EASA
European Union Aviation Safety Agency

EUROPEAN PLAN FOR AVIATION SAFETY (EPAS)

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Safety Risk Portfolios
2025 Edition

European Union Aviation Safety Agency

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What is this volume about?

Volume III of the 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 the 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 European Safety Risk Management (SRM) process

The main safety risks and corresponding mitigating actions feeding the EPAS are developed through the European SRM process. This comprises a set of processes that aim to identify the safety issues[1] and their mitigations. It involves analysis of data from different sources and collaboration with safety partners from national aviation authorities and the industry (through the Collaborative Analysis Groups (CAGs) and the Network of aviation safety Analysts (NoAs)[2].

The SRM process follows five specific steps:

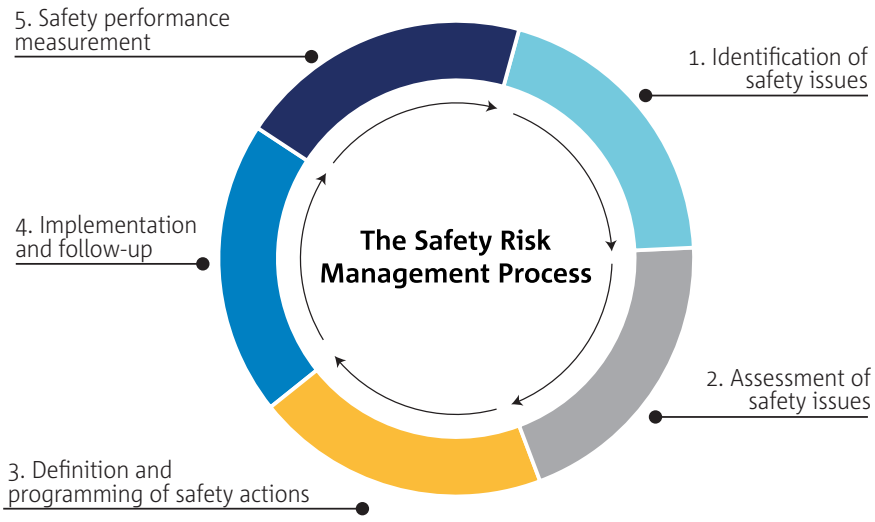

Figure 0-1: The European SRM process

1 Safety issues are safety deficiencies related to one or more hazards. They are the actual manifestation of a hazard or a combination of several hazards in a specific context. They can be assessed in terms of risk and practically managed (mitigated). The level of granularity of a safety issue should not be too detailed, in that it would then be controlled by selective and reactive operational mitigating controls, such as airworthiness directives (ADs) or safety directives (SDs). It should also not be too general, which would render its mitigation unfeasible in an acceptable timeframe.

2 For easy reference, the 'network of aviation safety analysts', as referred to in Regulation (EU) No 376/2014 of the European Parliament and of the Council, is abbreviated as 'NoAs'.

Identification of safety issues: The identification of safety issues is the first step in the SRM process, and it is performed through the analysis of occurrence data and other safety-related information and supporting information by the CAGs. These safety issues are formally captured by the Agency and are then subject to a preliminary safety assessment. This assessment then informs the decision on whether a safety issue should be formally included within the relevant safety risk portfolio or be subject to other actions. Advice is taken from the NoAs and the CAGs. The output of this step in the process are the domain safety risk portfolios. Within the portfolios, both the key risk areas and safety issues are prioritised.

Assessment of safety issues: Once a safety issue is identified and captured within the safety risk portfolio, it is subject to a technical safety assessment. These assessments are prioritised within the portfolio. The assessment process is led by the Agency and is supported by the NoAs and the CAGs. In addition, group members are encouraged to participate in the assessment itself. This collaborative approach with the Agency's safety partners is critical to achieving the best possible results. Together, this forms the Safety Issue Assessment (SIA), which provides potential mitigating actions for the EPAS.

Definition and programming of safety actions: This includes an impact assessment through the best intervention strategy (BIS) document, defining possible mitigation actions, assessing the implications and benefits of each possible action, and making recommendations on the best mitigation action(s) to be implemented in the EPAS. Using the BIS, formal EPAS action proposals are then submitted to the Agency Advisory Bodies (ABs). Once discussed and agreed upon, the actions are then included in the next version of the EPAS. Prior to publication, the EPAS is approved by the EASA Management Board (MB).

Implementation and follow-up: The next step in the process involves the implementation and follow-up of the actions that have been included within the EPAS. There are different types of actions within the EPAS, e.g. research, rulemaking, Member State tasks, safety promotion and evaluation.

Safety performance measurement: The final stage in the process is then the measurement of safety performance. This serves to monitor:

(1) specific changes that have resulted from the implementation of safety actions; and

(2) the systemic changes that may have occurred in the aviation system and may require additional actions.

The measurement of the performance is done via a safety performance framework that monitors:

(1) transversally the various domains while looking at the key risk areas at domain level; and

(2) the specific safety issues.

The Annual Safety Review (ASR) is the annual review of the safety performance framework. It identifies safety trends, highlights priority domains, key risk areas and safety issues. From this step, the SRM process begins again.

Introducing the Safety Risk Portfolios

The EPAS Volume III provides the EASA 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.

Safety Risk Portfolios form an essential component of the European SRM process. In developing the portfolios, safety information is gathered and analysed from sources such as occurrence data, expert judgement, and safety studies. Our safety partners are essential to gathering this safety information.

Safety issues[3]

Safety issues are identified through the Agency's analysis of aviation occurrence data and other safety-related information (such as hazards) or submitted as a safety issue through the CAGs, NoAs, EASA's website or internal EASA stakeholders. Safety issues identified through aviation data collected by the Agency are published in the EASA ASR Appendices in the form of a data portfolio[4]. 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 NoAs. The safety issues qualify to enter or exit the Safety Risk Portfolio according to the level of residual risk they bear. The residual risk considers the available mitigations introduced to control the safety issue (new or strengthened barriers, other solutions).

The safety issues and Safety Risk Portfolios are grouped by domain[5] as each domain has its particularities and requires specific expertise. The following domains are part of the SRM process:

- Systemic and conjunctural
- Human factors/human performance
- Commercial air transport — aeroplanes
- Rotorcraft
- Non-commercial operations — small aeroplanes
- Sailplanes
- Balloons
- Airworthiness
- Air traffic management/air navigation services (ATM/ANS)
- Aerodromes and ground handling

Although the analysis and portfolios are organised per domain, some safety issues are relevant to more than one domain. These safety issues have to be analysed from a multi-domain perspective. Within the Agency, 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 in only 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°.

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 the European SRM 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. The set of key risk areas (Commission Delegated Regulation (EU) 2020/2034[6]) provides a common taxonomy for the possible accident outcomes, based on which the safety risk management

3 Safety issue: Safety issues are safety deficiencies related to one or more hazards. They are the actual manifestation of a hazard or combination of several hazards in a specific context. They can be risk assessed and practically managed (mitigated).

4 It is important to note that due to additional layers of qualitative assessment, the safety issues presented in the data portfolios may evolve in their scope. Thus, there might be slight differences in how the safety issues are presented in the data portfolio and Safety Risk Portfolio.

5 A domain is a container that is used to consistently and coherently group safety issues to manage them. It can be led by operational, organisational, consensual or conjunctural considerations.

6 Commission Delegated Regulation (EU) 2020/2034 of 6 October 2020 supplementing Regulation (EU) No 376/2014 of the European Parliament and of the Council as regards the common European risk classification scheme (OJ L 416, 11.12.2020, p. 1).

is structured. Prioritisation applies to the safety issues being the safety deficiencies related to one or more hazards. In prioritising safety issues, key risk areas are considered when determining the worst likely accident outcome the safety issue may have escalated to, as part of the residual risk classification (refer to the description of 'prioritisation').

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 listed below, using the definitions as per the Delegated Act for the European risk classification scheme:

Airborne collision: a collision 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.

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.

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 cybersecurity events.

Links between safety issues and key risk areas they contribute to are depicted in Appendix A to this Volume.

Safety issues affected by climate change

Managing the impact of climate change on aviation safety is one of the strategic goals for the Agency (please refer to Volume I of the EPAS). Climate change is likely to affect the frequency and the intensity of hazardous weather phenomena, but also where and at what time of the year such phenomena tend to occur.

Examples of hazardous weather phenomena are severe airborne icing, severe turbulence, low-level windshear, hail encounters, lightning strikes, etc. Although the effects of climate change on hazardous weather phenomena are rather long-term, they should be considered to ensure that safety risk assessments and risk mitigation measures are sustainable.

The Agency is currently gaining more knowledge on the effects of climate change on aviation safety, with the intent to inform safety issue assessments. To that end, this topic has been one of the core activities of the Agency's Scientific Committee[7] since it was launched in 2022, and it is tracked by a research action in Volume II of the EPAS. The first findings of the Scientific Committee regarding severe convective storms, hail and clear-air turbulence can be consulted in the Scientific Committee's annual report 2022. The European_Academia@EASA conference in March 2023 covered, among others, how climate change affects aeroplanes take-off performance[8].

In addition, the Agency has decided to establish a work programme on climate change adaptation, and launched the European Network on Impact of Climate Change on Aviation (EN-ICCA) in November 2023. Comprising relevant experts from national competent authorities, the aviation industry, weather and climate scientists, in 2024 the work plan of the EN-ICCA included work on future trends of severe convective storms, hail and heavy precipitation and safety concerns resulting from those trends. In addition, trends regarding airborne icing conditions are being investigated and dedicated methodologies for assessing the scientific knowledge on weather hazard trends are being developed.

In the following section, provided that a weather hazard contributes to a safety issue and there are indications that climate change is likely to influence trends related to a particular weather hazard, the affected safety issue is tagged '(CC effect)'.

Safety issue prioritisation: Safety Issue Priority Index (SIPI)

Safety issue prioritisation is a structured approach allowing safety issues to be risk-classified in a consistent manner, regardless of the operational domains they belong to, and regardless of the source of the safety intelligence (safety data, experts' inputs, etc.) through which they have been identified. Some safety issues are identified via occurrence data, others through accident and serious incident investigations, and still more through expert judgement and safety studies.

The approach creates an index that is built upon a residual risk evaluation of the safety issues. 'Residual risk evaluation' means that we consider the worst likely accident outcomes and the effectiveness of their implemented systemic barriers. In other words, a safety issue with the same potential outcome as another one but with additional effective mitigations in place will have a lower 'residual risk'.

