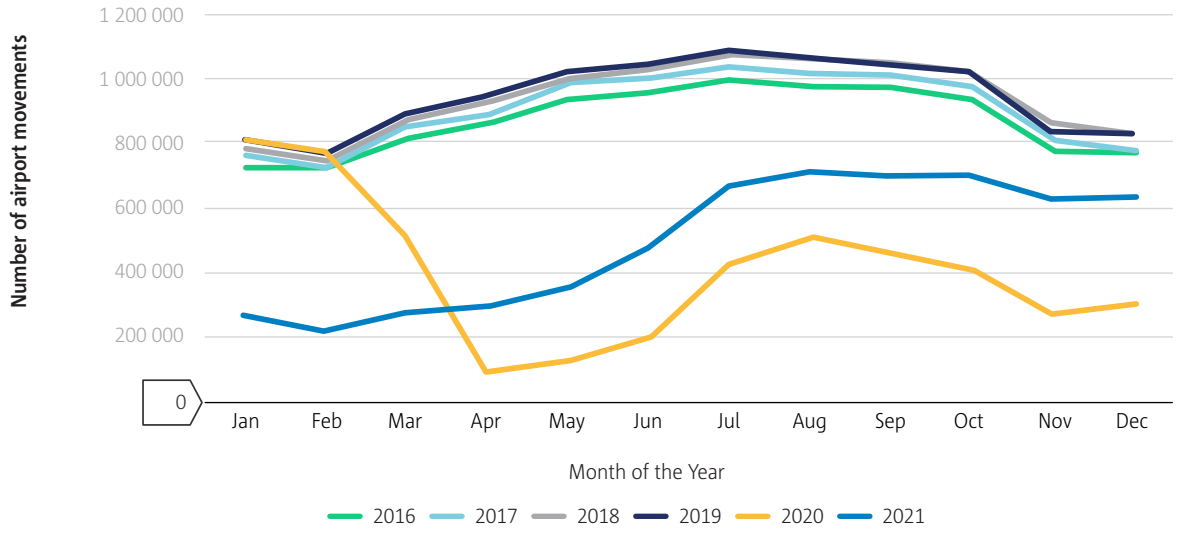


Figure 135 Number of airport movements per month per year, for EASA MS (except Iceland)

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 2016-2021.

Comparison of volume of reporting

In Figure 136, the total number of reports was split in 5 main categories of reporting organisations, using the ECR attribute reporting entity. These 5 categories are as follows:

- Aircraft operators
- Air navigation service providers (ANSPs)
- Aerodrome operators
- Others type 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 3 main types of organisations, the number of reports increased from 2016 to 2019, although less rapidly for the ANSPs. Over this period, the total number of reports from aircraft operators increased by 47%, from ANSPs by 20%, and from aerodrome operators by 93%. After the overall decrease observed in 2020, the volumes of reports clearly increased again in 2021, especially for aerodrome operators where the highest number of reports was observed since 2016.

