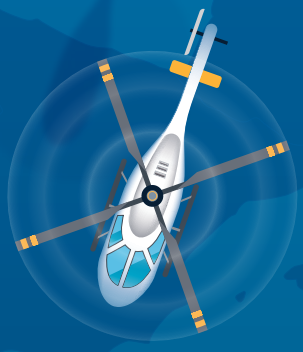
EASA
European Union Aviation Safety Agency

THE EUROPEAN PLAN FOR AVIATION SAFETY

(EPAS 2021-2025)



VOLUME III
Safety Risk Portfolios

Volume III

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17. Introduction: The basis of EPAS safety mitigations

What is this volume about?

Volume III of EPAS aims to present how aviation safety risks in Europe are analysed and the outcome of these analyses (i.e. where the risks are), with the purpose of providing readers with more insight on where the actions in EPAS come from.

You can use the volume to:

— understand more about the accident outcomes and safety issues that are the focus of the EPAS;

— use the information on the safety issues to inform decision-making in your own organisation.

The Safety Risk Management (SRM) process

The European SRM process can be thought of as a Safety Management System (SMS) at the European level. It comprises a set of processes that aim at identifying the safety hazards and their mitigations. It involves analysis of data from different sources and collaboration with safety partners from national aviation authorities and the industry.

The European SRM process follows the basic steps of any SMS:

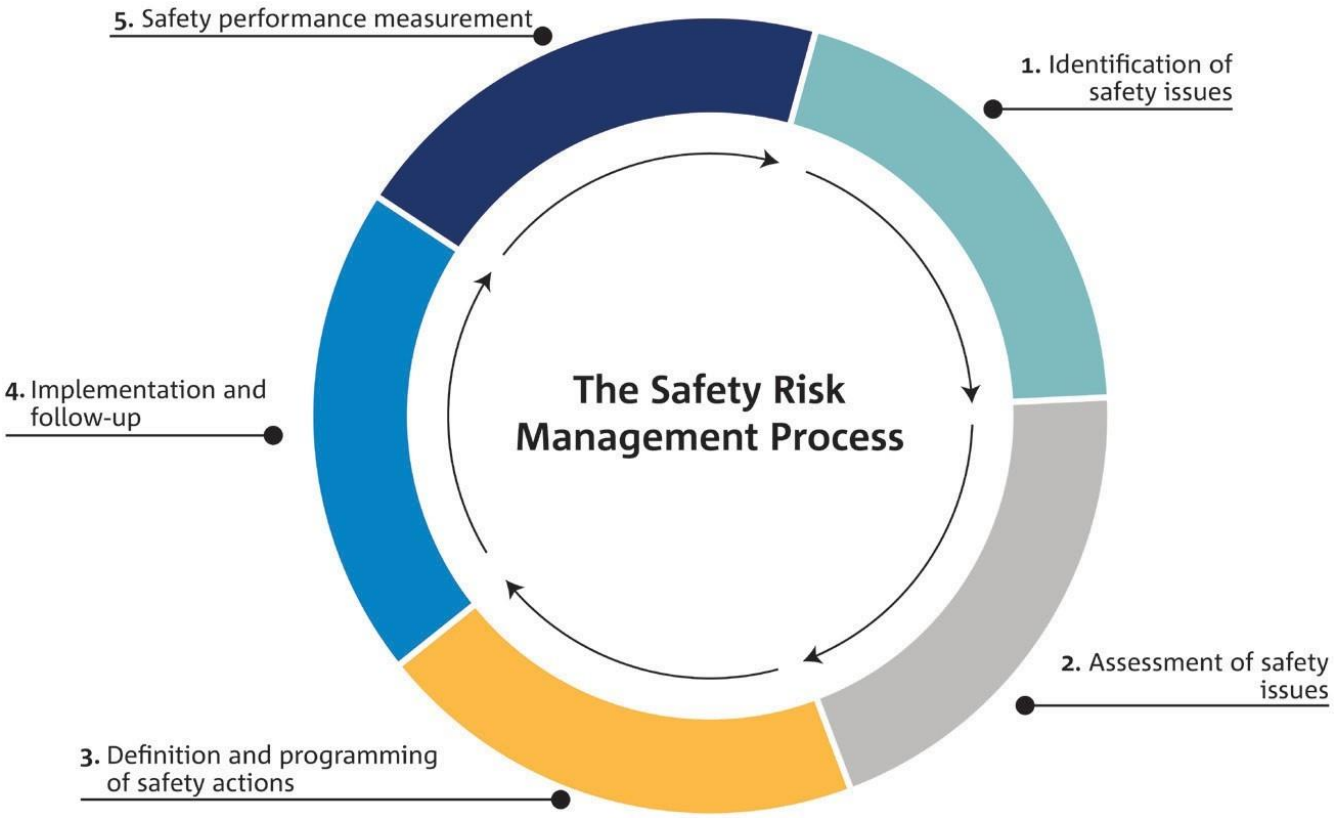

Figure 17: The European SRM process

Introducing the Safety Risk Portfolios

This inaugural edition of EPAS Volume III provides the first insights to EASA's Safety Risk Portfolios. In their most simplified versions, the Safety Risk Portfolios are a list of safety issues that need to be mitigated at European level.

These have been developed by EASA in conjunction with our safety partners, through the CAGs and the NoA.

Safety Risk Portfolios form an essential component of EASA's SRM process. They gather together insights from quantitative sources, e.g. data from the European Central Repository, and qualitative sources e.g. expert judgement from safety partners. The combination of data analysis and expert judgment steers the strategic focus on the mitigation of safety issues that have been assessed to be of high priority.

The elementary matter of safety analysis: the safety issues

A safety issue defines a safety problem, or a set of problems, in a manner specific enough so that safety experts can work on it. Example of safety issues are 'increased presence of wildlife on aerodromes' or 'rapid storage and de-storage of aircraft'. Beyond the name/label of the safety issues, a short description is provided so that the scope of the safety issue is commonly understood.

Safety issues are identified through EASA's analysis of aviation occurrence data or submitted as a candidate safety issue through the CAGs, NoA, EASA's website or internal EASA stakeholders. Safety issues identified through aviation data collected by EASA are published in the EASA ASR in the form of a Data Portfolio. The Safety Risk Portfolio is an advanced and processed form of the Data Portfolio that has been augmented with additional layers of qualitative analysis and subject matter expertise from the CAGs and the NoA.

The safety issues and Safety Risk Portfolios are grouped by domain as each domain has its specificities and requires specific expertise. The following domains are part of the SRM process:

— Aerodromes and Ground Handling

— ATM/ANS

— Commercial Air Transport – Aeroplanes

— Human Factors

— Non-Commercial Operations – Small Aeroplanes

Rotorcraft

The analysis of safety issues is domain-centric by nature, which means that they are analysed in-depth within a given domain (which can be thought of as analysing 'vertically'). However, given that some safety issues are relevant to more than one domain, these safety issues have to be analysed from a multi-domain perspective (or 'horizontally'). Within EASA, we ensure that such issues are assessed in a cross-domain manner with one domain taking the lead. Thus, while the safety issue may appear only in one Safety Risk Portfolio, all relevant domains participate in the assessment of the safety issue to ensure the development of a holistic solution. In addition to such efforts, EASA coordinates a multi-domain perspective for such safety issues through the Safety in Aviation Forum for Europe, which is also known as SAFE 360°.

Remark: For more information on the Data Portfolio and the main key risk areas of the aviation domains mentioned above, please refer to the latest version of the EASA ASR, which can be accessed through this link. It is important to note that due to additional layers of qualitative assessment, the safety issues presented in

the Data Portfolio may evolve in its scope. Thus, there might be slight differences in how the safety issues are presented in the Data Portfolio and Safety Risk Portfolio.

Introducing the Key Risk Areas

Key risk areas are the determination of the most likely type of accident that an occurrence could have escalated to. They are another core concept in EASA's Safety Risk Management process along with safety issues. The key risk areas provide insights to the most common potential accident outcome and the immediate precursors that may lead to the accident outcome.

Each safety issue is therefore associated with one, or most of the time, several key risk areas. For example, the safety issue 'Entry of aircraft performance data' may have as an outcome (i.e. key risk area) 'excursion' or 'aircraft upset'.

The 10 key risk areas are defined below:

— **Airborne collision**

Collisions between aircraft while both aircraft are airborne; or between aircraft and other airborne objects (excluding birds and wildlife).

— **Aircraft upset**

An undesired aircraft state characterised by unintentional divergences from parameters normally experienced during operations, which might ultimately lead to an uncontrolled impact with terrain.

— **Collision on runway**

A collision 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. This does not include collisions with birds or wildlife.

— **Excursion**

An occurrence when an aircraft leaves the runway or movement area of an aerodrome or landing surface of any other predesignated landing area, without getting airborne. This includes high-impact vertical landings for rotorcraft/VTOL and balloons/airships.

— **Fire, smoke and pressurisation**

An occurrence involving cases of fire, smoke, fumes or pressurisation situations that may become incompatible with human life. This includes occurrences involving fire, smoke or fumes affecting any part of an aircraft, in flight or on the ground, which is not the result of impact or malicious acts.

— **Ground damage**

Damage to aircraft induced by operation of aircraft on ground on any other ground area than a runway or predesignated landing area, as well as damage during maintenance.

— **Obstacle collision in flight**

Collision between an airborne aircraft and obstacles raising from the surface of the earth. Obstacles include such things as tall buildings, trees, power cables, telegraph wires and antennae as well as tethered objects.

— **Other injuries**

An occurrence where fatal or non-fatal injuries have been inflicted, which cannot be attributed to any other Key Risk Area.

— **Security**

An act of unlawful interference against civil aviation. This includes all incidents and breaches related to surveillance and protection, access control, screening, implementation of security controls and any other acts intended to cause malicious or wanton destruction of aircraft and property, endangering or resulting in unlawful interference with civil aviation and its facilities. It includes both physical and cyber security events.

— **Terrain collision**

An occurrence where an airborne aircraft collides with terrain, without indication that the flight crew was unable to control the aircraft. This includes instances when the flight crew is affected by visual illusions or degraded visual environment.

Remarks: The definitions above were updated in August 2020, in line with the definitions that have been developed for the future Implementing Act and Delegated Act for the European Risk Classification Scheme. Hence, the definitions may not be the same as the ones published in this year's ASR.

Process to handle safety issues in the SRM

Each safety issue is assigned an identification number to facilitate tracking of its progress within the SRM process, as well as its relevance to different aviation domains. The safety issues are then categorised in the Safety Risk Portfolios as follows:

Assess

Facilitates Step 2: Assessment of safety issue

- Safety issues with residual risks that require further analysis to identify contributory factors and proposed mitigations

Mitigate

Facilitates Step 3: Definition and programming of safety actions and Step 4: Implementation and follow-up

- Safety issues with existing mitigations ready for implementation e.g. in EPAS

Monitor

Facilitates Step 5: Safety performance measurement

- Monitoring the rate of occurrences linked to the safety issue or more specifically, the effectiveness of the mitigations implemented for a given safety issue

The mitigation action for some safety issues in the 'mitigate' or 'monitor' could be a safety promotion item; more information is available on the EASA Together4Safety Community Websites.

How to read this volume?

This volume is organised by the domains mentioned earlier in the introduction. For each domain, we present the Safety Risk Portfolios, i.e. the list of safety issues that have been identified at European level using the

process explained above. The description of the safety issue can be found by clicking on the safety issue list at the start of the chapter.

Given the unique circumstances in 2020, this inaugural volume will include a dedicated chapter on COVID-19, which deals with the specific safety issues that emerged out of the current pandemic.

Important note 1: *Safety Risk Portfolios for certain domains are still undergoing validation (e.g. the Rotorcraft Safety Risk Portfolio) at the time this document is published and have therefore not been included in this inaugural edition of Volume III. They will be included in future editions of Volume III once they have been validated.*

Important note 2: *Presently, the Safety Risk Portfolios and EPAS are at differing levels of maturity and thus, some safety issues may reflect different categories in this Volume vis-à-vis Volumes I and II. However, as the Safety Risk Portfolios and the SRM matures, these differences will be reconciled and more links will be drawn between the safety actions in Volume II with this Volume of the EPAS. This provides stronger traceability within the SRM process, especially the genesis of a safety action, and strengthens the impetus for the assigned actors to execute the safety action.*

18. COVID-19

2020 was an exceptional year due to the onset of the COVID-19 pandemic, especially for the aviation industry. The pandemic resulted in an extreme reduction in operations that began in March. With traffic forecasted to increase during the summer period, EASA took the initiative to rapidly apply the SRM process to identify and manage safety risks associated with an increase in activity in a pre-emptive manner.

In collaboration with our safety partners, EASA published a review of aviation safety issues arising from the COVID-19 pandemic, where 45 safety issues were identified. Since the publication of the review in June, EASA has worked with Member State CAs and industry partners to identify appropriate mitigating actions for 11 safety issues which have been assessed to be of high risk. The status of these 11 safety issues can be found in the summary below.

Since then, EASA has identified 3 more COVID-19-related safety issues, bringing the total number of COVID-19 related safety issues to 48. The remaining 37 safety issues which have not undergone this expedited safety assessment are currently being assessed and integrated into our domain-specific Safety Risk Portfolio to be managed as part of our SRM process, where possible.