Other elements that are factored in the prioritisation index are:

- whether the safety issue has already resulted in fatalities, or contributed to a high-energy accident outcome; or
- whether the safety issue is novel, i.e. associated conditions are not fully understood or known, thus the risk may potentially be elevated (e.g. associated with newly introduced technology, unusual operations, innovative design); or
- whether the operational exposure to the safety issue is important (e.g. safety issue is affecting all flights of the domain, or safety issue may only be of concern during training flights, reducing the operational exposure).

Any positive replies to the above questions will imply a higher-priority index.

7 Refer to EASA's Scientific Committee (SciComm) | EASA (europa.eu)

8 Refer to European_Academia @EASA conference 2023 - Physical | EASA (europa.eu)

The resulting index enables a prioritisation of the safety issues for further assessment (refer to SRM process step 2) and support the Agency and its safety partners in deciding what safety assessments are to be launched in priority. The index is reviewed on a regular basis for all safety issues to reflect changes in the elements that were factored in. It is an iterative and continual approach towards prioritisation of safety issues.

As a practical way to support the prioritisation per domain, the safety issues are then split into two categories, an 'elevated' one and a 'normal-to-low' one. The eventual intention is to focus the collaborative resources first on safety issues within the elevated category. Indeed, based on the priority index construction, the 'elevated' category will include safety issues such as novel ones and/or safety issues for which undesired outcomes have already realised and where the effectiveness of the current systemic barriers is not satisfactory and for those where a significant part of the flights are affected.

Higher-risk safety issues in the EU aviation system

As the SIPI method is applied in a systemic and consistent manner for each of the safety issues from all domains, it also provides a cross-domain perspective of the higher-risk safety issues in the EU aviation system, irrespective of the SRM step they are currently in. The safety issues are grouped by nature: systemic issue (an issue affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome), and contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome). Refer to Figure 0-2 for the distribution of higher-risk safety issues per nature, domain portfolio and status.

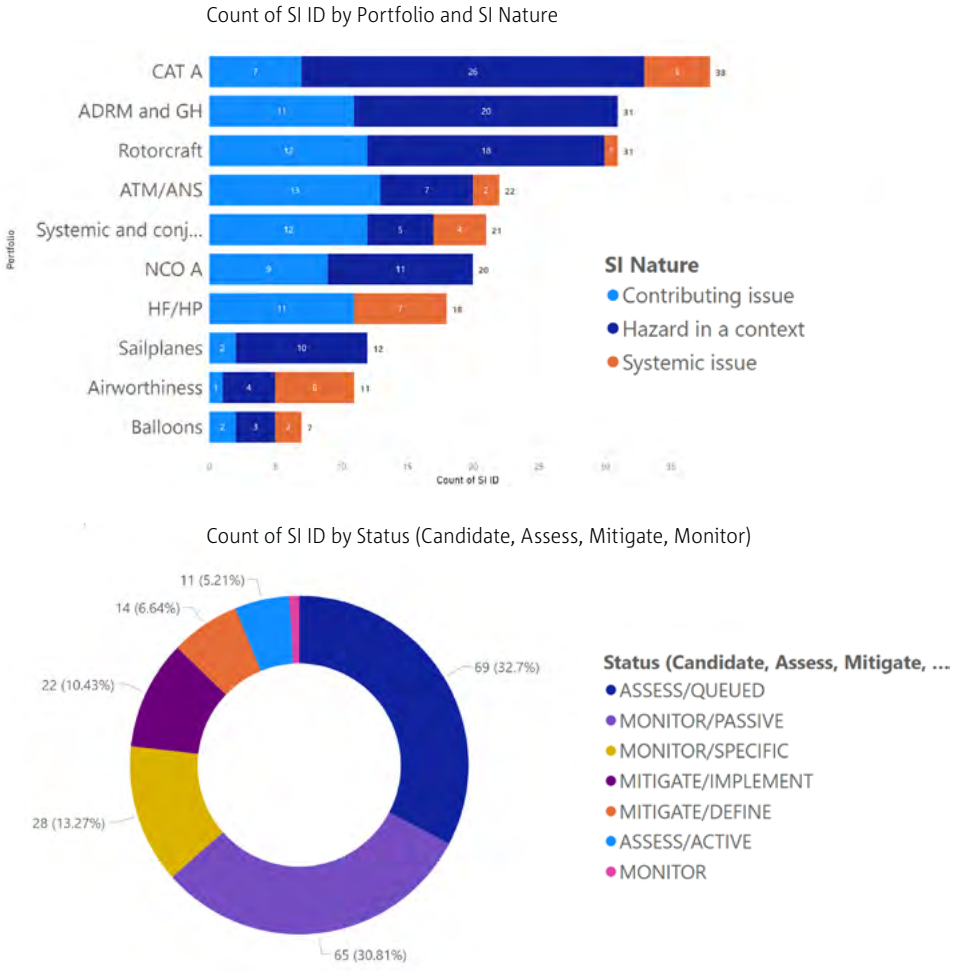

Figure 0-2: Distribution of higher-risk safety issues per nature, domain and status

Currently, there are 20 higher-risk cross-domain safety issues listed in the order of status. The lists below are grouped per nature: hazard in context, systemic issue and contributing issue. The lists do not refer to safety issues from the Aerodrome and Ground Handling domain because this portfolio requires a review and restructure and was therefore put on hold. This work will be concluded by the next update cycle.

Since 2024, there have been 8 higher-risk safety issues entering the top 20, highlighted in the tables below.

➔ Hazards in a context (all statuses)

Portfolio	SI ID	Safety Issue Title	Status
CAT A	SI-0034	Impact of GNSS interferences on civil aviation operations	ASSESS/ACTIVE
ATM/ANS	SI-2006	Inappropriate clearance due to undetected occupied runway	ASSESS/QUEUED
NCO A	SI-4008	Inadvertent flight into IMC/scud running	ASSESS/QUEUED
Rotorcraft	SI-8024	Unanticipated yaw/loss of tail rotor effectiveness	ASSESS/QUEUED
Airworthiness	SI-9012	Oxygen-fed fire in the flight deck	ASSESS/QUEUED
CAT A	SI-0007	Approach path management	MITIGATE/DEFINE
NCO A	SI-4023	Risks associated with parachuting operations	MITIGATE/DEFINE
Rotorcraft	SI-8031	Inadequate obstacle clearance during any flight phase	MITIGATE/DEFINE
CAT A	SI-0001	Icing in flight	MITIGATE/IMPLEMENT
Rotorcraft	SI-8028	Inadequate airborne separation under VFR operation	MITIGATE/IMPLEMENT
Rotorcraft	SI-8051	Inadvertent flight into IMC	MITIGATE/IMPLEMENT
Systemic and conjunctural	SI-5515	Airspace infringements by military UAS, aircraft, missiles, or debris spilling over from conflict zones	MONITOR/SPECIFIC

➔ Systemic issues

Portfolio	SI ID	Safety Issue Title	Status
Airworthiness	SI-9006	Shortcomings in design and maintenance instructions resulting in maintenance errors	ASSESS/QUEUED
Airworthiness	SI-9005	Outdated certification bases established for major changes to type certificates	MITIGATE/DEFINE
Airworthiness	SI-9003	Insufficient consideration of flight crew human factors in the continued airworthiness process of the type design	MITIGATE/IMPLEMENT
Airworthiness	SI-9002	Insufficient consideration of flight crew human factors in functional hazard assessments	MONITOR/SPECIFIC

➔ Contributing issues

Portfolio	SI ID	Safety Issue Title	Status
CAT A	SI-0039	Fatigue (FTL)	ASSESS/ACTIVE
NCO A	SI-4003	In-flight decision-making	ASSESS/QUEUED
Rotorcraft	SI-8017	Poor pre-flight planning and preparation	ASSESS/QUEUED
Rotorcraft	SI-8034	Poor operational management at take-off and landing sites	ASSESS/QUEUED

➨ **Table 1:** 20 higher-risk cross-domain safety issues grouped per nature and sorted per status

Process to handle safety issues in the SRM

Each safety issue is assigned an identification number (SI-DNNN) to facilitate tracking 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 – Elevated priority index — *Facilitates Step 2: Assessment of safety issue*

- Safety issues for which further assessment is or will be launched in higher priority to propose mitigation actions as needed.

Assess – Normal-to-low priority index — *Facilitates Step 2: Assessment of safety issue*

- Safety issues for which further assessment should be launched, when resources allow, to propose mitigation actions as needed.

Mitigate – define — *Facilitates Step 3: Definition and programming of safety actions*

- Safety issues with proposed mitigation actions under validation.

Mitigate – implement — *Facilitates Step 4: Implementation and follow-up of safety actions*

- Safety issues with validated mitigation actions ready for implementation, e.g. in the EPAS

Monitor — *Facilitates Step 5: Safety performance measurement*

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

Figure 0-3: Categories of safety issues

The mitigating 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 are safety issues removed within the SRM?

Safety issues are **removed** from the relevant Safety Risk Portfolio following an assessment concluding that:

- they are no longer relevant or current in the present operational context, or
- they are being refined.

Any decision to remove a safety issue temporarily or permanently from a Safety Risk Portfolio is validated and documented as part of the relevant EU SRM process steps.

Safety issues will **exit** a domain Safety Risk Portfolio where the risk assessment concludes that they are sufficiently mitigated and that the residual risk is acceptable, without the need for further action or monitoring.

Main changes since the last edition

As per the SIPI method, the priority has been reviewed in full especially considering the exposure of flights in the domain affected, changes since 2024 in terms of occurrences and ERCS aggregated scores, novelty, barrier effectiveness, mitigating actions introduced and implemented. Also, the currency of safety issues has been reviewed, and 'non-current' safety issues have been removed from the portfolio.

- There are 211 safety issues in this EPAS Vol. III edition. Since the last edition, 6 new safety issues have been added, 16 safety issues have been amended, and 15 safety issues have been removed.
- The cross-domain higher-risk safety issues list has been updated.
- New safety issues marked '(New)'. Safety issues for which definitions and/or the title were updated are marked '(Amended)'.
- The safety issues are categorised by nature:
  - systemic issue (an issue affecting the EU aviation system, linked with existing rules),
  - hazard in a context (operational issues that may directly lead to an accident outcome), and
  - contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome). The contributing safety issues will not be individually assessed; instead, they will be assessed as part of the hazard in context to which they contribute.
- As part of a holistic exercise across all portfolios, the exposure assumptions in the prioritisation exercise have been reviewed.

2. Systemic and conjunctural[9] — SYS & CONJ

The Systemic and conjunctural Safety Risk Portfolio is designed to manage the safety issues at a systemic level affecting several domains, or stemming from or being associated with crises.