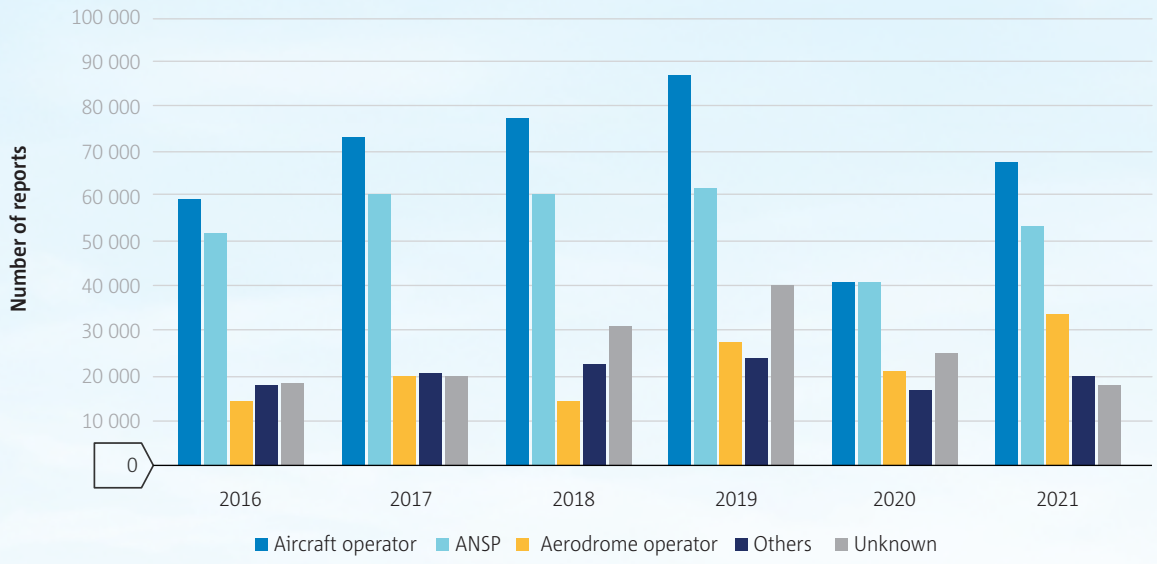


Figure 136 Number of reports collected in the ECR per type of reporting organisation

Figure 137 brings an additional perspective on the trend in occurrence reporting, by showing the relative proportion of reports for the 5 categories defined in Figure 136.

The proportion of reports from aircraft operators was stable around 37 % of all reports over the period 2016-2019, before dropping to 28% in 2020 and increasing again in 2021. For the ANSPs, the proportion of reports slightly decreased from 2016 to 2019 to stabilise then around 28% of the total reports. The proportion of aerodrome reports had a continuous increase over the whole period analysed, starting from 9% of the total reports in 2016 to reach 18% of the overall reports in 2021.

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. In 2021, this proportion was reduced to 9% of the overall reports, which is encouraging, but still a limiting factor in the interpretability of the ECR data.

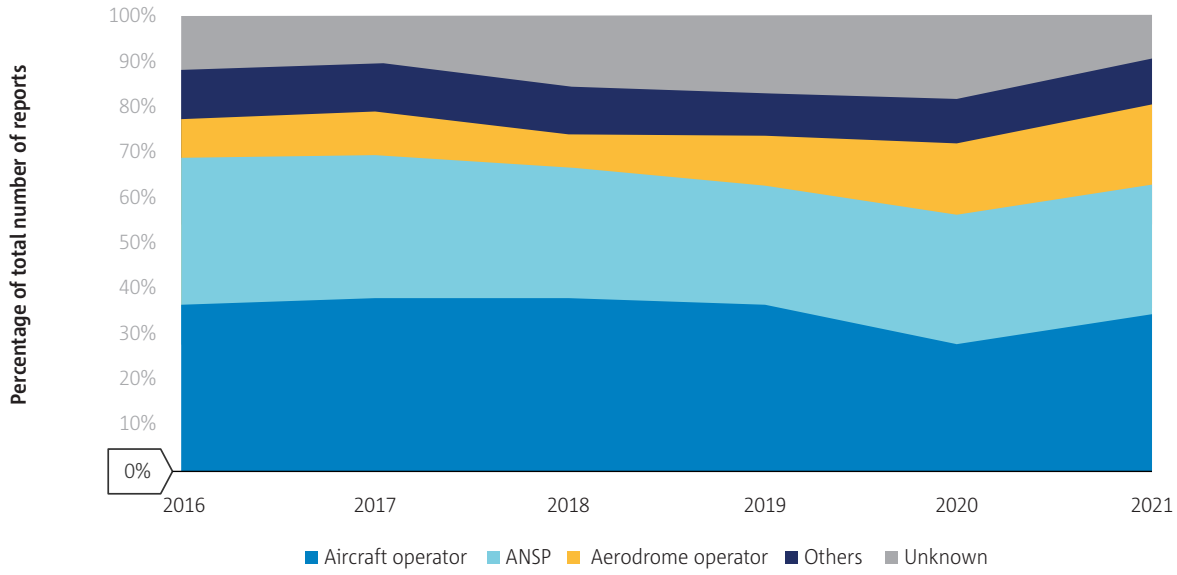


Figure 137 Proportion of reports (in % of the total number of reports) per type of reporting organisation

Chapter 9
Standardisation

As safety is the Agency's core business, Standardisation[12], 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[13] and its Implementing Rules, as well as their uniform implementation, to enable that:

- passengers can fly safely across 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, 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 all available indicators.