It is also important to note that some safety issues such as 'Reduced available financial resources' cannot be addressed by EASA or EASA Member States but are important for organisations to include in their Safety Management Systems during this period. In addition, not all safety issues may be applicable in the future due to the fluidity of the circumstances. Thus, not all 37 safety issues may be featured in the domain-specific Safety Risk Portfolios in future editions of this Volume.

Mitigate

- Aviation personnel fatigue (SI-5002)
- Rapid storage and de-storage of aircraft may lead to technical failures (SI-5011)
- Reduced focus on, or prioritisation of safety (SI-5009)
- Reduced oversight by competent authorities due to lockdown (SI-5001)
- Restarting a complex system is challenging (SI-5005)
- Skills and knowledge degradation due to lack of recent practice (SI-5003)

Monitor

- Decreased well-being of aviation professionals during shutdown (SI-5007)
- Increased presence of wildlife on aerodromes (SI-5010)
- Personnel may not feel safe and in control about returning to work (SI-5006)
- Documentation and database updates may not have been applied (SI-5004)
- Risk assessments based on previous normal operations are no longer valid (SI-5008)

Aviation personnel fatigue (SI-5002)

With redundancy and furlough reducing the available number of personnel, those left working may have to work additional hours. The preparation for and eventual return to (new) normal operations will require significant additional effort in comparison with actual normal operations. These may both contribute to rising levels of fatigue.

Decreased well-being of aviation professionals during shutdown (SI-5007)

The pandemic is a significant source of anxiety, stress and uncertainty for almost everyone. Worries about unemployment for aviation staff and their relatives may be exacerbated. During the shutdown, with people working from home and therefore isolated from normal support, the personal well-being of professionals is likely to have suffered. For those working, this may lead to task distraction/interruption, workload/task saturation, instructions or requirements not followed. Regardless of whether personnel are working, are employed, furloughed or unemployed, we have a duty of care to support the well-being of aviation professionals.

Documentation and database updates may not have been applied (SI-5004)

Relevant updates of operational procedures and documentation, especially temporary revisions/updates may be missed. This may have a cascading effect on the safety of operations. In addition, aircraft databases may not have been updated, such as FMS, TAWS, charts, etc. Manufacturers and data service providers may not be able to produce and deliver updates within the necessary timescales.

Increased presence of wildlife on aerodromes (SI-5010)

The reduced level of traffic at aerodromes has increased the presence of wildlife habitation at aerodromes. This increases the risk not only of birds and insects nesting in stored aircraft and equipment, but also the risk of bird strikes to aircraft once airborne.

Personnel may not feel safe and in control about returning to work (SI-5006)

Personnel will be returning to duty with a higher than normal psychological stress, potentially reducing staff performance and increasing safety risks. Organisations and authorities need to understand and develop strategies to mitigate against this.

Rapid storage and de-storage of aircraft may lead to technical failures (SI-5011)

The number and rate of aircraft entering and then exiting storage has been very high. Examples of associated hazards are: aircraft that have not been adequately protected by covers; fuel contamination; wildlife ingress; and a lack of maintenance. Sufficient time and personnel will need to be made available in order to return these aircraft to service.

Reduced focus on, or prioritisation of safety (SI-5009)

There are multiple factors that mean that organisations may not be providing safety and safety management with the same level of attention and resources as was previously possible. These include distractions and stress at a personal level, and economic pressures and the practical pressures of returning to service at an organisational level. Also, focusing too much on returning to service and economic survival may reduce the emphasis on human and organisational factors, to the detriment of safety.

Reduced oversight by competent authorities due to lockdown (SI-5001)

CA staff have had to adapt their oversight activities to meet the COVID-19-related restrictions, one key difference being their ability to undertake on-site visits with these having been difficult or impossible to arrange. This means that oversight is not as in-depth as it should be and in many cases, the time periods between checks have increased.

Restarting a complex system is challenging (SI-5005)

The aviation system is highly interconnected, sophisticated and made up of people and technology, meaning that the consequences of shutdown and restart are not completely predictable. Organisations will need to prepare good communications and decision-making strategies, using personnel expertise, data, information and good internal and external coordination.

Risk assessments based on previous normal operations are no longer valid (SI-5008)

Risk assessments performed by organisations and authorities are made in the context of specific operations and operating environments. The substantially changed and still-changing operating environment and the addition of 'new' types of operations mean that most risk assessments are no longer valid.

Skills and knowledge degradation due to lack of recent practice (SI-5003)

The 90 % reduction in traffic means that most aviation professionals are not performing their normal tasks, sometimes they are doing a substantially different job, and sometimes they are not working at all or at a substantially reduced frequency. Simulator and classroom-based training has also not been taking place. Together, this results in a reduction in the skills and knowledge of aviation professionals, and with poses the associated safety risks.

19. Aerodromes and Ground Handling

The Aerodromes and Ground Handling Safety Risk Portfolio was first developed in 2017 by EASA, in conjunction with the Aerodromes and Ground Handling CAG, and has since been reviewed annually. Each safety issue contributes to one or more key risk areas as defined in the introduction.

The main key risk areas for this domain are highlighted in Figure 18 and are defined by their potential accident outcome and by the immediate precursors of that accident outcome. This figure is obtained by aggregating the ERCS score for the risk-scored occurrences relevant to this domain and plotting it against the number of risk-scored occurrences. This provides us with a risk picture of this domain and allows us to identify key risk areas of greater concern.

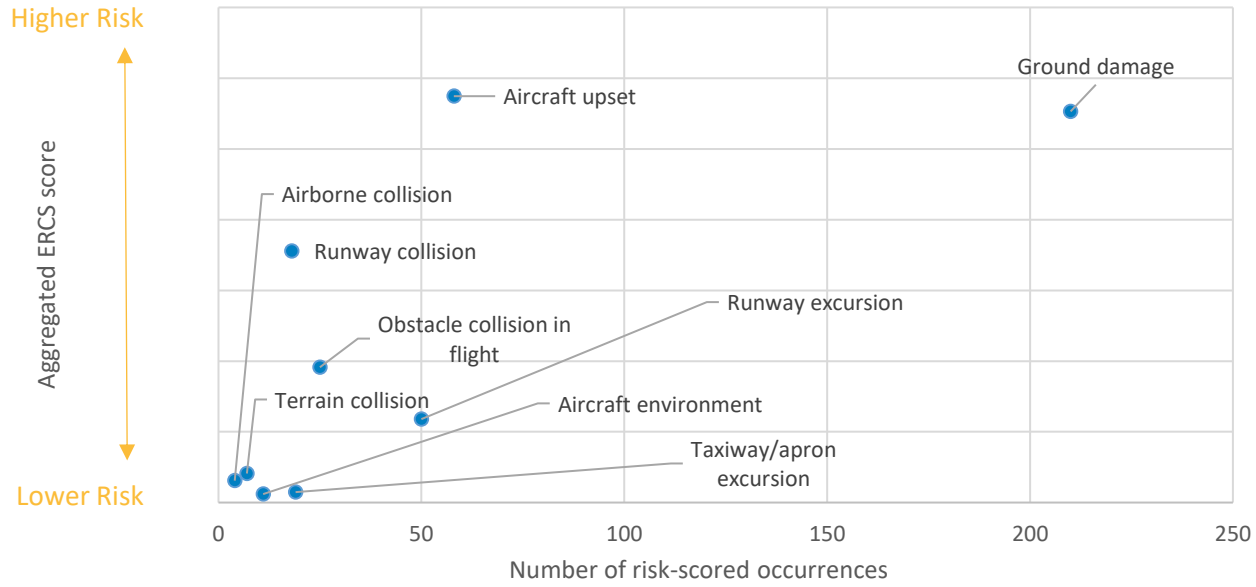

Figure 18: Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving Aerodromes and Ground Handling

The safety issues are sorted into the 'Assess, Mitigate and Monitor' categories, which provide a snapshot of their current status within the European Safety Risk Management process. To understand each safety issue better, please click on the safety issue in the list to access their description.

Assess

- Aircraft movement under its own power (SI-1001)
- Apron/stand design and layout (SI-1003)
- Baggage and cargo loading in passenger aircraft (SI-1004)
- Bird/wildlife control (SI-1005)
- Communication of operationally safety critical information (SI-1605)
- Condition and serviceability of aerodrome operating environment (SI-1007)
- Commercial pressures (SI-1601)
- Control of airside works (SI-1008)
- Control of passengers on the apron (SI-1009)
- Coordination and control of turnarounds (SI-1010)
- CRM and operational communication in the airside environment (SI-1301)
- Decision making and planning (SI-1302)

- Design of air bridges/passenger boarding bridges (PBBs) (SI-1012)
- Design of ground equipment (non-motorised) (SI-1013)
- Design of vehicles (motorised GSE) (SI-1014)
- Embarkation and disembarkation of passengers (SI-1040)
- Emerging technologies (SI-1016)
- Experience, training and competence of individuals (SI-1303)
- Ground staff movement around aircraft (SI-1019)
- Ground operations in extreme temperatures (SI-1044)
- Handling of passengers with reduced mobility (SI-1020)
- Load sheets and other documentation/systems (SI-1022)
- Occurrence reporting and sharing of information received (SI-1041)
- Operation of ground equipment (non-motorised) (SI-1024)
- Operation of vehicles (and other motorised GSE) (SI-1025)
- Parking and positioning of aircraft (SI-1026)
- Personal Pressure and Arousal (SI-1307)
- Positioning and securing of ground equipment (SI-1027)
- Pushback operations (SI-1028)
- Recruitment and staffing (SI-1606)
- Risk perception/complacency (SI-1306)
- Runway/taxiway design and layout (SI-1029)
- Serviceability of air bridges/passenger boarding bridges (PBBs) (SI-1030)
- Serviceability of ground equipment (non-motorised) (SI-1033)
- Serviceability of runways/taxiways (SI-1032)
- Serviceability of vehicles (motorised GSE) (SI-1034)
- Transition of ground handling service contracts (SI-1036)
- Transition of other aerodrome-related service contracts (SI-1037)
- Unreported events (SI-1038)
- Weather effects (SI-1308)
- Worker fatigue leading to human error (SI-1039)

Mitigate

- Operation of air bridges/passenger boarding bridges (PBBs) (SI-1023)

Monitor

- Aircraft towing (SI-1002)
- Cargo loading in cargo aircraft (SI-1006)
- Dangerous goods handling and lithium batteries (SI-1011)
- Emergency/abnormal operations (SI-1015)
- Fuelling operations (SI-1017)
- Ground operations in high winds, rain, thunderstorms (SI-1042)
- Ground operations in low-visibility conditions (SI-1018)
- Ground operations in snow/ice conditions (SI-1043)
- Jet blast (SI-1021)
- Serviceability of apron/stand (SI-1031)
- Terminal design and layout (SI-1035)

Aircraft movement under its own power (SI-1001)

The management, handling or coordination of aircraft movement under its own power may lead to damage and/or injuries. Aircraft movements under its own power should be correctly managed and coordinated to ensure safe operations. This safety issue covers all potential events that may occur when the aircraft is moving under its own power, such as collisions with ground vehicles, ground equipment and ground infrastructure, injuries and damage due to jet blast and potential foreign object debris (FOD) ingestion in aircraft engines.

Aircraft towing (SI-1002)

The forward movement of an aircraft, usually with engines off, using the power of a specialised ground vehicle attached to or supporting the nose landing gear. It includes both towing performed with nose gear elevation (towbarless, no person in cockpit), as well as towing with towbar (person in cockpit). This safety issue covers all potential events that may occur when the aircraft is being towed, such as collisions with ground vehicles, ground equipment and ground infrastructure, damage to the towing vehicle and/or towing equipment and injuries to towing personnel. In this safety issue, towing operation out of a parking position (pushback) is not included – this is addressed in Pushback operations (SI-1028).

Apron/stand design and layout (SI-1003)

Effective apron/stand design and layout is crucial in ensuring safe operations during aircraft taxiing, aircraft parking and loading/unloading of baggage. Poor design and layout may induce the potential for collisions, aircraft damage, and injuries. Important factors to consider are placement and marking of designated areas for parking of ground equipment, proximity to adjacent stands/buildings/structures, evaluation of needed space against the minimum required space, etc.

Baggage and cargo loading in passenger aircraft (SI-1004)

Inadequate management or handling of the baggage and cargo loading process may lead to ground damage or other safety repercussions. Baggage and cargo loading is correctly managed and handled to ensure that. The issue relates to the inadequate management or handling of the baggage and cargo loading process which may result in a significant change in the centre of gravity of the aircraft or the actual weight of the aircraft without the flight crew becoming aware. This safety issue includes the procedures, training and equipment provided to the ground handling personnel to perform their duties. It also includes the coordination with other actors (dispatch, flight crews, etc.).

Bird/wildlife control (SI-1005)

Insufficient control of birds and wildlife may lead to either damage to the aircraft or loss of control during take-off or landing. By understanding bird and wildlife habitats in detail, airport operators can develop and implement Bird and Wildlife Hazard Management Plans to manage such activity in and around the aerodrome, thereby minimising the risk for bird strikes and bird ingestions in engines, which may lead to critical situations during take-off/climb and approach/landing.