The traffic levels in 2024 have reached the ones of 2019. The effects of the war in Ukraine and other ongoing conflicts are still present and affect the civil aviation sector, namely errors of civil aircraft identification by ground military forces and airborne assets outside the conflict zone, non-standard and unplanned military activities outside the conflict zones, airspace infringements by military UAS, aircraft, missiles, or debris spilling over from conflict zones, GNSS manipulation, missing suppliers and low availability of parts, cyber-attacks, and others.

It is important to note that some safety issues, such as 'Reduced available financial resources', cannot be directly addressed by the Agency or the EASA Member States but are important for organisations to include in their safety management systems. In addition, not all safety issues may be applicable in the future due to the fluidity of the circumstances. Some safety issues have been removed from this year's portfolio as being not current anymore.

The safety issues in the portfolio are sorted into the 'Assess – Elevated priority index', 'Assess – Normal-to-low priority index', 'Mitigate – define', 'Mitigate – implement', and 'Monitor' categories, which provide a snapshot of their status within the European SRM process by priority. The safety issue prioritisation method is described in the Introduction of this Volume. To understand each safety issue better, please click on the safety issue in the list to access their description. All safety issues are now grouped by their nature: systemic issue (an issue affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome) and contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome).

Currently there are 21 safety issues in the SYS & CONJ Safety Risk Portfolio. Since the last edition 9 safety issues have been removed from the portfolio as non-current any longer, mostly the ones related to the COVID-19 pandemic situation.

The highest SIPI score safety issues in the portfolio are 'Errors of civil aircraft identification by ground military forces and airborne assets outside the conflict zone', 'GNSS signal manipulation leading to navigation or surveillance degradation', and 'Airspace infringements by military UAS, aircraft, missiles, or debris spilling over from conflict zones'.

Refer to Appendix A for the link between safety issues and key risk areas.

List 2-1: Systemic and conjunctural safety issues per category & priority

Assess – Elevated priority index *Facilitates Step 2: Assessment of safety issue*

NIL

Assess – Normal-to-low priority index *Facilitates Step 2: Assessment of safety issue*

NIL

9 A critical set of circumstances; a crisis.

Mitigate – define *Facilitates Step 3: Definition and programming of safety actions*

NIL

Mitigate – implement *Facilitates Step 4: Implementation and follow-up of safety actions*

NIL

Monitor *Facilitates Step 5: Safety performance measurement*

Systemic issues and hazards in a context

- Errors of civil aircraft identification by ground military forces and airborne assets outside the conflict zone (SI-5530)
- Airspace infringements by military UAS, aircraft, or debris spilling over from conflict zones (SI-5515)
- Shortage of operational and technical staff (SI-5018)
- Non-standard and unplanned military activities outside the conflict zones (SI-5508)
- Separation with unidentified aircraft (SI-5514)
- Flight route congestion (hotspots) (SI-5506)
- Reduced available financial resources (SI-5019)
- Reduced oversight by competent authorities (SI-5001)
- Aircraft collision with space debris (SI-5101)

Contributing issues:

- GNSS signal manipulation leading to navigation or surveillance degradation (SI-5501A)
- Missing suppliers and low availability of parts (SI-5020)
- Non-standard operational air traffic routings, reservation of military areas outside the conflict zone (SI-5532)
- Transition of a civilian airport to mixed civil-military operations (SI-5533)
- Cyberattacks (SI-5017)
- Aviation personnel fatigue (SI-5002)
- Knowledge transfer issue for new generation aviation personnel (SI-5033)
- Unrealistic staff resource planning causing flight delays or cancellations (SI-5034)
- Short time available for training affecting training effectiveness (SI-5032)
- Space weather effects on aviation (SI-5102)
- Aircraft vulnerability leading to flight safety degradation due to cyberattacks (SI-5017B)
- Spare parts shortages (other than aircraft) (SI-5504)

Aircraft collision with space debris (SI-5101)

Some re-entries of rocket bodies have already caused a certain level of disruption in the European airspace. The disruption was caused by the closure of airspace by several national authorities. The non-harmonised response in the affected area further increased the disruption and potentially increased the safety risk for flights in the region (e.g. holding aircraft under the trajectory of the rocket debris).

It is understood that there will be an increase in numbers of re-entry events due to increased space activity (increase in number of rocket launches, satellites, increased probability of airborne collision with debris).

Related SIBs:

- SIBs issued for known re-entry events.

Aircraft vulnerability leading to flight safety degradation due to cyberattacks (SI-5017B)

Aircraft systems may be vulnerable to hacking, or ground support systems leading to faulty maintenance, airline systems causing major disruptions to the air traffic system.

Airspace infringements by military UAS, aircraft, or debris spilling over from conflict zones (SI-5515)

Airspace infringement by military UAS, or aircraft spilling over from conflict zones into the controlled airspace without coordination/permission, debris of shot missiles, could lead to loss of separation. Presence of military UAS unexpectedly within civilian air traffic areas may disrupt normal operations. There is the potential for misuse of civilian UAS as obstacles, to attack critical sites or to disrupt normal air traffic flows.

Aviation personnel fatigue (SI-5002)

The increase of activity in combination with possible traffic disruptions may give rise to aviation personnel fatigue. The consequence of fatigued personnel (impaired person's alertness and ability to perform safety-related operational duties) in the workplace is the increased likelihood of human error, lower readiness to recognise that error or a problem, and timely and appropriately react to them.

Organisations should pay close attention to the fact that Commander's discretion measures are not used as a standard resource planning tool. Organisations should closely monitor fatigue reporting and actively support reporting of fatigue and other occurrences via a strong just culture.

Guidance on how to address this issue is available at: https://www.easa.europa.eu/community/topics/fatigue-management

Related SIBs: EASA SIB 2023-05: Possible Risks Emerging During Summer 2023

Cyberattacks (SI-5017)

Increase in cyberattacks, associated with the war in Ukraine and other conflict zones.

Proposed actions to mitigate this safety issue:

- Perform security risk assessments
- Identify severe threats
- Raise staff and user awareness of cybercrimes
- Constantly train IT and security staff
- Protect sensitive data
- Use multi-factor authentication
- Ensure strong security policy
- Conduct regular unannounced audits
- Advise crew to avoid carrying substantial amounts of company data (laptops or removable storage devices)

Errors of civil aircraft identification by ground military forces and airborne assets outside the conflict zone (SI-5530)

As shown by previous wars, misidentification is easy in the confused arenas of warfare. Blue on blue incidents have been numerous in the past. It's not only from one side that the risk develops. If the likelihood of the jamming of electronic aids that may be involved with navigation and/or aircraft identification tools is added, there is a potential risk for civil aircraft becoming subject to missiles or radar laid weapons.

Guidance on how to address this issue is available at: EASA CZIBs and relevant NOTAMs

Flight route congestion (hotspots) (SI-5506)

The reduction of available airspace (due to military activity and airspace closure) creates a corresponding increase in traffic in the remaining available airspace. This may lead to flight route congestion or high traffic on certain routes, with consequences such as: increased ATCO/flight crew workload, more frequent turbulence and wake turbulence, phraseology issues, risk of injury to passengers and aircrew during avoidance manoeuvres, and increased risk of mid-air collision (MAC).

GNSS signal manipulation leading to navigation or surveillance degradation (SI-5501A)

Due to military electronic warfare system usage, GNSS signals may be disturbed or altered in countries adjacent to conflict zones, affecting the operation of aircraft en route and/or operating at aerodromes. GNSS signal interference may be only temporary, and pilots should not only be aware of the risk but also ensure that procedures in case of GNSS signal loss are included in the flight planning. This safety issue is linked with SI-0034 Impact of GNSS interferences on civil aviation operations.

Related SIBs: EASA SIB 2022-02R3: Global Navigation Satellite System Outage and Alterations Leading to Navigation/Surveillance Degradation

Knowledge transfer issue for new generation aviation personnel (SI-5033)

Many highly knowledgeable people have retired from the industry or changed over to another industry during the pandemic, with little opportunity to provide detailed and gradual handovers to colleagues. As a result, organisations and the industry has lost the experience and tacit knowledge from a generation that in many cases founded the industry we work in and developed the procedures, principles, and regulations that we now take for granted.

Related SIBs: EASA SIB 2023-05: Possible Risks Emerging During Summer 2023

Missing suppliers and low availability of parts (SI-5020)

The lockdown had resulted in difficulties for organisations liaising with their suppliers. Further economic strains have increased problems with maintaining or recovering the supply chains, and or leading to a lack of spare parts, products, calibrated tooling and others. This may affect the availability of aircraft.

Related SIBs: EASA SIB 2023-05: Possible Risks Emerging During Summer 2023

Non-standard and unplanned military activities outside the conflict zones (SI-5508)

This safety issue relates to non-standard military activities, such as increased activity of unmanned aircraft patrolling, or surveillance conducted outside conflict zones. The response to the Ukraine war may result in Member States experiencing an increase in unplanned military exercises, as well as movement of military aircraft from certain airbases to others. Unexpected 'due regard' flights could also pose an increased risk for commercial air operations in certain areas. Traffic types that are unusual in certain areas (e.g. formation flights, in-flight refuelling of aircraft, etc.) may increase. Overall, this can lead to an increase in ATCO workload created by the need for increased coordination/communication. It will affect the airspace capacity and increase the risk of airborne collision of civil traffic with military manned and unmanned aircraft.

Non-standard operational air traffic routings, reservation of military areas outside the conflict zone (SI-5532)

Ad hoc requests to establish temporary segregated areas (transit corridors) and ad hoc reservation of military areas outside of operational hours published in AIPs, may lead to extra workload as they must be coordinated with all parties involved.

Reduced available financial resources (SI-5019)

A reduction in available financial resources may cause the loss of key personnel and corporate knowledge, increased pressure on personnel, and affect decision-making. Long-term investment plans may slip or be changed, with consequences long after traffic levels have begun to recover.

Reduced oversight by competent authorities (SI-5001)

Competent authority staff are less available and that affects on-site visits. This means that oversight may not be in depth and in many cases the time periods between checks have increased. Guidance has been provided to the Member State competent authorities on how to effectively mitigate this risk.

Separation with unidentified aircraft (SI-5514)

This safety issue addresses the increased presence of unresponsive and/or unidentified traffic. As an example, between the Finnish and the Estonian territorial waters, there is a narrow corridor of neutral waters providing Russia with access to the Baltic Sea and Kaliningrad. Russian flights may or may not have a transponder on/flight plan, they may or may not be in radio contact, and they use any level that suits their purpose. Such traffic conflicts with the Helsinki inbound–outbound civil traffic or is a completely new category of en-route traffic operating under normal air navigation service (ANS) rules and regulations but within the limitations set for Russian operators concerning the Finnish and the Estonian airspace. The number of flights over neutral waters has drastically increased, increasing in turn the ANS workload and imposing an effect on the flight profiles of civil aircraft.