This chapter summarises the standardisation activities conducted by EASA in 2021. As in 2020, the COVID-19 pandemic continued to have a significant impact on aviation, although the sector experienced a certain recovery compared to 2020.

While COVID-19 restrictions continued to affect the Agency's ability to perform on-site inspections, the lessons learned during the first year of the pandemic allowed an increased reliance on remote and hybrid inspections, and an enhanced continuous monitoring methodology was developed. As a result, in 2021 standardisation activities resumed to the pre-pandemic level of 2019, and the Agency effectively discharged its obligation to monitor the overall status of the EU civil aviation system during these challenging times.

EASA also continued to provide support to NCAs on how to deal with the main pandemic-related challenges, while working closely with NCA and industry experts to identify new or emerging safety issues arising from COVID-19 as part of the European Safety Risk Management process. In preparation for the expected increase in flying activities, the Agency published Version 2 of the Review of Aviation Safety Issues Arising from the COVID-19 Pandemic[14] in April 2021; while numerous issues were identified across a wide range of operational activities, the over-arching theme remained the need for well-functioning management systems, enabling stakeholders to identify and manage their risks effectively.

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

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

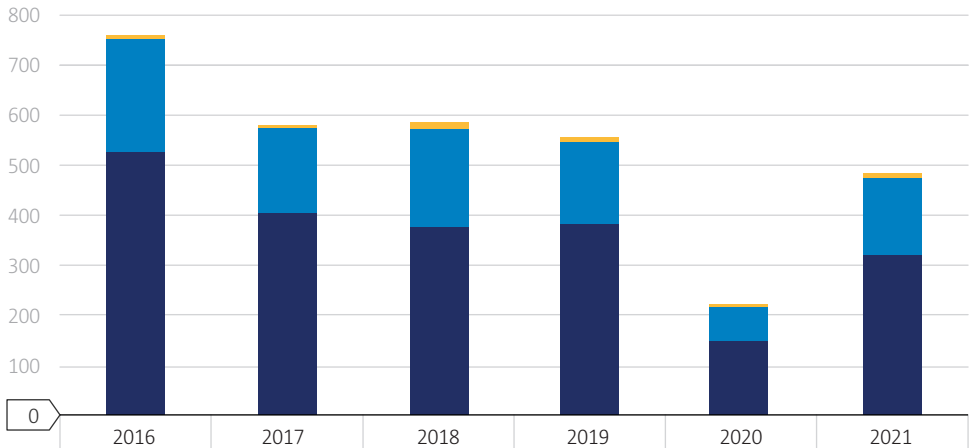
14 https://www.easa.europa.eu/document-library/general-publications/review-aviation-safety-issues-arising-covid-19-pandemic

During 2021, the Agency performed standardisation inspections and Continuous Monitoring Activities (CMA) in the following domains:

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

Furthermore, the Agency started its standardisation activities in the domain of Unmanned Aircraft Systems (UAS), initially by means of two surveys (Enhanced CMA activities) among all Member States.

In 2021 the Agency raised a total of 481 findings of non-conformity, as shown in Figure 138:



	2016	2017	2018	2019	2020	2021
Class G	4	3	9	5	3	6
Class D	227	177	198	166	72	157
Class C	525	400	375	380	147	318

Figure 138 Number of findings by class and year

Class C findings (318 in 2021) raise mainly standardisation concerns, whereas class D findings (157 in 2021) also raise safety concerns, if not timely corrected, and class G findings (6 in 2021) represent immediate safety concerns (ISCs) requiring the concerned NCA to take immediate corrective actions.

While a direct comparison of the total number of findings raised vs. the previous years is not meaningful due to the impact of the COVID-19 pandemic, the average number of findings per inspection remained stable (6.3 in 2021, vs. 6.2 in 2020 and 5.9 in 2019). The same applies to the percentage of findings raising safety concerns (class D + class G findings: 34% of all findings in 2021, same as in 2020, vs. 31% in 2019). The stability of both ratios indicates that the level of compliance of the system as a whole remained stable throughout the pandemic, although the immediate safety concerns observed in six States in 2021 show a need to remain vigilant about emerging safety issues.