Cargo loading in cargo aircraft (SI-1006)

The management or handling of the cargo loading process that may lead to ground damage or other safety repercussions. Cargo loading is correctly managed and handled to ensure that all activities are carried out effectively in accordance with relevant regulations, procedures and processes. The issue relates to the inadequate management or handling of the cargo loading process, which may result in a significant change

in the centre of gravity of the aircraft or the actual weight of the aircraft without the flight crew becoming aware. This safety issue includes the procedures, training and equipment provided to the ground handling personnel to perform their duties. It also includes the coordination with other actors (dispatch, flight crews, etc.).

Condition and serviceability of aerodrome operating environment (SI-1007)

The management of the condition and serviceability of the aerodrome operating environment including maintenance of ATM/CNS equipment, aerodrome movement area surfaces, visual aids (markings/signage, lights), snow/ice removal, FOD control and other infrastructure, to assure their availability in every condition. Effective management of the condition and serviceability of the entire aerodrome operating environment includes having maintenance and service plans which are adhered to. This safety issue covers all potential events that may occur due to poor condition of the aerodrome operating environment.

Communication of operationally safety critical information (SI-1605)

With the movement towards more centralised operational load planning, the communication of operationally safety-critical information (for example, load sheet changes) from ground staff, via Centralised Load Control (CLC), to cockpit crew, is essential. This safety issue covers all potential events that may occur due to incorrect operational data being provided to the flight crew ahead of the flight.

Commercial pressures (SI-1601)

Commercial pressures (e.g. seasonal workforce/contracts/on-time performance/non-aviation regulations) have an effect on safety. External commercial pressures are understood so that risks are identified and mitigated. This safety issue covers all potential events that may occur due to the commercial pressures of the operations having a negative effect on the execution of operational tasks by aerodrome and ground handling personnel.

Control of airside works (SI-1008)

Improper supervision, coordination and control of airside works may lead to aircraft damage and/or injuries. Airside works are properly supervised, coordinated, and controlled to ensure safe operations. This safety issue covers all potential events that may occur where airside works are involved, such as ingestion of FOD produced by construction equipment/material, aircraft collisions with vehicles/equipment, etc.

Control of passengers on the apron (SI-1009)

Insufficient control of passengers on the apron or any other operational area of the aerodrome or airport. If passengers move outside of designated areas on the apron the risk of sustaining injuries increases. In a well-functioning operation, passengers are correctly controlled between leaving the terminal and entering the aircraft and vice versa.

Coordination and control of turnarounds (SI-1010)

Inadequate management or coordination of the turnaround process, covering the period from leaving the centre line of the taxiway until the aircraft leaves under its own power. This includes the non-application or incorrect application of procedures due to mismanagement, in particular those relating to loading and off-loading of passengers and cargo, fuelling operations or those involving coordination with other entities (such as the aerodrome operator or other handling companies).

CRM and operational communication in the airside environment (SI-1301)

Ineffective crew resource management (CRM) and communication, including language proficiency (all languages), use of standard terminology, hand signals, visual communication, distraction from outer sources (e.g. mobile phones) are all factors that may lead to unsafe situations in the airside operational environment. In a well-functioning operational environment, individuals have the necessary skills to communicate effectively.

Dangerous goods handling and lithium batteries (SI-1011)

Fires involving lithium batteries and/or other dangerous goods, both in the aircraft cabin or hold areas, followed by the potential inability to extinguish any subsequent fire may lead to an aircraft environment incompatible with human life. In a well-functioning system, dangerous goods and lithium battery handling is correctly identified and managed to ensure that all activities are carried out effectively in accordance with relevant regulations, procedures and processes.

Decision-making and planning (SI-1302)

Incorrect planning and decision-making by individuals may lead to unsafe situations in the aerodrome and ground handling operational environment. In a well-functioning operational environment, individuals plan effectively and then make the correct decisions by employing the right decision-making strategies for a given situation.

Design of air bridges/passenger boarding bridges (PBBs) (SI-1012)

Design of air bridges that may lead to injuries to persons or damage to aircraft. This safety issue covers all potential events that may occur due to the design of PBBs, such as collisions between aircraft and PBBs, personal injuries to passengers or ground staff, etc.

Design of ground equipment (non-motorised) (SI-1013)

This safety issue covers the design of non-motorised airport ground support equipment (GSE) including steps, baggage trollies/dollies. If the design of the equipment is not fit for purpose, it may lead to damage and/or injuries. Effective design of non-motorised airport GSE will prohibit occurrences where damage and/or injuries are sustained due to improper design of the ground equipment.

Design of vehicles (motorised GSE) (SI-1014)

This safety issue covers the design of motorised airport GSE including belt loaders, baggage trucks, catering trucks, fuel bowsers and pushback equipment, etc. If the design of the equipment is not fit for purpose, it may lead to damage and/or injuries. Effective design of motorised airport GSE will prohibit occurrences where damage and/or injuries are sustained due to improper design of the ground equipment.

Embarkation and disembarkation of passengers (SI-1040)

Changes in the centre of gravity during embarkation/disembarkation may lead to the aircraft nose lifting up, causing issues and potential injuries to passengers/crew, damage to the GSE docked to the aircraft or result in an aircraft tail tipping.

Emergency/abnormal operations (SI-1015)

The supervision, coordination and control of emergency/abnormal operations may lead to damage, injuries, and/or impaired responses to emergencies. In a well-functioning operational environment,

emergency/abnormal operations are properly supervised, coordinated, and controlled to ensure safe operations.

Emerging technologies (SI-1016)

The adoption of new technologies in the operation of aerodromes or ground handling operations may induce new potential hazards and risks for damage and injuries that need to be correctly assessed and mitigated. An example of such technology is the transition from working with paper forms to digital forms for a load master/turnaround coordinator.

Experience, training and competence of individuals (SI-1303)

Individuals (all types of actors) have insufficient experience, training or competence to perform the duties that they have been assigned, and this may lead to unsafe situations in the airside operating environment. In a well-functioning operational environment and before performing any duty, all individuals should be suitably trained (initial and recurrent training), qualified and competent.

Fuelling operations (SI-1017)

This safety issue covers the management and handling of the aircraft refuelling process and its coordination/oversight. In a well-functioning operational environment, fuelling operations are correctly managed to ensure that all activities are carried out effectively in accordance with relevant regulations, procedures and processes. Adherence to the procedures and communication with crew (flight/cabin) during fuelling with pax on board or during embarking/disembarking are important factors to avoid fire, spillage and contamination, avoid misfuelling, correct fuel load and fuel quality, etc.

Ground operations in extreme temperatures (SI-1044)

Negative effects of extreme temperatures (high or low) on ground operations may lead to unsafe situations in the airside operational environment. In a well-functioning operational environment, the effective handling and management of ground operations in extreme temperatures will mitigate the risks of unsafe situations.

Ground operations in high winds, rain, thunderstorms (SI-1042)

Negative effects of high winds, intense rain, thunderstorms on ground operations may lead to unsafe situations in the airside operational environment, such as equipment malfunctions (e.g. non-functioning windscreen wipers on vehicles) or equipment caught by winds, as well as danger of staff and/or passengers being struck by lightning. In a well-functioning operational environment, the effective handling and management of ground operations in high winds, intense rain, thunderstorms, etc. will mitigate the risks of unsafe situations.

Ground operations in low-visibility conditions (SI-1018)

Negative effects of low visibility in ground operations may lead to unsafe situations in the airside operational environment. In a well-functioning operational environment, the effective handling and management of ground operations in low-visibility conditions will mitigate the risks of unsafe situations.

Ground operations in snow/ice conditions (SI-1043)

Negative effects of winter conditions on ground operations may lead to unsafe situations in the airside operational environment. In a well-functioning operational environment, the effective handling and management of ground operations in winter conditions will mitigate the risks of unsafe situations.

Ground staff movement around aircraft (SI-1019)

This safety issue covers the movement of personnel that takes place around an aircraft during the turnaround process, especially while engines are running or an aircraft is about to move (anti-collision beacon on) or within extended danger zones during cross-bleed engine starts. In a well-functioning operational environment, ground staff are able to move safely around the aircraft without the risk of injuries whilst being aware of the risks involved.

Handling of passengers with reduced mobility (SI-1020)

The assistance provided to passengers with reduced mobility may lead to injuries and/or damage to aircraft if not executed properly. This includes the physical assistance provided to the passengers as well as the correct storage and handling of battery-powered mobility aids (electric wheelchairs, scooters, etc). In a well-functioning operational environment, the assistance provided to passengers with reduced mobility during the boarding process is provided in accordance with applicable safety standards and regulations.

Jet blast (SI-1021)

This safety issue covers the management of ground running or taxi patterns, which may lead to injuries or damage due to jet blast. In a well-functioning operational environment, ground running and taxi patterns are properly managed to mitigate the consequences of jet blast.

Load sheets and other documentation/systems (SI-1022)

This safety issue covers errors and omissions in load systems and documentation or systems for recording loading of aircraft. Errors in the load sheets and other documentation can lead to incorrect pre-flight calculations of flight parameters, which may put the aircraft in an unsafe state. In a well-functioning operational environment, the completion and reconciliation of load sheets and other documentation or systems for recording loading of aircraft are carried out properly.

Occurrence reporting and sharing of information received (SI-1041)

This safety issue covers the information flow of safety-critical information between different stakeholders at an aerodrome. For example, safety occurrences reported to authorities and/or organisations are not always shared with the organisations involved in the occurrence. A report submitted by an airline concerning a ground handling issue at a specific airport is not always systematically shared with the ground handling service provider and/or the aerodrome operator.

Operation of air bridges/passenger boarding bridges (PBBs) (SI-1023)

This safety issue covers the operation of air bridges or PBBs, which, if done incorrectly may lead to collisions between aircraft and PBBs or injuries to personnel or passengers. In a well-functioning operational environment, the operation of air bridges is following effective user training and the correct use of effective procedures and processes.

Operation of ground equipment (non-motorised) (SI-1024)

This safety issue covers the operation of non-motorised ground equipment (GSE), which, if done incorrectly may lead to collisions between aircraft and non-motorised GSE or injuries to personnel or passengers. In a well-functioning operational environment, the operation of non-motorised ground equipment is following effective user training and the procedures and processes are applied correctly and effectively.

Operation of vehicles (and other motorised GSE) (SI-1025)

This safety issue covers the operation of vehicles/motorised ground equipment, which, if done incorrectly may lead to collisions between aircraft and vehicles/motorised GSE or injuries to personnel or passengers. In a well-functioning operational environment, the operation of vehicles/motorised ground equipment is following effective user training and the procedures and processes are applied correctly and effectively.

Parking and positioning of aircraft (SI-1026)

This safety issue covers the procedures and processes of marshalling, parking or positioning of aircraft which, if done incorrectly, may to lead to damage or injuries. It includes issues related to visual parking aids, manual marshalling and stand allocation. In a well-functioning operational environment, aircraft are marshalled, parked and positioned on an aerodrome such that it ensures sufficient clearance from other aircraft and objects.

Personal Pressure and Arousal (SI-1307)

This safety issue covers the inability of individuals to perform to their best due to pressure or lack of/excessive arousal, in an aerodrome and ground handling operational environment. In a well-functioning operational environment, personnel are not put under undue pressure or are able to handle low arousal states so that they can perform their duties effectively when needed.

Positioning and securing of ground equipment (SI-1027)

This safety issue covers the positioning or inadequate securing of ground equipment such as baggage trolleys/dollies, unit load devices (ULDs), steps, etc. when they are not in use. If done incorrectly, ground equipment may be blown around the apron due to bad weather, jet blast or other external influence and consequently, cause damage to aircraft or injuries to passengers or personnel. In a well-functioning operational environment, ground equipment is parked in designated areas and properly secured in order to prevent it from being blown around the apron.

Pushback operations (SI-1028)

This safety issue covers the management, handling and coordination of the pushback, that, if done incorrectly, may lead to collisions with other aircraft or ground vehicles/equipment and/or injuries to ground personnel. In a well-functioning operational environment, pushbacks are correctly managed and coordinated to ensure safe operations.

Recruitment and staffing (SI-1606)

In certain ground operations, the working conditions and prospective career opportunities offered are not considered attractive by prospective job seekers. This leads to a high staff turnover. The safety implications of a high staff turnover include loss of valuable operational experience. In a well-functioning operational environment, the working conditions are considered attractive and thus encourage staff members to stay within this role, and the processes for knowledge and experience transfer between staff members are functioning smoothly.

Risk perception/complacency (SI-1306)

This safety issue covers the incorrect perception and inadequate situational awareness of individuals, in an aerodrome and ground handling operational environment. It also addresses the risks of complacency when performing routine/repetitive tasks. Individuals acting upon incorrect perception or inadequate situational awareness may cause damage to aircraft or injuries to themselves or others. In a well-functioning operational

environment, individuals have the necessary situational awareness to take the appropriate action in any given situation and a good understanding of the situation and the dangers of working in close vicinity of aircraft.

Runway/taxiway design and layout (SI-1029)

Complex runway/taxiway design and layouts may induce a higher probability of runway incursions or the potential for collisions and aircraft damage. In a well-functioning environment, the design of runways/taxiways minimises the likelihood of incursions and/or collisions.

Serviceability of air bridges/passenger boarding bridges (PBBs) (SI-1030)

This safety issue covers the serviceability and maintenance of air bridges that may, if not performed correctly, lead to collisions between aircraft and PBBs and/or to injuries to passengers or personnel. In a well-functioning operational environment, the serviceability and maintenance of air bridges are performed effectively and thus would facilitate safe operations of PBBs.