Shortage of operational and technical staff (SI-5018)

Organisations' limited finances may have limited the number of personnel they employed, and movement restrictions due to the pandemic may have further hampered personnel in remaining in the workplace. Staffing shortages at aerodromes, caused by difficulty in recruiting and retaining ground handlers and significantly exacerbated by the unexpectedly strong recovery of European airline operations may lead to increased human error due to high staff workload/time pressure and unofficial adaptations to streamline tasks, increased time in security checks (passengers and crew) causing delays and constraining pre-flight activities, reduced capacity in supplying ground service equipment to aeroplanes at the stand, and delays causing changes to planned operations. This safety issue also includes shortage of dispatchers, staffing maintenance staff, air traffic services and flight/cabin crews.

Related SIBs:

- EASA SIB 2022-06: Risks Emerging During Ramp-up of Aviation Activities
- EASA SIB 2023-05: Possible Risks Emerging During Summer 2023

Short time available for training affecting training effectiveness (SI-5032)

Turnover of operational staff, and required staffing due to increased traffic makes the time available for training short. That may lead in reduced availability of the operational staff or reduced competence. The issue may become a limiting factor on capacity during increased volume of operations or will cause fatigue or overload where there is a reduced number of personnel providing services.

Related SIBs: EASA SIB 2023-05: Possible Risks Emerging During Summer 2023

Space weather effects on aviation (SI-5102)

The solar activity follows an 11-year cycle. The last peak was in April 2014 and the next one is forecasted for 2025 (as published on 15 September 2020 on https://www.weather.gov/news/201509-solar-cycle; also refer to

paragraph on solar radiation timeline in SIB 2012-09R1). However, there are sources mentioning that the cycle has started earlier, already in 2019. The following risk considerations are relevant:

- An increased reliance on GNSS as the main source for navigation and time.
- In a similar manner, an increased reliance on satellite-based communications.
- The use of polar routes for aircraft trajectory is increasing as it provides reduction in travel times or evasion of conflict zones. Especially on such routes, airlines also need to consider the effects of solar activity on HF communication: poorer quality, a shift to lower usable frequency bands, and more noise or fading. During extreme solar activity, HF communications may not be available in the polar region.
- The availability, continuity, integrity and accuracy of un-augmented GNSS in the region close to the magnetic equator can rapidly change in time during the event. The most intense scintillation is around the magnetic equator.

Related SIBs:

- EASA SIB 2012-09R1 Effects of Space Weather on Aviation
- EASA SIB 2012-10R1 Single Event Effects on Aircraft Systems caused by Atmospheric Radiation

Spare parts shortages (other than aircraft) (SI-5504)

The current crisis may lead to an increase in the prices of spare parts (other than aircraft, ATM/ANS equipment, aerodromes, ground handling, etc.) and shortages in the availability of electronic equipment, especially if components are manufactured in countries which are directly affected by the crisis or are geopolitically aligned with Russia, and this may have a negative effect on aviation safety.

Related SIBs: EASA SIB 2023-05: Possible Risks Emerging During Summer 2023

Transition of a civilian airport to mixed civil-military operations (SI-5533)

In the event of an increase in the number of air operations with military status related to military operations and securing NATO's eastern flank using civil air traffic services, there may be increased risks stemming from mixed civil-military operations at airports, especially during the transition period. When introducing subsequent alert levels and preparing the airport infrastructure for military purposes (temporary logistic bases, field hospitals, fuel bases, etc.), the airport operational procedures may not be fit for the new purpose and can create organisational and operational disruptions to the airport's services. The emerging facilities may pose a potential threat to air operations.

Unrealistic staff resource planning causing flight delays or cancellations (SI-5034)

Due to commercial pressure in the increase of activity after the pandemic period, the staff resource planning may become unrealistic in the drive of trying to sell maximum number of flights, leaving limited or no margin of staff available to operate these flights. Also, the planning may be too aggressive and not consider the real capacities of the partner organisations, namely of ground handling, security services at aerodromes, etc. This may lead to delays, causing fatigue, and other disruptions. While pilots are trained to be able to adapt their plans, it subtly increases the risk of errors due to expectation bias, raises workload and therefore marginally increases the risk associated with the flight. At a macro level, this raises the risk of more serious errors occurring, leading to flight safety issues. Organisations are invited to apply a conservative and realistic approach in activity planning to avert these issues at a later stage.

Related SIBs: EASA SIB 2023-05 Possible Risks Emerging During Summer 2023

3. Human factors/human performance — HF/HP

The Human factors (HF)/human performance (HP) Safety Risk Portfolio developed in 2017 by the Agency, in conjunction with the HF Collaborative Analysis Group (CAG), has since been reviewed regularly. Due to the broad nature of HF/HP safety issues, they contribute to most, if not all key risk areas.

The safety issues in the portfolio are sorted into the 'Assess – Elevated priority index', 'Assess - Normal-to-low priority index', 'Mitigate – define', 'Mitigate – implement', and 'Monitor' categories, which provide a snapshot of their status within the European SRM process by priority. The safety issue prioritisation method is described in the Introduction of this Volume. To understand each safety issue better, please click on the safety issue in the list to access their description.

All safety issues are now grouped by their nature: systemic issue (an issue affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome), and contributing issue (a safety issue is contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome). Consecutively, the HF/HP-related ones have been reviewed and grouped as systemic or contributing safety issues. HF/HP safety issues were identified from various sources as per the EU SRM process, discussed in the Agency's CAGs and reviewed by the Agency itself.

In 2024, the MESAFE (MEntal health for aviation SAFEty) project was completed, addressing the existing safety issue on the state of well-being and being fit for duties (SI-3024). Initiated in response to concerns raised by safety investigation authorities and medical experts, MESAFE aimed to improve the early diagnosis and treatment of mental health conditions among pilots and air traffic controllers. The project provided evidence-based recommendations for the assessment and management of conditions such as stress, depression and substance misuse. The findings are being integrated into the Part-MED and Part-ATCO.MED requirements for pilots and air traffic controllers respectively, enhancing the mental well-being support framework within the aviation industry.

Concerning the safety issue on fatigue and quality sleep (SI-3005), EASA has incorporated scientific recommendations from the Effectiveness of Flight Time Limitation (FTL) study, particularly regarding night duties and late finish duties, into the regulatory framework under Commission Regulation (EU) No 965/2012 (the Air OPS Regulation). This process began in 2017 with the launch of research task RES.006, which aimed to review the effectiveness of the rules related to flight and duty time limitations and rest requirements, as outlined in Annexes II and III to the Air OPS Regulation. The first phase of RES.006, published in 2019, focused on duties lasting more than 10 hours at less favourable times of the day and on disruptive schedules. The report recommended safety enhancements and suggested a rulemaking task to amend the applicable regulations.

In 2020, the BIS on Aircrew Fatigue concluded that the findings from RES.006 should be integrated into the regulatory framework, which was done through RMT.0492 as a specific subtask. This laid the foundation for the most recent regulatory updates. ED Decision 2023/023/R was issued to mitigate the risk of fatigue onset and accumulation in aircrews by integrating the latest scientific knowledge and best practices in fatigue risk management (FRM). As part of this effort, a significant amendment to AMC1 ORO.FTL.250, which addresses fatigue management training, was published in late 2023. This amendment is part of a broader revision to refine training requirements for flight and cabin crew, management and other personnel responsible for managing fatigue risks.

In relation to the same safety issue on fatigue and quality sleep (SI-3005) but looking at it from the ATM/ANS perspective, the results of the EASA commissioned study on air traffic controller (ATCO) fatigue were published in February 2024. The study recommended improving the reporting of fatigue incidents to the European Central Repository (ECR) due to current underreporting, ensuring consistent regulations across EU air traffic services

providers (ATSPs) by addressing the lack of prescribed values for rosters and work practices, and clarifying the terminology to standardise fatigue management practices and enhance understanding across the industry.

In connection to the safety issue of training effectiveness and competence (SI-3011), the latest amendment to AMC1 ORO.FC.230 which deals with recurrent training and checking for flight crew, was published in late 2023. This amendment continues to align with the evolving safety needs of the aviation industry, addressing elements like crew resource management (CRM), upset prevention and recovery training (UPRT) and the implementation of evidence-based training (EBT).

Regarding the safety issue on HF of multiple remote towers (SI-3022), guidance material (GM) on remote tower operations was issued in 2023. The GM provides a comprehensive framework for the HF/HP considerations in the design, implementation and operation of remote tower services, especially focusing on multiple remote tower operations. It emphasises the importance of ensuring adequate vigilance, workload management and task alignment for ATCOs operating in remote environments.

The safety issue assessment was completed for safety issue SI-3012 'Lack of industry-wide staff support programmes'.

The safety issues of the-HF/HP safety risk portfolio and the published deliverables contribute to the strategic priority identified in EPAS 2023-2025 Volume I Section 3.1.3 Manage human factors and human performance (all domains).

For a more detailed overview on better consideration of human factors in aircraft certification, refer to Chapter 9. Airworthiness.

List 3-1: Human factors/human performance safety issues per category & priority

Assess – Elevated priority index

Facilitates Step 2: Assessment of safety issue

NIL

Assess – Normal-to-low priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Senior management lacking competence and/or commitment to HF/HP principles (SI-3001) (Amended)
- Lack of evaluation of adverse impact of culture on human performance (SI-3002)
- Knowledge development and sharing (SI-3008)
- Degradation of resilient performance of an organisation and/or individual (SI-3009)
- Lack of industry-wide staff support programmes (SI-3012)
- Inadequate HF activities/HF specialist involvement and the effect on safety, efficiency, effectiveness and project timeline (SI-3014)
- Integration of HF/HP principles into the organisation's management system (SI-3004)

Contributing issues:

- Heavy workload and misaligned tasks (SI-3006)
- State of well-being and fit for duties (SI-3024)
- Critical gaps in risk driven decision making in complex systems (SI-3016)
- Impact of degraded levels of attention or vigilance on human performance (SI-3015)
- Impact of startle and surprise on flight crew management of safety-critical situations (SI-3010)
- Limitations to root cause analysis (SI-3018)

Mitigate – define

Facilitates Step 3: Definition and programming of safety actions

Systemic issues and hazards in a context:

NIL

Contributing issues:

- Fatigue and quality sleep (SI-3005)
- Training effectiveness and competence (SI-3011)

Mitigate – implement

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

Contributing issues:

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

Monitor

Facilitates Step 5: Safety performance measurement

Contributing issues:

- HF in multiple remote tower operations (SI-3022)

Critical gaps in risk driven decision making in complex systems (SI-3016)

Decision-making in aviation-related activities can be complex, pressing and involve a high risk. Yet it plays a key role in achieving safe outcomes in every stage (i.e., design, production, operation, maintenance of products, systems, and processes) and in every stakeholder (i.e. original equipment manufacturers (OEMs), operators, aerodromes, air navigation service providers (ANSPs), continuing airworthiness management organisations (CAMOs), aircraft maintenance organisations (AMOs), etc.). Operational decisions made by frontline operators (i.e. pilots, cabin crew, ATCOs, engineers, technicians, ground handlers, airport staff) and the strategic decisions made by leadership/management in an organisation and regulatory authorities can have a huge impact on safety.