Class C

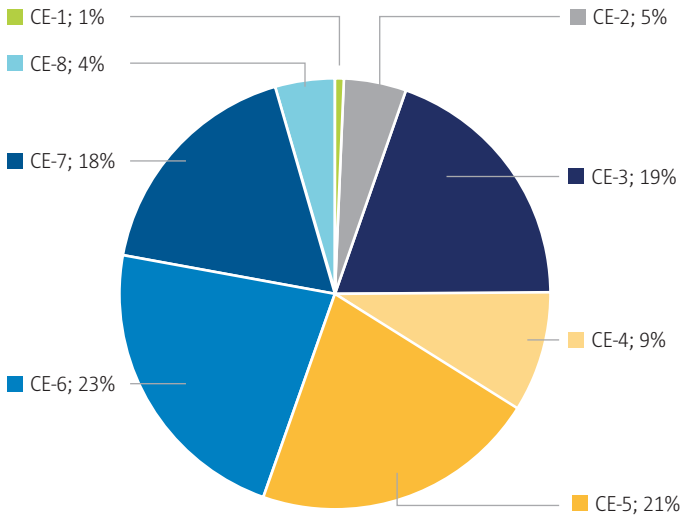


Figure 139 Distribution of Class C findings by Critical Element

Class D

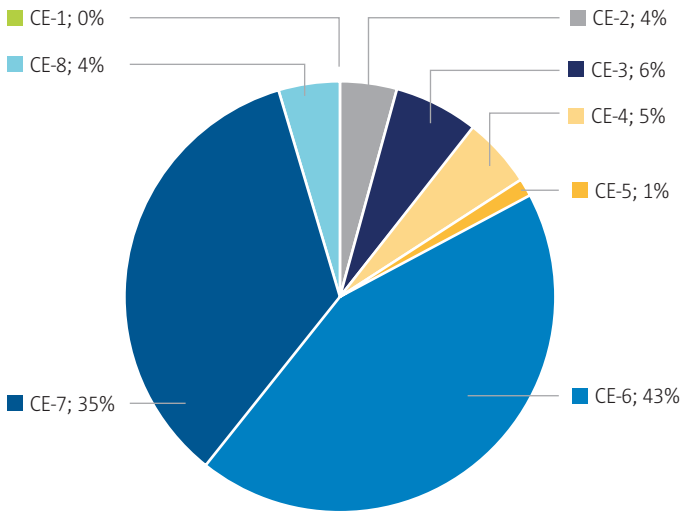


Figure 140 Distribution of Class D findings by Critical Element

Figure 139 and Figure 140 illustrate the distribution of class C and D findings raised in 2021 according to the eight Critical Elements of a State's Safety Oversight System (CEs) 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,