Serviceability of apron/stand (SI-1031)

This safety issue covers the serviceability and maintenance of aprons/stands that, if not performed correctly, may lead to collisions, damage, and/or injuries. In a well-functioning operational environment, the serviceability and maintenance of aprons/stands are performed effectively and thus would facilitate safe operations at aprons/stands.

Serviceability of ground equipment (non-motorised) (SI-1033)

This safety issue covers the serviceability and maintenance of non-motorised airport GSE including steps, baggage trollies/dollies, ULDs, that, if not performed correctly may lead to damage and/or injuries. In a well-functioning operational environment, the serviceability and maintenance of non-motorised airport GSE are performed effectively and thus would facilitate safe operations of non-motorised airport GSE.

Serviceability of runways/taxiways (SI-1032)

This safety issue covers the serviceability and maintenance of runways/taxiways that, if not performed correctly may lead to collisions, damage, and/or injuries. In a well-functioning operational environment, the serviceability and maintenance of runways/taxiways are performed effectively and thus would facilitate safe operations on runways and taxiways.

Serviceability of vehicles (motorised GSE) (SI-1034)

This safety issue covers the serviceability of vehicles/motorised airport GSE including belt loaders, baggage trucks, catering trucks, fuel bowsers and pushback equipment, etc. that, if not done correctly, may cause damage and/or injuries. In a well-functioning operational environment, the serviceability and maintenance of vehicles/motorised airport GSE are performed effectively and thus would facilitate safe operations of vehicles/motorised GSE.

Terminal design and layout (SI-1035)

When planning and (re-)designing the airport, terminal design and layout problems may induce the potential for collisions, aircraft damage, and injuries. In a well-functioning risk-based design process, the design and placement of terminals are done effectively, thereby minimising the likelihood of taxiway incursions, injuries, and/or collisions.

Transition of ground handling service contracts (SI-1036)

The transition of the ground handling operations between service providers might, if not coordinated correctly, induce potential for damage and/or injuries. In a well-functioning operational environment, the transition of operations between service providers is done smoothly to ensure a safe continuous operation of the service.

Transition of other aerodrome-related service contracts (SI-1037)

The transition of other aerodrome-related services (e.g. passenger bridges, passengers with reduced mobility (PRM) service) between service providers might, if not coordinated correctly, induce potential damage and/or injuries. In a well-functioning operational environment, the transition of operations between service providers is done smoothly to ensure a safe continuous operation of the service.

Unreported events (SI-1038)

In a non-functioning or badly functioning operational environment, events go unreported due to fear of repercussions, lack of awareness of and training on occurrence reporting and just/learning culture, etc. In particular, damages to composite structures tend to be under-reported as such damage, which sometimes can be significant and may not be visible on the surface. In a well-functioning operational environment, the just culture within the organisation facilitates the accurate reporting of events by ground staff when it occurs to ensure that an assessment is carried out.

Weather effects (SI-1308)

This safety issue covers the inability of individuals to perform to their best due to the effect of weather in the aerodrome and ground handling operational context. The degraded individual performance in combination with extreme weather may induce potential for damage and injuries. In a well-functioning operational environment, personnel do not suffer from the effects of extremes of weather (i.e. work attires that are appropriate for the climate and season, etc.) so that they can perform their duties effectively when needed.

Worker fatigue leading to human error (SI-1039)

The inability to recruit and retain ground handling staff is leading to staff shortages, long working hours and an ageing workforce. In the long term, if left unchecked, commercial growth and expectations will exceed human resources, resulting in unsustainable operations with possible safety-critical impact on flight safety due to human error.

20. ATM/ANS

The ATM/ANS Safety Risk Portfolio was first developed in 2017 by EASA, in conjunction with the ATM/ANS Collaborative Analysis Group, and has since been reviewed annually. Each safety issue contributes to one or more key risk areas as defined in the introduction.

The main key risk areas for this domain are highlighted in Figure 19 and are defined by their potential accident outcome and by the immediate precursors of that accident outcome. This figure is obtained by aggregating the ERCS score for the risk-scored occurrences relevant to this domain and plotting it against the number of risk-scored occurrences. This provides us with a risk picture of this domain and allows us to identify key risk areas of greater concern.

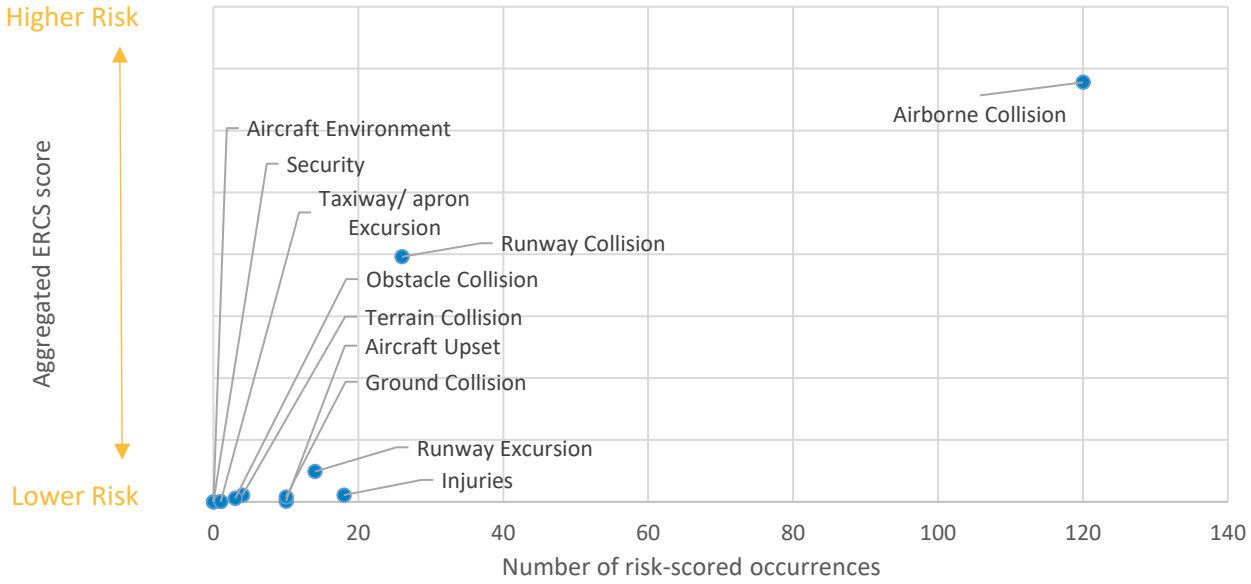

Figure 19: Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving ATM/ANS

The safety issues are sorted into the "Assess, Mitigate and Monitor" categories, which provide a snapshot of their current status within the European Safety Risk Management process. To understand each safety issue better, please click on the safety issue in the list to access their description.

Assess

- ACAS RA not followed (SI-2001**)**
- Airspace infringement (SI-2025)
- ATM influence on non-stabilised approaches (SI-2010)
- Conflict detection with closest aircraft (SI-2003)
- Cybersecurity (SI-2013)
- Deconfliction with aircraft operating with a malfunctioning/non-operative transponder (SI-2002)
- Failure of air-ground communication service (SI-2018)
- Failure of navigation service (SI-2016)
- Failure of surveillance service (SI-2017)
- High-energy runway conflict (SI-2005)

- Integration of RPAS/drones (SI-2014)
- Landing/take-off/crossing without clearance (SI-2007)
- Level bust (SI-2004)
- Mass diversions (SI-0032)
- New technologies and automation (SI-2015)
- Provision of weather information (turbulence/windshear/convective weather) (SI-2008)
- Provision of weather information (wind at low height) (SI-2009)
- Sector overload (SI-2019)
- Understanding and monitoring system performance interdependencies (SI-2022)
- Undetected occupied runway (SI-2006)

Mitigate

- Deconfliction between IFR and VFR traffic (SI-4009)
- Effectiveness of safety management system (SI-2026)

Monitor

- ATCO-pilot operational communication (SI-2027)
- Procedure design and obstacle publication (SI-2028)

ACAS RA not followed (SI-2001)

The anti-collision avoidance system (ACAS) is considered one of the last lines of defence in preventing an airborne collision. This safety issue pertains to the situations where the flight crew of one or both of the aircraft ignore the ACAS RA, react excessively late, do not follow the instruction regarding vertical rate precisely or respond in opposite direction. Flight crew are required to comply immediately with all Resolution Advisories (RAs), unless doing so would endanger the aircraft. Similarly, air traffic controllers are required not to provide further ATC instructions once the flight crew reports the RA. The appropriate responses which flight crew and air traffic controllers are expected to demonstrate in the event of an ACAS RA are outlined in ICAO and EU regulatory documentation.

Airspace infringement (SI-2025)

Airspace infringement occurs when an aircraft enters notified airspace without previously requesting and obtaining clearance from the controlling authority of that airspace, or enters the airspace under conditions that were not contained in the clearance. Such infringements pose a safety risk to traffic within the controlled airspace and increases the air traffic controller's workload. The safety issue addresses infringements by aircraft flying using VFR in controlled airspace (Class A to D), aircraft accessing airspace without ATC clearance, and infringements of restricted airspaces, such as danger areas, restricted areas, prohibited areas and temporary segregated/reserved areas by all types of traffic.

ATCO-pilot operational communication (SI-2027)

Good communication between air traffic controllers and flight crew is essential in ensuring clear understanding of instructions and maintaining situational awareness. ATCO-pilot communication deficiencies may lead to all types of serious incidents and accidents. Common issues include three or more instructions in a single clearance, incorrect use of standard phraseology, misuse of the aircraft emergency frequency (121.5 MHz), and the uncoordinated introduction of phraseology. This safety issues also addresses use of native language between local air traffic controllers and flight crew which reduces the situational awareness of all other users on the frequency.

ATM influence on non-stabilised approaches (SI-2010)

ATM-related attributable factors may lead to non-stabilised approaches, increasing the risk of hard landings, runway excursions and controlled flight into terrain. These ATM-related factors include ATCO instructions (e.g. vectoring, hold descent instruction, intermediate level-off) which result in a high descent profile for the flight crew or bring the aircraft too close to the runway, thereby increasing the risk of unstabilised approach. As unstabilised approach is a multi-faceted issue with contributory factors from different aviation domains, this safety issue is assessed as part of the 'Approach path management (SI-0007)' safety issue led by the CAT A CAG (see 0).

Conflict detection with closest aircraft (SI-2003)

Air traffic controllers may not detect a conflict between one aircraft and the aircraft next to it due to HF-related considerations ranging from distraction and high workload to inadequate training. Air traffic controllers usually experience this loss of separation 'blind spot' after an incorrect descent or climb clearance in the context of a rapidly developing situation. There is normally very little or no time to react and most of the conflicting clearances result in an incident. This phenomenon can occur in both controlled and uncontrolled airspace, but the scope of this safety issue is limited to controlled airspace. While airspace infringements may potentially result in a controller blind spot, these events are excluded from this safety issue as they are addressed in the 'Airspace Infringement (SI-2025)' safety issue (see 0).

Cybersecurity (SI-2013)

ATM systems have become increasingly digitalised to reap efficiency gains. However, a move towards the digital sphere exposes ATM systems to more vulnerabilities and threats to confidentiality, integrity and availability of the systems. Given the strong interdependence of the different domains in the aviation industry, a cyberattack on ATM systems may compromise safety and integrity of the aviation system as a whole. In addition to terrorist-related attacks, the safety issue is concerned with how ATM systems can remain resilient in the face of attacks perpetrated by hackers to gain access to systems or cause disruption for non-terrorist purposes and attacks carried out for commercial espionage.

Deconfliction between IFR and VFR traffic (SI-4009)

Ineffective deconfliction of flights adhering to IFR and VFR in an airspace class where at least one of the flights is not under ATC separation has been identified as a strong contributor to airborne collision risk. Such airspace classes include class E, controlled airspace where VFR flights are not subject to ATC clearance and no IFR-VFR separation is provided by ATC, and class G, where neither IFR flights nor VFR flights are subject to ATC clearance and ATC does not provide any separation service. The safety issue arises due to the fragmented knowledge of the traffic situation as some traffic is subject to ATC clearance (i.e. IFR) and some traffic is not (i.e. VFR). ATC may not be aware of VFR flights or their intentions and potentially may not pass traffic information to the IFR traffic. In addition, some of the VFR traffic may not be equipped with ACAS or even a transponder (C or mode-S), reducing the conspicuity of VFR traffic. As a result, both IFR and VFR traffic have to rely solely on the visual acquisition by the flight crew to maintain separation. This safety issue addresses how the conspicuity of VFR traffic can be improved as well as best practices to underscore the importance of existing procedures in maintaining airborne separation. This safety issue is captured in the Non-Commercial Operations – Small Aeroplanes Safety Risk Portfolio and is also relevant to the Commercial Air Transport – Aeroplanes domain.