Degradation of resilient performance of an organisation and/or individual (SI-3009)

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

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. Due to 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.

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 HP in all the known areas of human limitations. Preventing fatigue is dependent on obtaining both a sufficient quantity and quality of sleep. SI-3005 strives to ensure that adequate prevention against effects of fatigue is provided in all aviation domains.

Heavy workload and misaligned tasks (SI-3006)

The workload issue remains at the top of aviation discussions. It can be considered as consisting 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. In addition, task elements not aligned with staff competence will create additional error-prone conditions.

HF in multiple remote tower operations (SI-3022)

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

Human factors competence for regulatory staff (SI-3003)

Competence is a set of observable and measurable behaviours that an individual is expected to demonstrate in relation to required task performance. It is important for regulatory staff to have specific HF competence to be able to perform their duties. This also provides an added benefit of improving the conversation on safety and HF between regulatory staff and people at different levels in industry.

Impact of degraded levels of attention or vigilance on human performance (SI-3015)

Maintaining appropriate levels of attention and vigilance supports situational awareness. It is important to ensure that the working environment, equipment, and processes support the operator in performing the task, and do not introduce additional and unnecessary challenges to attention and vigilance required for safe operations. Typical descriptions of occurrences include becoming preoccupied with an unusual task rather than managing the more immediate situation; missing a step in a process where the process has become repetitive; lack of monitoring and cross check leading to undetected data entry errors.

Impact of startle and surprise on flight crew management of safety-critical situations (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. During an unexpected critical event in aviation, such impairment could be critical to the effective recovery from the situation. 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.

Inadequate HF activities/HF specialist involvement and the effect on safety, efficiency, effectiveness, and project timeline (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 HFs activities and knowing at which point in a process to involve HF professionals is an important element of a successful project.

Integration of HF/HP principles 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 HP 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.

Lack of evaluation of adverse impact of culture on human performance (SI-3002)

Organisational culture has a significant impact on HP, but this is not generally recognised across the aviation industry. From a HF and safety perspective, there is a vast amount of diverse and inconsistent information about how organisational culture affects safety.

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 aerodrome or ATC equipment; and so on. These observations clearly demonstrate a challenge from regulatory, safety and HF perspectives.

Lack of industry-wide 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 and after the COVID-19 pandemic, where aviation professionals have worked under high pressure and often in isolating circumstances.

Refer also to 'State of well-being and fit for duties (SI-3024)'.

Limitations to root cause analysis (SI-3018)

Investigations into incidents and hazard observations often result in poor or ineffective interventions because investigations pursue straightforward root causes of the issue. Shallow investigations often address symptoms of the event rather than the error-prone conditions, and consequently rarely prevent reoccurrence.

Senior management lacking competence and/or commitment to HF/HP principles (SI-3001) (Amended)

Operators, maintenance organisations, manufacturers, national competent 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 particularly affected by the values and actions of senior management. Senior leaders need to understand and communicate the critical significance of HF and HP to all members of staff.

State of well-being and fit for duties (SI-3024)

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 'Lack of industry-wide staff support programmes (SI-3012)'.

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. 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.

4. Commercial air transport — aeroplanes — CAT A

The CAT Aeroplanes Safety Risk Portfolio was first developed in 2016 by the Agency, in conjunction with the CAT Aeroplanes CAG, and has since been reviewed annually. Each safety issue contributes to one or more key risk areas as defined in the Introduction of this Volume.

The scope of the portfolio is commercial air transport (CAT) passenger and cargo operations conducted by EASA and EASA Member State (MS) air operator certificate (AOC) holders with complex aeroplanes and EASA Member State (MS) registered, or operated complex aeroplanes carrying out non-commercial complex (NCC) operations.

Regarding the main key risk areas for this domain, refer to Appendix 2 'Advanced statistics for aeroplanes' Chapter 1 'Advanced statistics for commercial air transport (CAT) complex aeroplanes and non-commercial complex aeroplanes' 'Safety risks' to EASA ASR 2024. These key risk areas are defined by their potential accident outcome and by the immediate precursors of that accident outcome. The 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. The risk picture of this domain identifies the key risk areas of greater concern that are collision on runway, airborne collision and aircraft upset.

The safety issues in the portfolio are sorted into the 'Assess – Elevated priority index', 'Assess – Normal-to-low priority index', 'Mitigate – define', 'Mitigate – implement', and 'Monitor' categories, which provide a snapshot of their status within the European SRM process by priority (refer to the List 0-1). The safety issue prioritisation method is described in the Introduction of this Volume. To understand each safety issue better, please click on the safety issue in the list to access their description. All safety issues are now grouped by their nature: systemic issue (an issue affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome) and contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome).

Currently there are 38 safety issues in the CAT A Safety Risk Portfolio. Since the last edition, two new safety issues have been added: 'Ambiguity in operational requirements and lack of authority oversight for non-revenue flights' (SI-0058) and 'Controller-pilot data link (CPDLC) miscommunication' (SI-0059). Three safety issues have been amended. The former SI-0043 has been moved to the NCO portfolio (SI-4010).

The highest SIPI score safety issues in the portfolio are SI-0007 'Approach path management', SI-0034 'Impact of GNSS interferences on civil aviation operations', SI-0001 'Icing in flight', SI-0015 'Entry of aircraft performance data' and SI-0010 'Inappropriate flight control inputs'.

SI-0014 'Alignment with wrong runway' has been moved from status 'mitigate' to 'assess' as being part of the runway safety precursors assessment.

Refer to Appendix A for the link between safety issues and key risk areas.

List 4-1: Commercial air transport — aeroplanes (CAT A) safety issues per category & priority

Assess – Elevated priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Impact of GNSS interferences on civil aviation operations (SI-0034) (Amended)

Assess – Normal-to-low priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Inappropriate flight control inputs (SI-0010)
- False or disrupted instrument landing system (ILS) signal capture (SI-0035)
- Ambiguity in operational requirements and lack of authority oversight for non-revenue flights (SI-0058) (New)
- Mishandling of non-precision approaches (SI-0037)
- Adverse convective weather (turbulence, hail, lightning, ice) (SI-0003) (CC effect)
- Alignment with wrong runway (SI-0014) (Amended)
- Gap between certified take-off performance and take-off performance achieved in operations (SI-0017) (CC effect)
- Encoding of the required navigation performance approaches (RNP APP) in flight management systems (FMS) (SI-0051)

Contributing issues:

- Ineffective crew resource management (CRM) (SI-0009) (Amended)
- Fatigue (FTL) (SI-0039)
- Controller-pilot data link (CPDLC) miscommunication (SI-0059) (New)
- Safety education of air passengers (SI-0052)

Mitigate – define

Facilitates Step 3: Definition and programming of safety actions

Systemic issues and hazards in a context:

- Approach path management (SI-0007)
- Emergency evacuation (SI-0042)

Contributing issues:

- Poor language proficiency causing communication breakdown (SI-0054)

Mitigate – implement

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

Systemic issues and hazards in a context:

- Icing in flight (SI-0001) (CC effect)
- Entry of aircraft performance data (SI-0015) (CC effect)
- Effectiveness of safety management (SI-0041)
- Clear air turbulence and mountain waves (SI-0018) (CC effect)

Monitor

Facilitates Step 5: Safety performance measurement

Systemic issues and hazards in a context:

- Congestion/interference of the electromagnetic spectrum (5G) (SI-0053)
- Bird/wildlife strikes (SI-0045)
- Handling and execution of go-arounds (SI-0019)
- Inadequate fuel management (SI-0025)

- Hail (SI-0003A) (CC effect)
- Icing on ground (SI-0002) (CC effect)
- Wind shear (SI-0024) (CC effect)
- Wake vortex encounter (SI-0012)
- Fuel contamination and quality (SI-0011)
- Volume and quality of the information in NOTAMs (SI-0044)
- Runway surface condition (SI-0006) (CC effect)
- Laser illumination (SI-0046)
- Carriage and transport of lithium batteries (SI-0027)
- Explosive door openings on parked aeroplanes (SI-0048)
- Disruptive passengers (SI-0047)
- Excessive speed in the manoeuvring area (SI-0028)

Contributing issues:

- Airline systems' vulnerability leading to disruptions due to cyberattacks (SI-5017A)
- Flight crew incapacitation (SI-0049)

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

This safety issue addresses 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.

Effects of climate change under scrutiny

With climate change, severe convective storms may become more frequent and/or intense, and the safety risks caused by the associated threats for CAT aeroplanes may increase. For example, some research works suggest a significant increase of hail precipitation with hailstone size exceeding 5 cm over Europe, and an increase of the lightnings activity.

Airline systems' vulnerability leading to disruptions due to cyberattacks (SI-5017A)

Airline systems may be vulnerable to hacking, causing major disruptions to the air traffic system.

Ambiguity in operational requirements and lack of authority oversight for non-revenue flights (SI-0058) (New)

This systemic safety issue comprises:

1. Operational oversight and implementation of safety management for non-revenue flights, such as maintenance check flights, demonstration flights and delivery flights.
2. Implementation and oversight of the Subpart-SPO.SPEC.MCF requirements by national authorities.
3. Manufacturers' flights.

Such flights involve additional risks that are not always understood by the parties involved and these may lead to several key risk areas, including aircraft upset. Additionally, the nature of some of these flights means that it

is not always clear who owns the risks or whether the conflicting situations of the different parties involved are conducive to safe operations.

Most of these operations are conducted by AOC holders under Part-CAT of the Air OPS Regulation with defined areas of control and safety management systems, however a considerable number of flights take place each year outside the area of Part CAT.

Alignment with wrong runway (SI-0014) (Amended)

Unintended landing, approach or take-off of an aircraft on/to/from a wrong runway can lead to excursions or collisions. It includes cases of landing on/taking-off from a runway edge, 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), flight crew distraction/ confusion 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 FL100 until reaching safe taxiing speed. 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 issue 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.

Related SIBs: EASA 2023-03: Incorrect Barometric Altimeter Setting

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) (CC effect)

Clear air turbulence and turbulence generated by high mountains (mountain waves) 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 the 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.