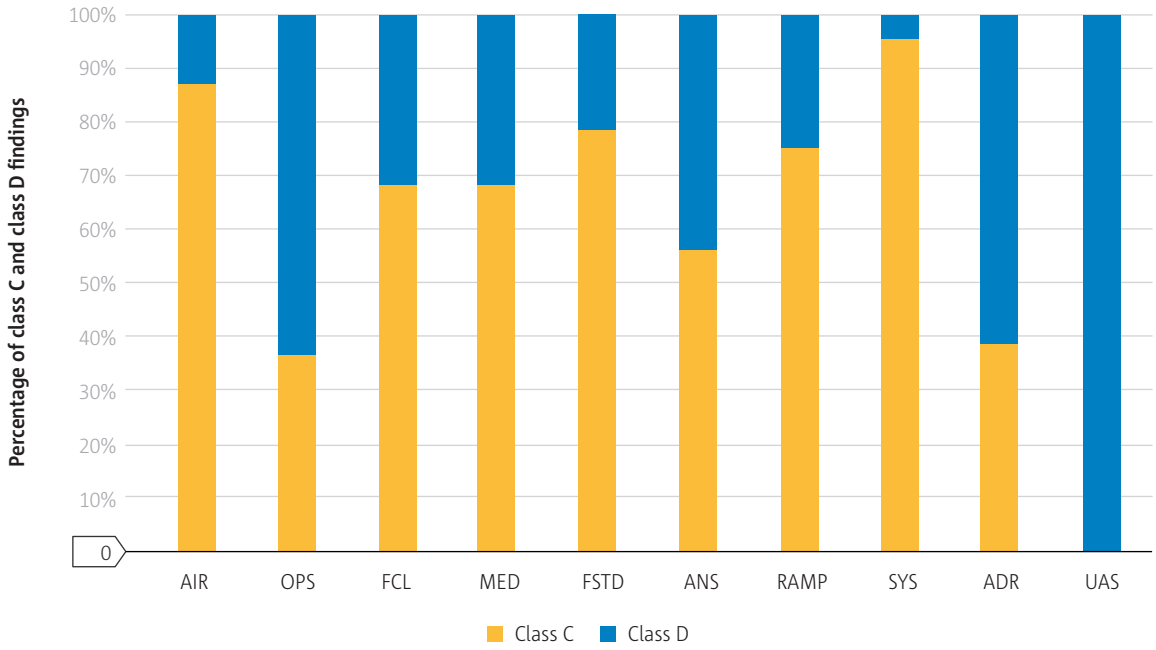
CE-8 Resolution of safety concerns.

As in previous years, most class D findings (79%) 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 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 81% of all class C. Besides certification and oversight, the unavailability of proper procedures and tools (CE-5), although not having a direct safety impact, is a source of standardisation concerns.

More generally, the key outcomes of standardisation activities in 2021 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, ATM/ANS and Aerodromes, as can be seen in Figure 141. The main cause of a higher ratio of class D findings in such domains is mainly the inadequate oversight of key safety risk areas, which did not take into account the audited organisations' past safety performance and/or their current risk exposure. The inability of several NCAs to properly discharge their oversight responsibilities in these domains is a concern also in the light of the size, scope and complexity of the aviation industry that some of them oversee. It should be noted that the 100% D findings in the UAS domain corresponds to only two findings in one Member State.



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 141 Ratio of class C and D findings per domain in 2021[15]

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

- **A two-speed system.** While some NCAs have reached a suitable and stable level of maturity, several others continue to underperform and/or struggle in achieving sustainable improvements. To that extent, a simple performance indicator is the number of class D findings open and overdue at the end of each year. This indicator only slightly decreased in 2021 compared to 2020 (from 52 to 44).
- **Management Systems**. While progress has been noted in the implementation of management systems at NCAs, a lack of effective oversight of the audited organisations' (safety) management systems continues to be of concern. Several NCAs struggle to implement risk-based oversight in practice. Furthermore, in 2021 there were more findings related to initial certifications/approvals (ICAO CE-6) compared to the previous years. This was caused by a failure to properly implement several recent changes in the applicable regulations.
- **COVID-19 specific issues.** While NCAs and the aviation community overall has adapted better to the challenge of COVID-19 in 2021, the proper management of changes caused by the pandemic continued to be an area of attention. The key issues found in several NCAs relate to:
  - **Management of flexibility provisions** (Basic Regulation Art. 71) and of the associated mitigations;
  - **Remote oversight of activities,** considering the intrinsic limitations of remote audits/inspections; and
  - **Resources and staffing,** due to lack of on-job-training and to staff shortages (sickness, quarantines).

The Agency will continue to focus its standardisation efforts by tailoring its monitoring and inspecting activities to the identified risks, and by supporting NCAs in effectively implementing adequate action plans to eliminate the findings and their root causes.

In parallel, the Agency is making use of the tools made available by the Basic Regulation, such as implementation support and transfer of responsibility, when considered appropriate to address safety concerns and achieve durable improvements. Support activities have taken place in three EASA MS where EASA seconded staff on a full-time basis support NCAs in their restructuring efforts and ensure close cooperation among the experts involved - with positive results.


N

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European Union Aviation Safety Agency

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SAFETY INTELLIGENCE
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