Deconfliction with aircraft operating with a malfunctioning/non-operative transponder (SI-2002)

When an aircraft with non-operative transponder or a dysfunctional one operates in an airspace where aircraft must be equipped with secondary surveillance radar (SSR) transponder, the incorrect information transmitted by the transponder increases the risk of mid-air collision and collision into terrain (CFIT). Without a functioning transponder, ATC may be misled by the incorrect data on the aircraft's position and this may result in ATC issuing a clearance which poses a safety risk to another aircraft or to the aircraft itself if the clearance directs it into a terrain e.g. a mountain. As the operation of ACAS is contingent on a functioning transponder, other nearby aircraft will not be able to receive traffic advisories or resolution advisories to maintain separation with the aircraft without a functioning transponder should the need arise. This safety issue explores the frequency of such occurrences and whether existing procedures suffice in mitigating the risk posed by aircraft operating without a functioning transponder.

Effectiveness of safety management system (SI-2026)

Ineffective implementation of Safety Management Systems may lead to deficient management of ATM/ANS risks within the service provider organisations. The complex nature of aviation safety and the significance of addressing HF aspects justify the need for an effective management of safety by the aviation organisations. Shared understanding between regulatory/competent authorities and air navigation service providers is imperative for an effective SMS functioning in an already ultra-safe industry, like aviation. However, the lack of competent and experienced inspectors and strong regulatory authorities lead to the risk of bureaucratising SMS seeing it only as a compliance system. This safety issue covers the regulatory requirements and promotion of SMS principles, on both aviation authorities and organisations, and the capability to detect and anticipate new emerging threats and associated challenges.

Failure of air-ground communication service (SI-2018)

Failure of the air-ground communication system may degrade the performance of the communication service and increase safety risk to an unacceptable level. Air-ground communication refers to radio communication between two or more aircraft, or the exchange of data or verbal information between aircraft and air traffic control. Common failures in voice communications include radio equipment malfunction (air and on ground), radio interference, and sleeping VHF receiver problem. Another key mode of air-ground communication service is controller pilot data link communications (CPDLC) which allows air traffic controllers to transmit non-urgent strategic messages to an aircraft as an alternative to voice communications. Common failures in CPDLC include technical failure of data link equipment (air and ground) and disconnections known as provider aborts. This safety issue explores how such failures can be prevented using pre-emptive measures and the best practices to manage such failures on a tactical basis when it occurs.

Failure of navigation service (SI-2016)

Failure of the navigation service may degrade the performance of the communication service and increase safety risk to an unacceptable level. Air navigation service refers to the process of planning, recording, and controlling the movement of an aircraft from one place to another by providing accurate, reliable and seamless position determination capability. Effective management of these services is essential in minimising the impact on air traffic services (ATS). This safety issue covers appropriate maintenance, procedures to identify failures and their impact on ATS, procedures to operate in degraded modes of operation, and training staff to deal with abnormal situations.

Failure of surveillance service (SI-2017)

Failure of the surveillance service may degrade the performance of the communication service and increase safety risk to an unacceptable level. Surveillance systems are used by air traffic control to determine the position of aircraft. Such systems include SSR, GNSS and Automatic Dependent Surveillance – Broadcast (ADS-B). Effective management of these systems is essential in minimising the impact on ATS. This safety issue covers appropriate maintenance, procedures to identify failures and their impact on ATS, procedures to operate in degraded modes of operation, and training staff to deal with abnormal situations.

High-energy runway conflict (SI-2005)

A high-energy runway conflict occurs when there is little or no time for the air traffic controllers to react to a potential conflict between a high-energy landing (IAS of 100 knots or more) or take-off (IAS of 80 knots or more) and an aircraft which has infringed an active runway, which is also known as a runway incursion. Runway incursion is defined as any occurrence at an aerodrome 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. Thus, this safety issue addresses a specific subset of runway incursions.

Integration of RPAS/drones (SI-2014)

The increasing popularity of drones, especially drones of less than 25 kg operating in the 'open' category, has inadvertently led to an increase of airborne collision risk between drones and manned aircraft. This is largely due to unauthorised activity of drones in both take-off and approach paths of commercial airlines up to 5 000 ft. While less common, unauthorised activity of drones may also pose a collision hazard when an aircraft is flying en-route. As a result of a drone sighting, aerodrome traffic may be stopped or diverted, leading to secondary risks, such as fuel shortages, airspace capacity saturation and an increased workload of air traffic controllers and pilots.

Landing/take-off/crossing without clearance (SI-2007)

Aircraft landing, taking-off and crossing runways without clearance from the air traffic controller poses significant runway collision risk. Such events typically happen during critical and high-workload stages of the flight and can result in similar hazardous outcomes, such as runway incursion and runway collision. The safety issue covers contributory factors from both the flight crew and air traffic controllers ranging from call sign confusion, runway confusion, incorrect phraseology and expectation bias to cockpit overload.

Level bust (SI-2004)

Level bust is defined as any unauthorised vertical deviation of more than 300 ft from an ATC flight clearance. Within reduced vertical separation minima (RVSM) airspace, this limit is reduced to 200 ft. Level bust contributes towards the airborne collision and CFIT key risk areas when the aircraft fails to fly at the level to which it has been cleared. Such events may occur due to communication error, flight crew error in entering the clearance in the flight control unit and insufficient time for the flight crew to react to a late re-clearance.

Mass diversions (SI-0032)

Mass diversions due to airspace and/or airport closure have pervasive repercussions on various aviation domains, ranging from ATC to flight operations, due to their extensive nature. The large amount of displaced traffic results in an overload for ATC and increase workload for the flight crew. This carries the potential for loss of separation as well as other risks related to high-workload tasks and situational awareness. This safety

issue covers policies regarding fuel emergencies, air traffic flow management, ensuring alternate aerodromes have sufficient capacity, and diversions from many airports to one.

New technologies and automation (SI-2015)

This safety issue refers to the potential increase in safety risks due to the complexities arising from the introduction of new technology and concepts in ATM such as remote tower operations and system wide information management (SWIM). With more complex automation, it is important to address the relationship between humans and automation within the framework of a contemporary safety management system.

Procedure design and obstacle publication (SI-2028)

With the advent of new navigation systems, the design of instrument flight procedures (IFPs) and its publications have become key enablers of the ATM system globally. They must therefore be managed to ensure that quality-assured procedures are provided in support of ATM operations. Poorly designed IFPs can increase the risk of loss of separation, level bust and CFIT. In addition to well-designed IFPs, it is also essential to ensure that information relating to the IFP is accurate and updated in a timely manner. This reduces potential discrepancies during the take-off/approach of the flight.

Provision of weather information (turbulence/windshear/convective weather) (SI-2008)

Inaccurate or missing weather information on weather phenomena such as turbulence, windshear, and convective weather on board the aircraft (flight crew) and on ground (ATCOs) may lead to aircraft flying through weather phenomena without warning. Depending on the severity of the weather phenomena, passengers or cabin crew may sustain injuries on board. This safety issue is focused on IFR flights in the en-route/approach environment, where improvement in the provision of meteorological information will enable controllers to better manage traffic flows and pass weather information to pilots.

Provision of weather information (wind at low height) (SI-2009)

The landing phase is considered one of the highest-risk phases of flight due to the high cockpit workload and execution of difficult tasks such as the landing flare. Weather information near the surface of the runway such as tail wind on ground and cross wind is crucial to assist flight crew during the landing phase. Inaccurate weather information may contribute to non-stabilised approaches and increase the risk of runway excursions. As this topic spans across several aviation domains, the scope of this safety issue is focused on the ANSPs' and ATC's role in ensuring accurate and timely weather information is provided to flight crew during the landing phase.

Sector overload (SI-2019)

Sector overload refers to a complex situation where the ATCO on operational duty can no longer manage the existing levels of air traffic in a safe manner. As ATCOs are personnel responsible for the safe, orderly, and expeditious flow of air traffic, it is important to address any situation which impairs the controller's ability to achieve the desired levels of safety. A complex situation may arise due to a confluence of external or internal factors. External factors include aircraft deviation from the planned trajectory, unexpected bad weather conditions, reduction of available airspace, amongst others. Internal factors include partial ATM system failure, parallel system maintenances, blocked runway, amongst others. When assessed individually, some of these contributory factors may have a minor impact on safety. However, when compounded, these factors may manifest in unsafe management of the traffic demand.

Understanding and monitoring system performance interdependencies (SI-2022)

The safety performance of the ANSPs can be affected by a multitude of internal and external factors. While most ANSPs are adept at managing the safety hazards related to their provision of services, it is also important to consider the impact of external factors such as commercial pressure and demands related to increasing capacity and environmental protection on the safety performance of ANSPs. It is important to strike a balance between the competing priorities of safety, efficiency, capacity and environment protection, especially in view of limited resources in most ANSPs. To understand such trade-offs better, regulators and ANSPs should analyse safety performance using a dynamic safety model, such as Rasmussen's Migration Model, and develop guidelines to prevent ANSPs from drifting towards unsafe operations under the influence of competing priorities. Metrics related to factors that have not been traditionally linked to safety performance can be developed to monitor this practical drift and serve to provide 'weak signals' in ATM Safety Performance.

Undetected occupied runway (SI-2006)

This safety issue pertains to runway incursions by an aircraft landing or taking-off on an already occupied runway. This could be due to oversight by air traffic controllers, aerodrome design or other organisational factors. Especially during periods of high workload, the controller may accidentally clear an aircraft or a vehicle to enter a runway even though they had already cleared another aircraft to land or take-off from the same runway. Aerodrome design is also another key contributor to this safety issue as flight crew or manoeuvring area vehicle drivers may navigate onto the wrong surface if the design of the aerodrome may lead to disorientation.

21. Commercial Air Transport – Aeroplanes (CAT A)

The CAT A Safety Risk Portfolio was first developed in 2016 by EASA, in conjunction with the CAT A Collaborative Analysis Group, and has since been reviewed annually. Each safety issue contributes to one or more key risk areas as defined in the introduction.

The main key risk areas for this domain are highlighted in Figure 20 and are defined by their potential accident outcome and by the immediate precursors of that accident outcome. This figure is obtained by aggregating the ERCS score for the risk-scored occurrences relevant to this domain and plotting it against the number of risk-scored occurrences. This provides us with a risk picture of this domain and allows us to identify key risk areas of greater concern.

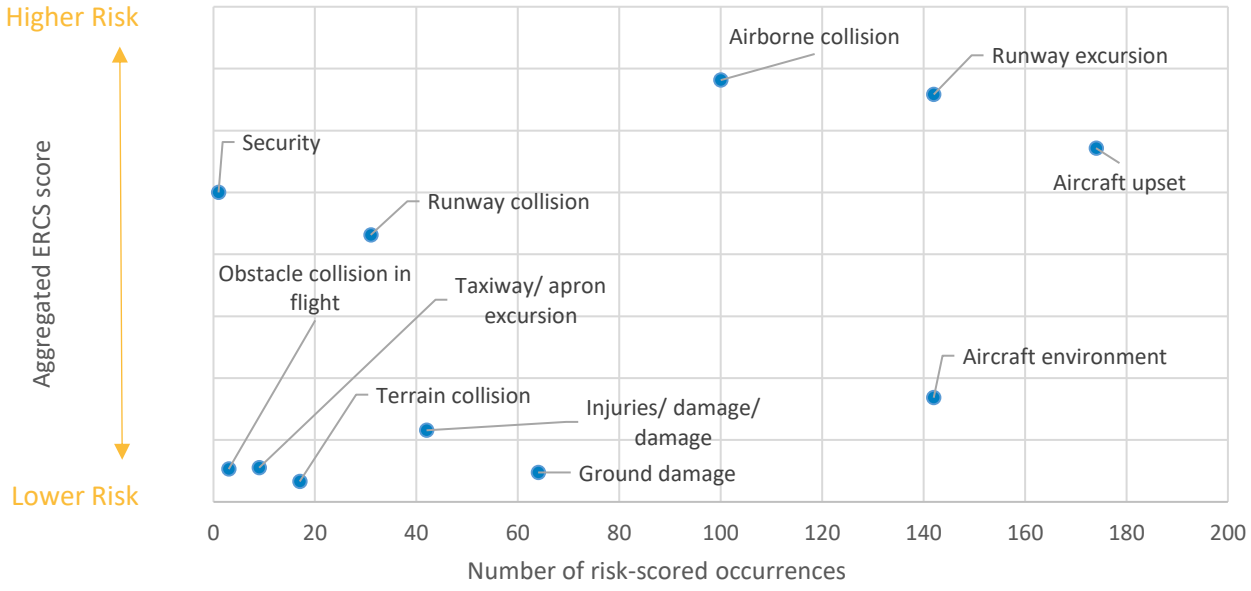

Figure 20: Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving commercial air transport – airlines and air-taxi

The safety issues are sorted into the "Assess, Mitigate and Monitor" categories, which provide a snapshot of their current status within the European Safety Risk Management process. To understand each safety issue better, please click on the safety issue in the list to access their description.