Effects of climate change under scrutiny

With climate change, moderate-or-greater clear air turbulence associated with jet streams may become more frequent in the future. For example, some research works suggest a significant increase in the probability of encountering moderate-or-greater clear air turbulence at cruise flight levels over the North Pacific, South-East Asia and the North Atlantic.

Congestion/interference of the electromagnetic spectrum (5G) (SI-0053)

The electromagnetic spectrum is crucial to the management of aviation activity as frequencies are required for ATM and ground movements control, navigation aids, weather and ATC radars, radio-altimetry, air-air communications, terrain and ground collision avoidance systems. The spectrum is becoming increasingly congested as traffic levels grow and the increasing demand for bandwidth from other users such as telecoms, radio and television services have led to some portions of the spectrum previously allocated to aviation being diverted for this purpose. This in turn leads to equipage changes (e.g. radar frequencies) and radiotelephony (RTF) frequency congestion. The proximity of competing users can have interference effects that cannot be managed or controlled by either user.

The roll-out of 5G across the world will have an impact on navigational equipment. The issue is that the equipment may not be robust enough against certain 5G frequency bandwidths. In some countries the two (aircraft navigational equipment and 5G networks) may not be able to co-exist.

It also includes the potential for interference from 5G transmissions from the passenger cabin.

Controller-pilot data link communication (CPDLC) miscommunication (SI-0059) (New)

The misinterpretation of a CPDLC (controller-pilot data link communications) message occurs when the ATC gives a clearance/information to the flight crew via CPDLC and the flight crew does not comply with it as intended by the ATCO, but the flight crew acts according to their understanding of the message. As an example, misinterpretation is possible with UM79 (CLEARED TO [position] VIA [route]) clearance that might lead to airspace infringements, loss of separation and airborne collision. Another example is a misinterpretation of CPDLC uplink message as a clearance instead of a request which was the intention of the message (UM148 WHEN CAN YOU ACCEPT FL[XXX]). Such a misinterpretation leads to a deviation to another than the cleared flight level, which can lead to an airspace infringement, a loss of separation or to an airborne collision.

As there could be errors introduced in the CPDLC messages and messages could be misinterpreted by both parties (ATCO and flight crew), this issue addresses the miscommunication aspects of using CPDLC.

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 systems 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. This issue 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.

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.

Encoding of the required navigation performance approaches (RNP APP) in flight management systems (FMS) (SI-0051)

The naming of the performance-based navigation (PBN) approach procedure is not standardised throughout the world. It is also inconsistent with the PBN navigation specifications. Examples of different naming: RNAV (GPS) RWY XX, RNAV (GNSS) RWY XX, RNAV (RNP) RWY XX. Chart identification and FMS encoding differences may lead to confusions and misunderstanding amongst crew. Procedure requirements are not always clearly understood e.g. specifications versus requirements (RF, RNP, missed approach RNP). The situation is the same as regards understanding of the minima (LNAV, LNAV/VNAV and LPV).

Another issue will be the data storage capacity and encoding capability of the on-board equipment against the number of approaches and different encoding requirements (e.g. letter designator for circling approaches, Z–Y, etc., when more than one approach exists).

Entry of aircraft performance data (SI-0015) (CC effect)

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; in the short to medium term, the focus will be on improvements to SOPs.

Effects of climate change under scrutiny

With climate change, more airports may be exposed to periods of very high air temperature, with effects on take-off performance of aeroplanes and on the cooling down of brakes. The prevailing direction of surface winds may change too. For example, some research works suggest that the number of days where the take-off weight has to be decreased to ensure a safe take-off will significantly increase at some airports.

Excessive speed in the 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 due to poorly designed aerodrome procedures.

Explosive door openings on parked aeroplanes (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.

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.

Fatigue (FTL) (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 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.

Related SIBs: EASA SIB 2023-05: Possible Risks Emerging During Summer 2023

Flight crew incapacitation (SI-0049)

This safety issue relates to pilot incapacitation, not being able to perform his/her duties and associated risks.

Fuel contamination and quality (SI-0011)

This safety issue relates to the upload of contaminated fuel in the aircraft or to fuel being contaminated once stored in the aircraft fuel system. This safety issue covers all types of contamination from water, algae, polymers, etc.; anything that is sufficient to cause an in-flight shutdown of the engines or to affect adversely the delivery of power from the engines. It also includes the supply chain of fuel that may be the cause of the contamination, the oversight capabilities of the aircraft operators and the regulatory framework of both the fuel supply and the operators' oversight.

Additionally, it includes the non-compliance with the technical specification for specific fuel type, resulting in wrong flash point, wrong concentration of any required chemical component, etc.

Gap between certified take-off performance and take-off performance achieved in operations (SI-0017) (CC effect)

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.

Effects of climate change under scrutiny

See SI-0015.

Hail (SI-0003A) (CC effect)

This safety sub-issue of the adverse convective weather safety issues group (SI-0003) focuses on the 'hail' phenomenon/precipitation. It is relevant for the take-off/climb and approach/landing phases of flight.

Effects of climate change under scrutiny

See SI-0003.

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, regarding go-around with all engines operating (workload).

Icing in flight (SI-0001) (CC effect)

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.

Effects of climate change under scrutiny

Climate change is affecting the air temperature and humidity. Moderate and severe airborne icing conditions may become more frequent, more intense, or they may affect larger ranges of altitude, increasing the risk exposure during the flight.

Icing on ground (SI-0002) (CC effect)

Icing on the ground may occur due to an atmospheric icing phenomenon and the adverse effect of the de-icing/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.

Effects of climate change under scrutiny

See SI-0001.

Inadequate 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.

Ineffective crew resource management (CRM) (SI-0009) (Amended)

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.

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.

Impact of GNSS interferences on civil aviation operations (SI-0034) (Amended)

The safety issue refers to the dependence of air transport (air operators, air navigation service providers, and original equipment manufacturers) on satellite systems and the potential impact of the associated vulnerabilities on the safety of the flight. Such vulnerabilities include jamming and spoofing that may affect position, navigation, timing, surveillance and communication.

It covers the equipment on board, the ATM/ANS equipment, the standard operating procedures, training and published navigation procedures.

Should the GNSS units malfunction in flight, potential mitigations include the procedure to revert to other means of navigation or ground aids in critical flight phases. There is also a risk of normalisation of deviance, due to crews getting used to false warnings.

The situation is exacerbated if several issues are affecting the flight simultaneously that may increase the workload to the flight crew and the ATCO and reduce the capability to recognise and properly react to the situation.

Loss of, misleading or false position, navigation, and timing information has severe repercussions as it can ultimately lead to airborne collision, airspace infringement or terrain collision.

Related with 'GNSS signal manipulation leading to navigation or surveillance degradation' (SI-5501A).

Related SIBs: EASA SIB 2022-02R3 : Global Navigation Satellite System Outage and Alterations Leading to Communication / Navigation / Surveillance Degradation, 2024-07-05

Runway surface condition (SI-0006) (CC effect)

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 aeroplane flight manual (AFM)/ flight crew operating manual (FCOM) and the performance data provided by the aircraft manufacturer.

Effects of climate change under scrutiny

Climate change may increase the occurrence of heavy precipitation events causing sudden runway flooding.

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.

Mishandling of 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 PBN, are 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).

Poor language proficiency causing communication breakdown (SI-0054)

The use (or misuse) of language can contribute directly or indirectly to an accident. Therefore, a minimum standard level of knowledge of the language used for communication mainly between pilots and ATCOs is critical to flight safety.

ICAO standardised phraseology should be used whenever possible. Also, when phraseology is not applicable, pilots and ATCOs should demonstrate a minimum level of proficiency in plain language.

The effective use of plain language is vital in routine operational situations in which phraseology provides no 'ready-made' form of communication and is especially critical in unusual or emergency situations.

Inevitable language errors should always be considered and judged in the wider context of miscommunication or failure to communicate successfully. The recognition of these errors contributed to the construction of ICAO Operational Level 4 which is considered to be the minimum level acceptable to ensure safe operations.

Safety education of air passengers (SI-0052)

Poor air passenger understanding of residual risks inherent in commercial air transport operations is likely to result in failure to comply with safety instructions and advice, with a consequent increase in the risks borne by crew and other passengers.

The understanding by the passengers of the cabin crews' safety role in the cabin (that is not only limited to assistance and selling). Instructions need to be obeyed, the safety purpose understood, attention to briefings paid, especially when relevant to coping with potential distress situations/evacuation.

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 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 encounter (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) (CC effect)

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.

Effects of climate change under scrutiny

See SI-0003.

5. Rotorcraft — RTR

The Rotorcraft Safety Risk Portfolio was first developed in 2021 by the Agency, in conjunction with the European Safety Analysis Group for Rotorcraft (ESAG-R) and has since been reviewed annually. Each safety issue contributes to one or more key risk areas as defined in the Introduction of this Volume.

Regarding the main key risk areas for this domain, refer to Appendix 3 Advanced statistics for helicopters' 'Advanced statistics for all helicopter operations' 'Safety risks' of EASA ASR 2024. It applies to all three types of helicopter operations: commercial air transport, specialised operations and non-commercial operations.

These key risk areas are defined by their potential accident outcome and by the immediate precursors of that accident outcome. The 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. The risk picture of this domain identifies the key risk areas of greater concern that are aircraft upset for commercial air transport helicopters, specialised operations with helicopters, and non-commercially operated helicopters.

The safety issues in the portfolio are sorted into the 'Assess – Elevated priority index', 'Assess – Normal-to-low priority index', 'Mitigate – define', 'Mitigate – implement', and 'Monitor' categories, which provide a snapshot of their status within the European SRM process by priority. The safety issue prioritisation method is described in the Introduction of this Volume. To understand each safety issue better, please click on the safety issue in the list to access their description. All safety issues are now grouped by their nature: systemic issue (an affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome) and contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome).

EASA continues to develop and implement safety enhancement initiatives in alignment with the Rotorcraft Safety Roadmap, our safety strategy aimed to reduce fatalities. The roadmap systematically addresses critical safety aspects, focused on reducing risks and ensuring safer rotorcraft operations industry-wide.

The EU SRM process, discussed in the ESAG-R has identified the following high-risk occurrence categories as safety priorities as presented in ASR 2024:

- Loss of control in-flight (LOC-I);
- Airprox / ACAS alert / mid-air collision (MAC);
- Abnormal runway contact (ARC);
- Controlled flight into terrain (CFIT);
- Collision with obstacle(s) during take-off and landing (CTOL).