Assess

- Adverse convective weather (turbulence, hail, lightning and ice) (SI-0003**)**
- Approach path management (SI-0007)
- False or disrupted Instrument Landing System (ILS) signal capture (SI-0035)
- Inappropriate flight control inputs (SI-0010)
- Incorrect rotation at take-off (SI-0017)
- Non-precision approaches (SI-0037)
- Reliance on satellite navigation (SI-0034)

Mitigate

- Alignment with the wrong runway (SI-0014)
- Bird/wildlife strikes (SI-0045)
- Clear air turbulence and mountain waves (SI-0018)

- Deconfliction of IFR and VFR traffic (SI-4009)
- Effectiveness of safety management (SI-0041)
- Emergency evacuation (SI-0042)
- Entry of aircraft performance data (SI-0015)
- Icing in flight (SI-0001)
- Laser illumination (SI-0046)
- Volume and quality of the information in NOTAMs (SI-0044)

Monitor

- Carriage and transport of lithium batteries (SI-0027)
- Crew resource management (CRM) (SI-0009)
- Fatigue (SI-0039)
- Disruptive passengers (SI-0047)
- Excessive speed in manoeuvring area (SI-0028)
- Explosive door opening (SI-0048)
- Flight crew incapacitation (SI-0049)
- Fuel management (SI-0025)
- Handling and execution of go-arounds (SI-0019)
- Icing on ground (SI-0002)
- Runway surface condition (SI-0006)
- State of well-being and fit for duties (SI-0005)
- Wake vortex (SI-0012)
- Windshear (SI-0024)

Adverse convective weather (turbulence, hail, lightning and ice) (SI-0003)

The ability and capability of the flight crew to manage the entire flight, including dispatch, and the possibility to detect, avoid and/or mitigate the effects of adverse convective weather on the flight. If not managed well, a flight crew may experience aircraft upset after being forced out of its flight envelope by a severe atmospheric phenomenon, or a significant degradation in performance or the handling qualities of the aircraft, or injuries due to abrupt movements. It also reviews the requirements for the aircraft to fly in certain atmospheric conditions. The main threats of convective phenomena affecting the flight, such as convective turbulence, up/down-drafts, wind shear, hail precipitation, lightning, and icing are reviewed in this safety issue.

Alignment with the wrong runway (SI-0014)

Unintended landing, approach, or take-off of an aircraft to/from a wrong landing/take-off surface can lead to excursions or collisions. It includes cases of landing/take-off to/from a taxiway or other surface mistakenly identified by the flight crew as the assigned runway. The mistake could be due to visual acquisition, wrong data entered in the flight management system (FMS) or miscommunication between ATC and the flight crew. Other contributing factors include complex aerodrome design, multiple runway thresholds located near one another and other aerodrome-design-related complexities. The safety issue includes the relevant standard operating procedures (SOPs) and the flight crew training, the ATS procedures and the lighting and marking of the aerodrome surfaces.

Approach path management (SI-0007)

This safety issue addresses the inappropriate execution of an approach at any point from the initial approach fix (IAF) until reaching safe taxiing speed after landing. This can lead to runway excursions, aircraft upset,

terrain collision, or airborne collision. It covers all types of instrumental and visual approaches. The following areas are reviewed in this safety issue:

— Management of the energy of the aircraft and the influence of external factors affecting the approach, such as tail or crosswind, windshear, down/up drafts and other weather-related factors;

— Decision-making process of the flight crew to go around or continue with the approach; and

— SOPs and the relevance of those procedures for the approach flown, flight crew training and the existing regulatory framework.

In addition to addressing this safety issue from a flight crew perspective, this safety issues also explores ATM-related factors that may lead to non-stabilised approaches. These include ATCO instructions (e.g. vectoring, intermediate level-off) that result in a high descent profile for the flight crew or bring the aircraft too close to the runway. This safety issue is linked to the 'ATM influence on non-stabilised approaches (SI-2010)' in the ATM/ANS Safety Risk Portfolio (see 0).

Bird/wildlife strikes (SI-0045)

Insufficient control of birds and wildlife may lead to either damage to the aircraft or loss of control during take-off or landing. This safety issue addresses the inadequate uncontrolled/excessive presence of birds/wildlife in the aerodrome vicinity, and reviews the controls in place by the different stakeholders e.g. aerodrome operators, aircraft operators, aircraft/engine manufacturers, certification authorities, environment protection agencies, etc.

Carriage and transport of lithium batteries (SI-0027)

Lithium batteries carried or contained in electronic devices on board carry a risk of fire in the aircraft. These batteries may potentially ignite due to a thermal runaway, self-ignition or other heat sources. Lithium batteries may be carried on board an aircraft as part of a cargo shipment, check-in luggage of the passengers in the cargo holds or in the cabin in personal electronic devices carried by the passengers or crew.

Clear air turbulence and mountain waves (SI-0018)

Clear air turbulence and turbulence generated by high mountains are weather phenomena that may result in aircraft upset or injuries/damages. To cope with the effects of such turbulence and mountain waves, it is important to train flight crew to identify and avoid such phenomena and ensure that relevant SOPs are implemented. These efforts should be complemented by the provision of information from external sources, such as ATC or pilot reports (PIREP), during the flight. The issue also covers the preparation of the flight and the availability of information to enable the flight crew to foresee a possible encounter with such phenomena during the flight.

Crew resource management (CRM) (SI-0009)

The issue encompasses all aspects of the communication that may impact the situational awareness of the crew members and/or the conduct of the flight, including lack of a common action plan, inadequate division of duties, poor coordination between crew members, use of non-standard phraseology, sensory overload (loss of communications, multiple aural messages, etc.), etc. Good CRM can be achieved by implementing relevant training for flight crew and an effective regulatory framework for CRM requirements. The goal of CRM is to maximise the available resources, through effective communication and efficient workload management.

Deconfliction of IFR and VFR traffic (SI-4009)

Ineffective deconfliction of flights adhering to IFR and VFR in an airspace class where at least one of the flights is not under ATC separation has been identified as a strong contributor to airborne collision risk. Such airspace classes include class E, controlled airspace where VFR flights are not subject to ATC clearance and no IFR-VFR separation is provided by ATC, and class G, where neither IFR flights nor VFR flights are subject to ATC clearance and ATC does not provide any separation service. The safety issue arises due to the fragmented knowledge of the traffic situation as some traffic is subject to ATC clearance (i.e. IFR) and some other traffic is not (i.e. VFR). ATC may not be aware of VFR flights or their intentions and potentially may not pass traffic information to the IFR traffic. In addition, some of the VFR traffic may not be equipped with ACAS or even a transponder (C or mode-S), reducing the conspicuity of VFR traffic. As a result, both IFR and VFR traffic have to rely solely on the visual acquisition by the flight crew to maintain separation. This safety issue addresses how the conspicuity of VFR traffic can be improved as well as best practices to underscore the importance of existing procedures in maintaining airborne separation. This safety issue is captured in the Non-Commercial Operations – Small Aeroplanes Safety Risk Portfolio and is also relevant to the ATM/ANS domain.

Disruptive passengers (SI-0047)

Disruptive passengers are defined as passengers who do not follow safety procedures or instructions from the cabin crew. Such behaviour is normally associated with the consumption of alcohol, drugs and certain types of medication. However, it may be also the result of stress or emotional distress. It is important to subdue these passengers as they may pose a safety threat to other passengers or the cabin crew. To achieve this, airlines have to design effective procedures and train cabin crew to handle such situations in a safe manner.

Effectiveness of safety management (SI-0041)

Aviation organisations are required to implement Safety Management Systems as part of their safety programmes. This issue reviews an ineffective implementation of Safety Management System by the aviation organisations. The complex nature of aviation safety and the significance of addressing HF aspects show the need for an effective management of safety by the aviation organisations. It covers the regulatory requirements and promotion of SMS principles, for both aviation authorities and organisations, and the capability to detect, anticipate and act upon new emerging threats and associated challenges. It also includes the settling of the adequate safety culture in organisations and authorities. This issue has deteriorated in the context of COVID-19 pandemic, refer to Reduced focus on, or prioritisation on safety (SI-5009).

Emergency evacuation (SI-0042)

The safety issue refers to the unsuccessful evacuation of an aircraft after an emergency. The areas of risk identified are:

— hand luggage amount blocking the aisle preventing or slowing down the evacuation;

— passengers taking hand luggage preventing or slowing down the evacuation; and

— emergency evacuation with the aircraft engine still running.

This safety issue considers the passenger behaviour and compliance with safety instructions, the decision-making for the flight crew to command the evacuation, the cabin crew to adequately execute it, and the certification requirements to ensure the adequacy of equipment and aircraft systems. As such, relevant SOPs, training for both flight and cabin crew, and the relevant regulatory requirements have to be reviewed to ensure the safe and efficient egress of all passengers during an emergency.

Entry of aircraft performance data (SI-0015)

The incorrect entry of data into the FMS that is used to set the take-off or landing performance parameters of the aircraft can have catastrophic consequences. This can potentially occur due to miscommunication errors, errors in electronic flight bags (EFBs), entry of data into FMS, last-minute changes by ATC and load masters, and the incorrect calculation of the performance parameters. To mitigate this safety issue, technical solutions are being considered for the long term, while the short to medium term will focus on improvements to SOPs.

Excessive speed in manoeuvring area (SI-0028)

Excessive ground speed of the aircraft during taxiing at the aerodrome before take-off or after landing may lead to collision on ground, injuries, or damages. This safety issue includes also taxiing phases on the runway e.g. back tracking. Such occurrences may occur due to lapses in SOPs and the associated trainings for the flight crews as well as poorly designed aerodrome procedures.

Explosive door opening (SI-0048)

When an aeroplane is parked, cooling or heating of the aeroplane cabin can be provided through the air-conditioning system powered up by the auxiliary power unit (APU) or by an external source of air (e.g. ground air-conditioning cart) ducted to the aeroplane cabin. Closing all aeroplane doors helps to reach and maintain the desired temperature. However, it may also result in an undesired build-up of excessive differential pressure between the cabin and the outside environment if the outflow valve is closed. As a result, this may cause an explosive door opening that can lead to injuries or damages. This may happen during normal operation of the aeroplane, during maintenance activities, or when conducting practical training of personnel on the aeroplane on ground.

Fatigue (SI-0039)

Fatigue can negatively affect aircrew performance in the aircraft and pose a hazard to flight safety. In commercial air transport, aircrew rosters are traditionally being developed on the basis of prescriptive duty time limits, flight time limits, minimum rest requirements and other constraints such as minimum notification times and prohibition to combine certain duties, to name a few. These limits and requirements, referred to as flight time limitations (FTL), are presumed to be adequate for maintaining aircrew fatigue at levels that will not put at risk the safety of flight operations. Note that general fatigue issues that are not limited to flight crew fatigue, such as quality sleep, are managed under Fatigue and quality sleep (SI-3005) in the Human Factors Safety Risk Portfolio.

False or disrupted Instrument Landing System (ILS) signal capture (SI-0035)

Aircraft on approach may potentially capture a false or disrupted ILS or localiser signal due to several factors:

— technical issues with the ILS; or

— interference of the ILS signal by obstacles, aircraft, and vehicles in the sensitive ILS areas; or

— inadequate approach procedures leading to the capture of upper/lower/side lobes.

A false or disrupted capture may lead to terrain collision or runway excursion. Due to its multi-faceted nature, this safety issue also includes the review of existing safety barriers implemented by different stakeholders, such as the CNS providers, aerodrome operators, ATS, aircraft operators, manufacturers as well as regulators.

Flight crew incapacitation (SI-0049)

With reduced and single-crew operations, a new certification requirement is needed for normal aircraft conditions. This will ensure the continued safe flight and landing in the event of pilot incapacitation. The concept of continued safe flight and landing currently applies only in the determination of airworthiness of aircraft structures and systems. A new requirement could engender pilot incapacitation detection, alerting, and recovery requirements, and be used as a reference for the certification of a possible ground-assistance element.

Fuel management (SI-0025)

Inadequate management of the fuel to perform the flight that may lead to aircraft upset or collision with terrain. This involves fuel planning, calculation, and the management once the flight has commenced i.e. defined as the point when the first engine has started. It includes the communication and coordination of the flight crew with ATC and the operations department of their organisation, the relevant SOPs, fuel policy and training of the flight crew.

Handling and execution of go-arounds (SI-0019)

Inadequate execution of the go around manoeuvre may lead to aircraft upset, runway excursion, injuries or damages, or collision with terrain. It is the deviation from the SOPs and published go-around procedures. It covers the HF relevant during this manoeuvre (e.g. somatogravic illusion, breakdown of CRM). It includes the procedures and training of the flight crew, and the adequacy of those, go-around with all engines operating (workload).

Icing in flight (SI-0001)

Icing in flight may occur due to various reasons, however, this safety issue is focused on the manifestation of icing during flight caused by an atmospheric icing phenomenon. The typical manifestation is the accretion of ice on aerodynamic surfaces, probes, engine parts or flight control system, leading to degradation of handling quality or performance issues, system failures or malfunctions, or damages on aeroplane´s structure. When such icing occurs, it is important to ensure that the flight crew is able to recognise the situation and manage the flight in adverse icing conditions. Other sources of icing, such as frozen water leaks from the waste water aircraft system, are excluded from this safety issue. This safety issue is also relevant to the Non-Commercial Operations – Small Aeroplanes domain.

Icing on ground (SI-0002)

Icing on the ground may occur due to an atmospheric icing phenomenon and the adverse effect of the de-/anti-icing fluids. If managed poorly, the flight crew may experience aircraft upset or collision with terrain after take-off, runway excursion, injuries or damages. It is crucial to ensure relevant SOPs and training are implemented to ensure that flight crew are able to recognise and manage the effects of adverse icing conditions experienced during the ground phases of flight. This safety issue is also relevant to the Non-Commercial Operations – Small Aeroplanes domain.

Inappropriate flight control inputs (SI-0010)

Flight crew may inadvertently introduce flight control inputs which may result in a deviation from actual or intended immediate flight path. Depending on the circumstance and magnitude of input, inappropriate flight control inputs may result in an undesirable safety consequence, such as aircraft upset, runway excursion, injuries or damage. It also addresses the HF affecting the flight crew performance, for instance, by reducing their cognitive capacity to recognise the situation and react appropriately.

Incorrect rotation at take-off (SI-0017)

One type of incorrect rotation is slow rotation rate performed by the flight crew at take-off, with the aim of avoiding tail strikes. This is especially critical in short- and high-altitude runways as too slow rotations there can lead to runway excursions, aircraft upset, or terrain collision. The most critical scenario is a heavy aircraft, typically a long haul flight by a large four-engine aircraft with high payload, in short high-altitude runways. Relevant SOPs and training for flight crew have to be reviewed and implemented to ensure that flight crew rotate the aircraft at the correct rate during take-off.

Laser illumination (SI-0046)

Even though it is illegal to shine a laser device at an aircraft in most countries, such errant behaviour still occurs and puts flight crews at risk of temporary or permanent blindness. It may result in pilot distraction, temporary vision impairments and in serious cases, ocular injury. These effects may pose significant flight safety hazards in critical phases of flight during approach and landing near airports.

Non-precision approaches (SI-0037)

The safety issue refers to the erosion of pilot skills to conduct non-precision approaches as most airline pilots are not required to conduct such approaches frequently. The high standards and wide spread of precision approaches, including the increasing number of performance-based navigation (PBN), is reducing the exposure, and limiting non-precision approaches to isolated cases (e.g. en-route diversion). The safety issue covers the training and SOPs for the flight crews on non-precision approaches. This safety issue is linked with Approach path management (SI-0007).

Reliance on satellite navigation (SI-0034)

The safety issue refers to the increasing reliance on satellite-based navigation and the potential impact of the associated vulnerabilities on the safety of the flight. Such vulnerabilities include jamming, spoofing and over-reliance of flight crew on satellite navigation. Over-reliance on satellite-based navigation may lead to complacency resulting in inadequate pre-flight preparation and potential loss of orientation when the GNSS unit fails. It covers the equipment on board, the SOPs, training and navigation procedures published. The procedure of key interest is the procedure to revert to other means of navigation in critical flight phases should the GNSS unit malfunction in flight. Wrong position information has severe repercussions as it can lead to airspace infringement or trigger false TAWS events which might result in increased mid-air collision risk.

Runway surface condition (SI-0006)

The mismatch between the actual status of the runway surface condition and the one used to calculate the aircraft landing performance may lead to runway excursions. This includes the measurement systems, the methodology to assess the runway surface condition and the reporting methods used to communicate said condition to the flight crews in approach. This safety issue also addresses the calculation methods used by the flight crew provided by the operator in the AFM/FCOM and the performance data provided by the aircraft manufacturer.

State of well-being and fit for duties (SI-0005)

Flight crew have to be fit and well both physically and mentally to conduct a flight safely. This is achieved by ensuring the well-being of flight crew through the introduction of procedures for airlines to assess the conditions of flight crew and well-being initiatives in the airline. These efforts should be undergirded by an

effective regulatory framework. Refer also to Decreased well-being of aviation professionals during shutdown (SI-5007).

Volume and quality of the information in NOTAMs (SI-0044)

With the steady growth in the number of notices to airmen (NOTAMs), flight crew are increasingly challenged in processing the volume of information during their pre-flight preparation. It is hard to identify the most important and relevant information, which may result in the flight crew overlooking safety-critical information. This is also exacerbated by the inconsistent quality of the information provided in NOTAMs. The content of a NOTAM does not always adhere with to ICAO standards and the use of non-standard acronyms may create confusion or a delay in understanding the content. The safety issue explores the different mitigations which can be adopted in the short to medium term while the long-term solution of digital NOTAMs is implemented incrementally across Europe.

Wake vortex (SI-0012)

The safety issue refers to the encounter with the wake turbulence of a preceding aircraft, which may lead to the upset of the trailing aircraft. It includes the possible ATS role in providing separation of the traffic, the SOPs for flight crews to stay away from the wakes of other aircraft and their associated training. Due to the differences in ATS procedures, encounter geometries and mitigation strategies, the safety issue can be divided in two scenarios: ‘encounters during arrival and departure’ and ‘en-route encounters’.

Windshear (SI-0024)

The encounter with windshear on final approach, landing, take-off, and initial climb may lead to aircraft upset or runway excursions. Effective SOPs and the training for the flight crew should be implemented by airlines to ensure that flight crew are well-equipped to avoid or deal with those conditions. Such efforts should also be supplemented by detection of potential windshear by third parties, such as ATC, and the effective relay of this information to the flight crew.

22. Human Factors

The Human Factors (HF) Safety Risk Portfolio was first developed in 2017 by EASA, in conjunction with the HF Collaborative Analysis Group, and has since been reviewed annually. Due to the broad nature of HF safety issues, they contribute to most, if not all key risk areas.

The safety issues are sorted into the "Assess, Mitigate and Monitor" categories, which provide a snapshot of their current status within the European Safety Risk Management process. To understand each safety issue better, please click on the safety issue in the list to access their description.

Assess

- Attention and vigilance (SI-2015)
- Decision-making in complex systems (SI-3016)
- Error mitigation by design (maintenance and production) (SI-3017)
- Evaluation of effect of HF activities on safety, efficiency, effectiveness and the project timeline of HF specialist involvement (SI-3014)
- Fatigue and quality sleep (SI-3005)
- Human factors of multiple remote towers (SI-3022)
- Impact of culture on human performance (SI-3002)
- Integration of practical HF/HP into the organisation's management system (SI-3004)
- Knowledge development and sharing (SI-3008)
- Organisational and individual resilience (SI-3009)
- Root cause analysis (SI-3024)
- Staff support programmes (SI-3012)
- Startle and surprise (SI-3010)
- Training effectiveness and competence (SI-3011)
- Workload (SI-3006)

Mitigate

- Design and use of procedures (SI-3007)
- Human factors competence for regulatory staff (SI-3003)

Monitor

- Senior management knowledge, competence and commitment to HF/HP (SI-3001)
- Alignment between OSD and FAA FSB processes (SI-3023)

Attention and vigilance (SI-2015)

Maintaining appropriate levels of attention and vigilance supports situational awareness. It is important to ensure that the working environment, equipment and processes support attention, vigilance and by extension situational awareness.

Alignment between OSD and FAA FSB processes (SI-3023)

The EASA operational suitability data (OSD) and FAA Flight Standardisation Board (FSB) processes both aim to ensure that flight crew training takes appropriate consideration of the aircraft design. Misalignments between the two would potentially create training discrepancies. This safety issue has been categorised as

'monitor' because it is believed that the issue has been resolved through coordination between EASA and the FAA.

Decision-making in complex systems (SI-3016)

Decision-making in aviation activities can be complex, pressured and bear a high risk. This by definition means that assessing trade-offs and interdependencies, or making the right decisions can be difficult. Structures and processes to support decision-making can be helpful; however, the complexity of the system means that it is difficult to create such structures and processes with the necessary level of detail.

Design and use of procedures (SI-3007)

Procedures are used throughout the aviation industry to describe the correct actions and sequence of actions to perform a task. Out of necessity, procedures are designed using assumptions about the circumstances in which they will be applied. While this frequently produces well-designed procedures, the complex nature of the aviation working environment means that not every circumstance can reasonably be accounted for. Regardless of whether the procedure has been designed well or badly, rapid changes in the aviation system can mean that a procedure becomes more difficult to use over time.

Evaluation of effect of HF activities on safety, efficiency, effectiveness and the project timeline of HF specialist involvement (SI-3014)

When a HF intervention is proposed, there are implicit questions including 'Will that make a safety enhancement difference?' and 'Can that be measured/qualified with respect to safety effectiveness and operational efficiency?'. Succinctly, what is the cost and safety impact of investments in HF and HF-related organisational interventions? Being able to evaluate the effect of HF activities and knowing at which point in a process to involve HF professionals is an important element of a successful project.

Error mitigation by design (maintenance and production) (SI-3017)

Incorrect assembly in production or maintenance may lead to an unsafe condition for the aircraft. It is inappropriate to rely solely on warnings in maintenance instructions, markings and independent inspections to detect misassembly, when the hazard can be eliminated by careful design in most cases.

Fatigue and quality sleep (SI-3005)

Fatigue is repeatedly identified as one of the most serious challenges within the aviation industry. The signs of fatigue are subtle and will lower human performance in all the known areas of human limitations. Preventing fatigue is dependent on obtaining both a sufficient quantity and quality of sleep.

Human factors competence for regulatory staff (SI-3003)

Competencies are observable and measurable patterns of knowledge, skills and attitude that an individual is expected to demonstrate in relation to required task performance. It is important for regulatory staff to have specific HF competencies to be able to perform their duties. This also provides an added benefit of improving the conversation on safety and human factors between regulatory staff and people at different levels in industry.

Human factors of multiple remote towers (SI-3022)

Remote tower operations are increasingly being used, as a means of effectively and efficiently providing ATS at an aerodrome. Multiple remote tower operations are also now being introduced, and the HF associated with this type of work needs thorough consideration.

Impact of culture on human performance (SI-3002)

Organisational culture is an important element in supporting human performance in the workplace. Culture depends on the historical context and the socio-technical environment and economic context in which we live. For example, with the 'economic survival' effect — or when the 'commercial benefit' dictates the running of the organisation too much, leading to: a lack of resources; stressful environment; no training policy; too much operational pressure and time pressure; too many subcontracting activities; insufficient maintenance or airport or ATC equipment; and so on.

Integration of practical HF/HP into the organisation's management system (SI-3004)

An organisation is made up of humans, procedures and processes, which work together, often in a hierarchical manner and interacting to achieve a common goal. As such, the organisation's management system cannot be fully effective unless it has integrated HF considerations and human performance principles in a practical manner.

Knowledge development and sharing (SI-3008)

Knowledge sharing, particularly of tacit knowledge, is difficult to do well. This makes knowledge retention in situations of increased staff turnover very difficult. Knowledge development and sharing is about developing the right knowledge and making this knowledge available to the right people at the right time.

Organisational and individual resilience (SI-3009)

Organisational resilience is a key factor in successfully managing safe operation, but there is scant regulatory guidance on how to apply the concept. Resilience comprises both a system's ability to withstand disturbances, challenges and change, and to recover and sustain operations thereafter. The positive contribution to safety of each and every staff member is a key component in an organisation's resilience.

Root cause analysis (SI-3024)

Investigations into incidents and hazard observations often result in poor or ineffective interventions because investigations do not uncover or address the root causes of the issue. Shallow investigations often address symptoms of the event rather than the causes and consequently rarely prevent reoccurrence.

Senior management knowledge, competence and commitment to HF/HP (SI-3001)

Operators, maintenance organisations, manufacturers, national aviation authorities, and other entities that contribute to continuing safety and efficiency strive to promote the process of positive organisational cultural change. Positive cultural evolution requires cooperation and shared values across all levels of management and workers. Corporate safety culture is significantly affected by the values and actions of senior management. Those senior leaders need to understand and communicate the critical significance of HF and human performance to all members of staff.

Staff support programmes (SI-3012)

The EASA-led Task Force on Germanwings Flight 9525 identified a number of safety risks, including the need for pilot support programmes. However, humans throughout the aviation system need such support programmes. This has been highlighted in particular throughout the COVID-19 pandemic, where aviation professionals have worked under high pressure and often in isolating circumstances.

Startle and surprise (SI-3010)

Surprise and its consequent reaction, startle, is a significant impediment to managing safety-critical situations but not enough is known about how to mitigate it. Research shows that cognitive impairment, particularly in the working memory, can be significant. Narrowed attention, decreased search behaviour, longer reaction time to peripheral cues, decreased vigilance, degraded problem-solving, performance rigidity, degraded working memory function and critical effects on psychomotor skills are just some of the impairments noted under the effects of startle and surprise.

Training effectiveness and competence (SI-3011)

Despite the obvious technological advances that have made the aviation industry safer and more efficient in the last few decades, the way that those working in the industry are trained has not changed significantly. Recently, ICAO has sought to address this through the development of competency frameworks; however, organisations and States need to assure themselves that they fully appreciate how to utilise competency frameworks to their best advantage, whilst striving for a shared understanding of terms and concepts.

Workload (SI-3006)

At its broadest, workload can be considered as being made up of two major components, physical workload and cognitive workload. High physical and mental workload situations often coincide, causing a significant degradation to cognitive capacity and consequently to one’s ability to execute a task correctly.

23. Non-Commercial Operations – Small Aeroplanes

The Non-Commercial Operations (NCO) – Small Aeroplane Safety Risk Portfolio was first developed in 2016 by EASA, in conjunction with the General Aviation Collaborative Analysis Group, and has since been reviewed annually. Each safety issue contributes to one or more key risk areas as defined in the introduction.

The main 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. This figure is obtained by aggregating the ERCS score for the risk-scored occurrences relevant to this domain and plotting it against the number of risk-scored occurrences. This provides us with a risk picture of this domain and allows us to identify key risk areas of greater concern.