The following main contributing factors have been identified in the initial or preliminary accident investigation reports for 2023:

- Impaired visibility, leading notably to LoC-I
- The non-detection of power cables, leading to collision with cables notably in low-altitude operations (LALT)

List 5-1: Rotorcraft safety issues per category & priority

Assess – Elevated priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Unanticipated yaw/loss of tail rotor effectiveness (SI-8024)

Contributing issues:

- Poor pre-flight planning and preparation (SI-8017)
- Poor operational management at take-off and landing sites (SI-8034)

Assess – Normal-to-low priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Inadequate handling of simulated technical failures and abnormal procedures during a training flight (SI-8027)

Contributing issues:

- Lack of knowledge of aircraft systems and application of procedures (SI-8011)
- Inadequate flight path management with the use of automation (SI-8022)
- Insufficient safety culture of organisation (SI-8045)

Mitigate – define

Facilitates Step 3: Definition and programming of safety actions

NIL

Mitigate – implement

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

Systemic issues and hazards in a context:

- Inadequate obstacle clearance during any flight phase (SI-8031)
- Inadvertent flight into IMC (SI-8051) (CC effect)
- Inadequate airborne separation under VFR operation (SI-8028)
- Impaired visibility conditions except IMC (SI-8019)
- External-sling-load-operations-related issues (SI-8038)
- Ineffective safety management systems (SI-8044)

Contributing issues:

- Vortex ring state (SI-8025)
- Pilot fatigue (SI-8016)
- Inadequate training and competence transfer — initial and recurrent training (SI-8015)

Monitor

Facilitates Step 5: Safety performance measurement

Systemic issues and hazards in a context:

- Inadequate handling of loss of power in flight (SI-8026) (Amended)
- Hoist-operations-related issues (SI-8037)
- On-board carriage of PEDs with lithium batteries (SI-8048)
- Downwash adverse effects (SI-8041)
- Dynamic rollover (SI-8040)
- Loose object in the helicopter cabin (SI-8050)
- Adverse weather encounter — effects other than IMC (SI-8021) (Amended)
- Bird and other wildlife hazard (SI-8030)
- Interference by lasers (SI-8049)
- Navigation-related issues (SI-8036)
- Unruly passengers (SI-8042)

Contributing issues:

- Incorrect in-flight decision-making (SI-8014)
- Incorrect application of operational rules and procedures (SI-8012)
- Ineffective application of crew resource management and multi-crew cooperation (SI-8013)
- Deficiencies and inconsistencies in operating manuals (SI-8046)

Adverse weather encounter — effects other than IMC (SI-8021) (Amended) (CC effect)

This issue refers to environmental conditions encountered during the flight and contributing to aircraft upset situations. It includes icing conditions, lightning strikes, high winds, convective weather phenomena such as windshear, up and down drafts or microburst, and obstacle induced turbulence. The safety issue addresses the identification, avoidance and recovery of such conditions.

Bird and other wildlife hazard (SI-8030)

This issue refers to proximity or actual collision with bird and other wildlife during flight operations, contributing to a possible unsafe outcome. It also includes the lack of control or inadequate warning of bird and wildlife hazard at an aerodrome or any take-off and landing sites.

Deficiencies and inconsistencies in operating manuals (SI-8046)

This issue refers to operating manuals not appropriate, not accurate or out of date. It encompasses the pilot's operating handbook (POH), the rotorcraft flight manual (RFM), the FCOM, the SOPs, the quick reference handbook (QRH) and the company operating manual Part B.

Downwash adverse effects (SI-8041)

This safety issue relates to helicopter downwash effects such as the blowing of foreign object debris (FOD) which can lead to injuries or damage to third parties on ground, or the recirculation of the snow/dust causing possible damages to the helicopter own engines. This safety issue does not include the effect of impaired visibility (addressed in SI-8019).

Dynamic rollover (SI-8040)

This issue refers to inability to prevent helicopter rollover during take-off, landing or air taxiing/hovering phases. It includes, in particular, the inadequate knowledge of the operating environment (soft landing surface, obstacles), and the inadequate skills to recover after the skid or landing gear enters in contact with possible obstacles and the aircraft started to roll.

Inadequate handling of loss of power in flight (SI-8026) (Amended)

This safety issue relates to the inability to safely continue the flight due to a sudden engine power loss or situation requiring the engine to be deliberately shut down in flight.

Multi-engine and single-engine airplanes operate differently during an engine failure. If a failure occurs on a multi-engine helicopter that causes a major, but not total, loss of power on one engine, it is likely that the engine will be shut down as positive engine-out performance is still available, whereas on a single-engine helicopter it may well be decided to make use of the residual power to stretch the glide distance.

It includes, for example, inefficient CRM, inadequate training or abnormal procedures not followed, leading to hard landings or total loss of control in flight.

External-sling-load-operations-related issues (SI-8038)

This safety issue gathers all operational scenarios specific to helicopters flying with external sling load, for both human and non-human cargo, which can contribute to an unsafe outcome. It includes, in particular, sling load falling or contacting terrain or obstacles, sling load contacting the tail rotor, main rotor or fuselage. Unnoticed exceed of the maximum all up mass (MAUM) is also addressed.

Hoist-operations-related issues (SI-8037)

This safety issue encompasses both technical and operational issues specific to hoist operations. It includes hoist malfunctions such as loss of reel in/out functions, hoist cable break due to design issues or due to damages from operational events or inadequate maintenance, but also cable contacts with obstacle or fuselage.

Impaired visibility conditions except IMC (SI-8019)

This safety issue relates to all operational situations where the visibility of the flight crew is impaired, causing a loss of visual cues and situational awareness, leading potentially to obstacle collision, terrain collision or aircraft upset. It includes impaired visibility conditions caused by dust or sand (brownout), snow (whiteout), sun glare, smoke, salt spray or any element that degrades the use of visual cues.

Inadequate airborne separation under VFR operation (SI-8028)

This safety issue relates to the inability, during a VFR flight, to detect, avoid or maintain sufficient airborne separation with other manned or unmanned aircraft, increasing the risk of airborne collision. The safety issue addresses both design and operational aspects involved.

Inadequate flight path management with the use of automation (SI-8022)

This safety issue relates to the inability to follow the intended helicopter flight path with the automatic flight control system (AFCS) being active, contributing to an unsafe outcome. The safety encompasses both technical and operational aspects leading to this situation. It includes, in particular, the ineffective use or monitoring of flight parameters and automation modes, and the inadequate management of the transition manual-automated flight.

Inadequate handling of simulated technical failures and abnormal procedures during a training flight (SI-8027)

This safety issue relates to the inability, during a training flight, to handle simulated technical failures such as power loss or hydraulic system failures, contributing to unsafe outcomes. It includes, in particular, the diagnosis of system failures in flight, and the handling of autorotation and forced landing, leading to hard landings or total loss of control in flight.

Inadequate obstacle clearance during any flight phase (SI-8031)

This safety issue relates to the inability to identify and safely avoid obstacles during any flight phase, in confined areas or in proximity to natural or manmade obstacles, such as, for example, agricultural work or power lines check, both in urban and natural environments.

Inadequate training and competence transfer — initial and recurrent training (SI-8015)

This safety issue relates to the incomplete or inadequate training content as well as ineffective delivery of training for any personnel involved in helicopter operations, including both initial and recurrent training, causing a degradation of competence transfers within an organisation, impacting the necessary knowledge and skills required to operate safely in normal and emergency operational situations.

Inadvertent flight into IMC (SI-8051) (CC effect)

This safety sub-issue of 'Impaired visibility conditions except IMC' (SI-8019) focuses on the safety issue related to a disorientation scenario due to loss of horizon references and/or an accompanying loss of visual contact with the ground. It is a well-known severe risk that can result in various accident types, notably LOC-I, CFIT, collisions with obstacles or cables especially in LALT, and MAC.

This includes also what is called 'scud running' where the pilot flies under low clouds close to the ground to reach their planned destination. It also captures the 'press-on-it' mentality during a VFR flight where pilots put themselves into unnecessary danger trying to reach their destination.

Incorrect application of operational rules and procedures (SI-8012)

This safety issue relates to the flight crew not complying with SOPs or operational manuals, contributing to an unsafe operation outcome. It includes, for example, operating below weather minima, altitude minima, or beyond the helicopter flight envelope.

Incorrect in-flight decision-making (SI-8014)

This safety issue relates to the cases where flight crew decisions during the flight negatively affect the operational safety. It includes, in particular, the decisions on diversions, or on contingency plans.

Ineffective application of crew resource management and multi-crew cooperation (SI-8013)

This safety issue relates to deficiencies in flight crew coordination, integration, communications and workload management, affecting the decision-making and problem-solving capacity, necessary to operate safely the aircraft.

Ineffective safety management systems (SI-8044)

This safety issue relates to ineffective or incomplete application of safety management systems within organisations, in particular change management, SRM, and safety reporting tools and processes.

Insufficient safety culture of organisation (SI-8045)

This safety issue relates to lack of safety policy, leadership and management, resulting in poor staff engagement for safety in the organisation, as well as poor knowledge of safety reporting and 'just culture' principles.

Interference by lasers (SI-8049)

This safety issue relates to events that involve the unintentional or malicious shining of a laser at an aircraft in flight leading to flight crew disorientation or distraction.

Lack of knowledge of aircraft systems and application of procedures (SI-8011)

This safety issue relates to the flight crew lacking the knowledge of the helicopter systems and related procedures necessary to operate safely these systems in normal and abnormal situations, in particular when frequently changing of aircraft types, variants, or configuration/equipment flown.

Navigation-related issues (SI-8036)

This safety issue relates to inadequate or incorrect navigation of the helicopter, both in VFR and IFR operations. It includes, for example, deviations from nominal track, interferences or losses of the radio navigation source as well as issues related to helicopter PBN operations.

On-board carriage of PEDs with lithium batteries (SI-8048)

This safety issue relates to carrying on board of personal electronic devices (PEDs) powered by lithium batteries which contain a risk of overheat and fire ignition in the cargo compartment or in the cockpit.

Loose object in the helicopter cabin (SI-8050)

This safety issue highlights the risk posed by loose items in the cabins of helicopters. It relates to carrying on board of personal electronic devices (PEDs) which may become loose and fallen in the cockpit. Loose items such as sunglasses, jewellery and hats are also risks being carried out. These types of loose items roaming throughout the flight deck and cabin area can pose much greater hazards including interfering with flight controls (e.g. jamming pedals or limiting other flight control authority) which could ultimately result in an aircraft accident and loss of life.

Pilot fatigue (SI-8016)

This safety issue relates to flight crew tiredness in relation to the duration of the flight or length of the duty, the quality of sleep, exposure towards whole-body vibration (WBV) and noise, degrading performance and contributing to an unsafe outcome. It also includes non-compliance with the approved FTL scheme, or an FTL scheme not fit for purpose.