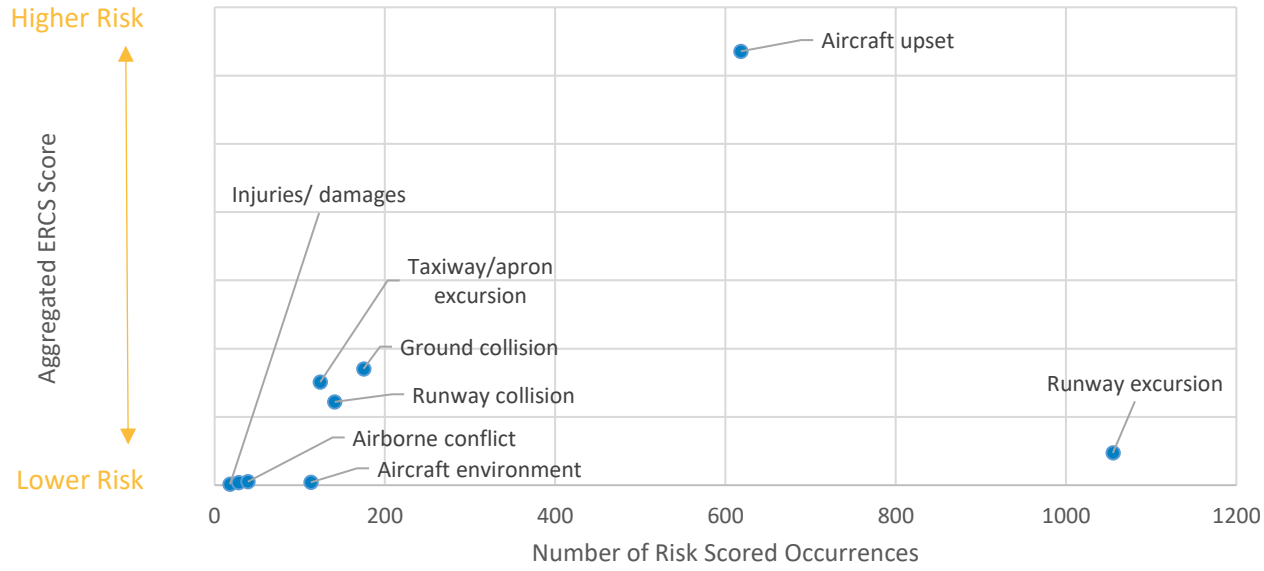

Figure 21: Key risk areas by aggregated ERCS score and number of risk-scored occurrences involving non-commercially operated small aeroplanes

The safety issues are sorted into the "Assess, Mitigate and Monitor" categories, which provide a snapshot of their current status within the European Safety Risk Management process. To understand each safety issue better, please click on the safety issue in the list to access their description.

Assess

- Approach path management on GA aeroplanes (SI-4005)
- Damage tolerance to UAS collisions (SI-4019)
- Handling of technical failures (SI-4001)
- Inflight decision making and planning (**SI-4003)**
- Parachuting operations (SI-4023)
- Pre-flight planning and preparation (SI-4007)
- Training, experience and competence of individuals (SI-4004)

Mitigate

- Airborne separation (SI-4010)
- Deconfliction between IFR and VFR traffic (SI-4009)

Monitor

- Aeroplane system reliability (SI-4012)
- Bird and wildlife strikes at smaller aerodromes/airfields (SI-4013)
- Crosswind (SI-4015)
- Fuel management (SI-4011)
- Icing in flight (SI-0001)
- Icing on ground (SI-0002)
- Knowledge of aircraft systems and procedures (SI-4017)
- Maintenance of GA aeroplanes (SI-4018)
- Turbulence (SI-4016)
- Weight and balance (SI-4014)

Aeroplane system reliability (SI-4012)

The reliability and handling of any hardware/software system on board the aeroplane is crucial for a safe flight. This includes all systems on board the aircraft such as the aircraft structure, engine(s), flight controls, FMS, software incorporated into system, etc. Failure of any of these hardware/software systems can result in loss of control and aircraft upset.

Airborne separation (SI-4010)

Maintaining airborne separation is one of the key contributory factors in reducing mid-air collision risk. This relies on the pilot's ability to detect and avoid loss of separation, and maintain safe distance between the aircraft and the surrounding traffic. This involves the adherence to separation minima and visual separation.

Approach path management on GA aeroplanes (SI-4005)

This safety issue addresses the inappropriate execution of an approach at any point from the IAF until reaching safe taxiing speed after landing. This can lead to runway excursions, aircraft upset, terrain collision, or airborne collision. It covers all types of instrumental and visual approaches. The following areas are reviewed in this safety issue:

— Management of the energy of the aircraft and the influence of external factors affecting the approach, such as tail or crosswind, windshear, down/up drafts and other weather-related factors;

— Decision-making process of the flight crew to go around or continue with the approach; and

— SOPs and the relevance of those procedures for the approach flown, pilot training and the existing regulatory framework.

The main objectives are to train pilots to achieve stabilised approaches on correct speeds, enhance pilots go-around decisions when the approach is unstable and the deployment of PBN approaches.

Bird and wildlife strikes at smaller aerodromes/airfields (SI-4013)

This safety issue considers the following contributory factors:

— Pilot's ability/inability to detect, recognise and avoid bird strike or wildlife strike;

— ATC's ability/inability to report the likelihood of bird strikes or wildlife strikes; and

— Aerodrome operator's ability/inability to control the population of birds and other wildlife in the vicinity of the airport.

For pilots experiencing a bird strike or a wildlife strike, the main goal is to enable them to manage the startle effect and control the aircraft correctly to achieve a safe landing.

Crosswind (SI-4015)

Crosswind conditions increase the complexity of a landing or take-off procedure as the pilot has to consider the crosswind conditions to avoid an aircraft upset or runway excursion. It includes the preparation of the approach and landing and the take-off, and the information received on crosswind, either from external sources or from the aircraft systems. It also includes the certified capabilities of the aircraft type to perform the landing in crosswind conditions (limitations), the SOPs and training of the pilot. It also includes the accuracy of the measurement of the wind conditions and the relay of that information to the pilot prior to landing or take-off.

Damage tolerance to UAS collisions (SI-4019)

UASs are a growing airborne collision threat to manned aircraft due to their growing popularity among the public who may not be aware of UAS regulations. It is important to consider the structural tolerance of a general aviation aircraft to withstand impact with an UAS and its ability to maintain controllability to enable a safe landing after a collision with an UAS. The damage tolerance has a direct relationship with the weight and size of the UAS.

Deconfliction between IFR and VFR traffic (SI-4009)

Ineffective deconfliction of flights adhering to IFR and VFR in an airspace class where at least one of the flights is not under ATC separation has been identified as a strong contributor to airborne collision risk. Such airspace classes include class E, controlled airspace where VFR flights are not subject to ATC clearance and no IFR-VFR separation is provided by ATC, and class G, where neither IFR flights nor VFR flights are subject to ATC clearance and ATC does not provide any separation service. The safety issue arises due to the fragmented knowledge of the traffic situation as some traffic is subject to ATC clearance (i.e. IFR) and some other traffic is not (i.e. VFR). ATC may not be aware of VFR flights or their intentions and potentially may not pass traffic information to the IFR traffic. In addition, some of the VFR traffic may not be equipped with ACAS or even a transponder (C or mode-S), reducing the conspicuity of VFR traffic. As a result, both IFR and VFR traffic have to rely solely on the visual acquisition by the flight crew to maintain separation. This safety issue addresses how the conspicuity of VFR traffic can be improved as well as best practices to underscore the importance of existing procedures in maintaining airborne separation. This safety issue is also relevant to the Commercial Air Transport – Aeroplanes and ATM/ANS domains.

Fuel management (SI-4011)

This safety issue includes the fuel planning, calculation and the management once the flight has started. Examples are pre-flight visual fuel quantity inspections including test for water in the fuel, correct mixture leaning during the flight, correct use of fuel valves, pumps and switches. Fuel management is important to ensure that there is sufficient fuel for the flight or different legs of the flight. Poor fuel management may

result in high workload and stress for the flight crew as they have to look for alternate aerodromes/airfields to land at a short notice.

Handling of technical failures (SI-4001)

Pilots may suffer from non-catastrophic technical failure(s) in the aircraft systems from time to time. It is important for the pilot to have the ability and capability to manage such failures to avoid an aircraft upset. This includes, for example, handling of engine failures, flight control problems as well as failures in navigation systems. Occurrence data shows that the pilot's focus is often fixed on resolving the technical issue instead of flying the aircraft towards the safest landing site. This often results in loss of control and, potentially, fatal accidents.

Icing in flight (SI-0001)

Icing in flight may occur due to various reasons; however, this safety issue is focused on the manifestation of icing during flight caused by an atmospheric icing phenomenon. The typical manifestation is the accretion of ice on aerodynamic surfaces, probes, engine parts or flight control system, leading to degradation of handling quality or performance issues, system failures or malfunctions, or damages on aeroplane´s structure. When such icing occurs, it is important to ensure that the pilot is able to recognise and manage the flight in adverse icing conditions. Aircraft specifically with carburettors are most prone to engine icing in flight. Proposed mitigations include the promotion of knowledge on icing conditions and how to handle the aircraft when icing occurs. This safety issue is captured in the Commercial Air Transport – Aeroplanes Safety Risk Portfolio.

Icing on ground (SI-0002)

Icing on the ground may occur due to an atmospheric icing phenomenon and the adverse effect of the de-/anti-icing fluids. If managed poorly, the pilot may experience aircraft upset or collision with terrain after take-off, runway excursion, injuries or damages. It is important for the pilot to detect and handle icing on the aircraft's fuselage, wings and control surfaces before the flight is initiated. This safety issue is captured in the Commercial Air Transport – Aeroplanes Safety Risk Portfolio.

Inflight decision making and planning (SI-4003)

To effectively respond to dynamic situations or changes during the flight, the pilot needs to possess the ability to correctly gather information and re-plan in flight. This includes decisions involving navigational matters, problem-solving and avoiding or recovering from low- or no-visibility conditions. This is exacerbated by social and commercial pressures (e.g. pressure from the passenger) to reach the planned destination, pushing the pilot to take unnecessary risks, instead of turning around and try another time. A wrong decision based on incorrect evaluation of the circumstances has caused fatal accidents. Proposed actions are to provide/promote education in the use of available information to enhance the decision-making process. This includes increasing the availability of information and simplifying the presentation of this information to the pilot to facilitate understanding.

Intentional low flying (SI-4008)

A poorly executed planned low-altitude flight may result in the aircraft's collision with objects or surface. This includes also what is called 'scud running' where the pilot flies under low clouds close to the ground to reach his planned destination. This also captures the 'press-on-it' mentality during a VFR flight where pilots put themselves into unnecessary danger trying to reach their destination.

Knowledge of aircraft systems and procedures (SI-4017)

The pilot's ability/inability to apply formerly acquired knowledge and training to the current event. This is evident where pilots are flying aircraft that they do not have much experience on – i.e. transitional training has not been or inadequately performed resulting in incorrect actions causing even cascade of other problems and inadequate decision-making. It is important for pilots to understand the characteristics of the different systems on board the aircraft. Pilots who are proficient in their knowledge of systems should instinctively use the correct systems, otherwise they may lose precious time in searching for the correct systems or use the wrong system.

Maintenance of GA aeroplanes (SI-4018)

Aircraft maintenance performed incorrectly, or the lack thereof, leading to a technical occurrence or failure. This issue involves both certified technicians as well as GA pilots performing part of the aircraft maintenance in accordance with their training.

Parachuting operations (SI-4023)

Parachuting operations are flights which are specifically chartered/operated to transport parachutists (called 'skydivers' in sport parachuting) to a designated altitude for jumping out from the aircraft. These operations, usually entailing short flights, are exposed to a range of operational hazards that may relate to changes in weight and balance, possible interference of the parachute deployment devices with structural elements of the aircraft upon exit, insufficient communication between the pilot and the parachutists, non-adherence to SOPs leading to convergent aircraft descent- and free-falling parachutist trajectories (a risk in particular in the case of wing suit or large formation skydiving), etc. This type of operation may also be exposed to organisational hazards such as commercial pressure, lack of or inadequate safety briefings, inadequate monitoring of continuing airworthiness.

Pre-flight planning and preparation (SI-4007)

Effective pre-flight planning and preparation is achieved by ensuring that the correct processes, tools and information used by the flight crew/operator to plan the flight. It includes the adequacy, accuracy and timeliness of the information used, how this is processed and digested by the flight crew and their training and SOPs. It includes the dispatch of the aircraft and the flight preparation steps before the flight is initiated.

Training, experience and competence of individuals (SI-4004)

This safety issue relates to the pilot's training, experience and competence to handle the required tasks in flying the aircraft from engine start-up till engine shutdown, as well as their ability to address occurrences they may face during the flight. This issue also addresses training aspects and planning within training organisations.

Turbulence (SI-4016)

This issue addresses turbulence-induced occurrences caused either by clear air turbulence, mountain waves or rotors as well as wake turbulence induced by large aircraft. All phases of flight are considered. The outcome of turbulence occurrences can be loss of control and g-force overload even causing structural damage or injuries to persons on board.

Weight and balance (SI-4014)

The weight and balance of the aircraft may be adversely affected by inadequate or incorrect loading of the aircraft by the pilot. GA pilots usually load their aircraft by themselves and do not use ground handling services. The objective is to improve the calculation of load and balance sheets and ensure that the baggage and cargo are securely fastened to prevent them from shifting and changing the aircraft´s centre of gravity.