Poor operational management at take-off and landing sites (SI-8034)

This safety issue relates to poor or inadequate operational management at take-off and landing sites, including aerodromes, heliports, helidecks, and any other urban or natural sites. It includes the management of vehicles, persons, obstacles, the training of ground operations personnel as well as the selection of a suitable landing site.

Poor pre-flight planning and preparation (SI-8017)

This safety issue relates to the inability to carry-out appropriate pre-flight planning due to pilot insufficient knowledge and/or lack of planning resources and information. It includes, in particular, the planning of the weather conditions, navigation, fuel, weight and balance, aircraft performance, and risk assessment for the planned flight.

Unanticipated yaw/loss of tail rotor effectiveness (SI-8024)

This safety issue relates to the inability to detect, control and recover from an unanticipated yaw or a loss of tail rotor effectiveness (LTE) during low-speed phases of flight, leading to the helicopter loss of control.

Unruly passengers (SI-8042)

This safety issue relates to passengers who, during commercial or private flights, do not respect or follow safety procedures, or cause disturbance to the flight crew. It also includes passengers overriding or pressuring professionals. The lack of adequate passenger pre-flight briefing is also addressed within this safety issue.

Vortex ring state (SI-8025)

This safety issue relates to the inability to detect, control and recover from an inadvertent VRS condition in flight, leading to the helicopter loss of control.

6. Non-commercial operations — small aeroplanes — NCO SA

The Non-commercial operations — small aeroplanes (NCO SA) Safety Risk Portfolio was first developed in 2016 by the Agency, in collaboration with the General Aviation CAG. While in the past years the portfolio was fully updated during each cycle, this year the portfolio underwent only a light review with a few adjustments, due to momentarily reduced resource capacity. The descriptions of the safety issues in the portfolio remain have not been amended and no new safety issue has been introduced. To understand each safety issue better, please click on the safety issue in the list to access their description.

Each safety issue contributes to one or more key risk areas as defined in the introduction of this volume. These key risk areas 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. The largest KRA contributing to the safety issues in the NCO Safety Risk Portfolio is aircraft upset, as was the case last year. For more information on the links between safety issues and key risk areas, please refer to Appendix A to this Volume. For further details regarding the domain, see Chapter 4 of the Advanced Statistics for the NCO domain in Appendix 7 to Annual Safety Review 2024.

The safety issues in the portfolio are sorted into the 'Assess – Elevated priority index', 'Assess - Normal-to-low priority index', 'Mitigate – define', 'Mitigate – implement', and 'Monitor' categories, which provide a snapshot of their status within the European SRM process by priority. The safety issue prioritisation method is described in the Introduction of this Volume. To understand each safety issue better, please click on the safety issue in the list to access their description. All safety issues are now grouped by their nature: systemic issue (an issue affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome) and contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome).

Overall, the highest-risk safety issues in the portfolio by SIPI score are 'Risks associated with parachuting operations' (4023), 'In-flight decision-making' (SI-4003) and 'Inadvertent flight into IMC/scud running' (SI-4008). Among these three, 'In-flight decision-making´ (SI-4003) is a contributing safety issue. For 'Risks associated with parachuting operations' (SI-4023), a safety issue analysis has been done and the next step is to define the best intervention strategy (BIS). Finally, the safety issue assessments for 'Approach path management on GA aeroplanes' (SI-4005) still needs internal review before undergoing the BIS stage for an impact assessment of the proposed actions.

Furthermore, it should be noted that since the last edition, no new safety issues have been added or amended.

List 6-1: Non-commercial operations — small aeroplanes safety issues per category & priority

Assess – Elevated priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Inadvertent flight into IMC/scud running (SI-4008) (CC effect)

Contributing issues:

- In-flight decision-making (SI-4003)

Assess – Normal-to-low priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Inappropriate control input (SI-4029)
- Approach path management on GA aeroplanes (SI-4005)

Contributing issues:

- Poor pre-flight planning and preparation (SI-4007)
- Training, experience, and competence of individual (SI-4004)

Mitigate – define

Facilitates Step 3: Definition and programming of safety actions

Systemic issues and hazards in a context:

- Risks associated with parachuting operations (SI-4023)
- Handling of technical failures (SI-4001)

Mitigate – implement

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

Systemic issues and hazards in a context:

- Airborne separation (SI-4010)

Monitor

Facilitates Step 5: Safety performance measurement

Systemic issues and hazards in a context:

- Mass and balance (SI-4014)
- Carbon monoxide poisoning (SI-4030)
- Damage tolerance to UAS collisions (SI-4019)
- Icing in flight (SI-4022/SI-0001)
- Bird and wildlife strikes at smaller aerodromes/airfields (SI-4013)

Contributing issues:

- Knowledge of aircraft systems and procedures (SI-4017)
- Engine system reliability (SI-4012)
- Operational communication (SI-4021)
- Fuel management in flight (SI-4011)
- Other aircraft system reliability (SI-4028)
- Crosswind (SI-4015) (CC effect)

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. This safety issue is also relevant for the CAT A and ATM/ANS domains.

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.

Carbon monoxide poisoning (SI-4030)

Carbon monoxide (CO) poisoning occurs mostly due to cracks in exhaust systems. Air conditioning systems in small aircraft often lead cold air around the exhaust pipes to heat it before it enters the cockpit. CO poisoning can result in crew incapacitation and death.

Crosswind (SI-4015) (CC effect)

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.

The 'Turbulence' safety issue (SI-4016) is transposed into the 'Crosswind' safety issue as many of the turbulence incidents occurred during the take-off or approach/landing phases of the flight.

Damage tolerance to UAS collisions (SI-4019)

UAS are a growing airborne conflict threat to manned aircraft due to their growing popularity among the public who may not be aware of their obligations under the UAS regulations. It is important to consider the structural tolerance of a general aviation aircraft to withstand impact with UAS and their 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, but also with the design of the UAS. The vulnerability of aircraft differs depending on the category of aircraft: Large aeroplanes (CS-25), small rotorcraft (CS-27) large rotorcraft (CS-29) and Normal, Utility, Aerobatic and Commuter Aeroplanes (CS-23). The latest research results from EPAS Action, RES.0015 on the "Vulnerability of manned aircraft to drone strikes" will now be analysed.

Engine system reliability (SI-4012)

The reliability and handling of any hardware/software system on board the aeroplane is crucial for a safe flight. This issue is focused on the engine and its operation. Failure of any of these hardware/software systems can result in loss of power, leading to loss of control while the pilot is trying to solve the problem.

Fuel management in flight (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-4022/SI-0001) (CC effect)

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 the 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 linked to the SI-0001, with the same title, in the Commercial air transport — aeroplanes Safety Risk Portfolio.

Inadvertent flight into IMC/scud running (SI-4008) (CC effect)

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 their planned destination. This also captures 'press-on-it' mentality during a VFR flight where pilots put themselves into unnecessary danger trying to reach their destination.

Inappropriate control input (SI-4029)

Included in this safety issue are occurrences where inappropriate control input by the pilot was evident in the occurrence.

In-flight decision-making (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.

Knowledge of aircraft systems and procedures (SI-4017)

This issue refers to the pilot's ability/inability to apply formerly acquired knowledge and training to the current event. This is evident when pilots fly 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.

Mass and balance (SI-4014)

The mass 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.

Operational communication (SI-4021)

Ineffective 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.

Other aircraft system reliability (SI-4028)

This issue refers to the reliability of all aircraft systems, other than the engine and propeller.

Risks associated with 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.

Poor pre-flight planning and preparation (SI-4007)

Effective pre-flight planning and preparation is achieved by ensuring that the correct processes, tools, and information are 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 procedures. It includes 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.

7. Sailplanes — SP

The sailplane portfolio was added to the EPAS in last year's edition. The safety issues have been identified from various sources as per the EU SRM process. While in the past years, the portfolio was fully updated during each cycle, this year the portfolio underwent only a light review with a few adjustments, due to momentarily reduced resource capacity.

The safety issues in the portfolio are sorted into the 'Assess – Elevated priority index', 'Assess – Normal-to-low priority index', 'Mitigate – define', 'Mitigate – implement', and 'Monitor' categories, which provide a snapshot of their status within the European SRM process by priority. The safety issue prioritisation method is described in the Introduction of this Volume. To understand each safety issue better, please click on the safety issue in the list to access their description. All safety issues are now grouped by their nature: systemic issue (an issue affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome) and contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome).

The highest key risk areas, to which the safety issues in the portfolio contribute, are aircraft upset, obstacle collision in flight and terrain collision. Refer to Appendix 5 to Annual Safety Review 2024 for a more detailed link between safety issues and key risk areas.

The highest-priority safety issues in the portfolio are 'Approach path management on sailplanes' (SI-7006), 'Incorrect glider assembly before flight´ (SI-7017) and 'Inappropriate flight control inputs' (SI-7016).

Two safety issues have been amended. One safety issue has been removed from the portfolio.

List 7-1: Sailplane operations — sailplane safety issues per category & priority

Assess – Elevated priority index

Facilitates Step 2: Assessment of safety issue

NIL

Assess – Normal-to-low priority index

Facilitates Step 2: Assessment of safety issue

Hazards in a context:

- Approach path management on sailplanes (SI-7006)
- Winch launch failures (SI-7002)

Mitigate – define

Facilitates Step 3: Definition and programming of safety actions

NIL

Mitigate – implement

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

Hazard in a context:

- Airborne separation (SI-7005)

Monitor

Facilitates Step 5: Safety performance measurement

Hazards in a context:

- Incorrect glider assembly before flight (SI-7017) (Amended)
- Inappropriate flight control inputs (SI-7016)
- Aerotow (SI-7007)
- Off-field landings (SI-7011)
- Under/overshoot (SI-7012)
- High wind encounter (SI-7013) (CC effect)
- Pilot incapacitation (SI-7001) (Amended)

Contributing issues:

- Training, experience, and competence of individuals (SI-7008)
- In-flight decision-making (SI-7004)

Aerotow (SI-7007)

The safety issue addresses the aerotow process, how it is taught and trained and captures occurrences related to aerotowing like, glider too high or too low compared with the towing aircraft, which can cause loss of control, and tow cable release issues.

Airborne separation (SI-7005)

Even though the gliders are flying close to each other due to thermal climbing or other activities, they come uncomfortably close to each other or collide with each other. This issue also involves collisions or near collisions with other type of aircraft in all types of airspaces. That part of the issue is also covered by SI-4010 in the NCO portfolio.

Approach path management on sailplanes (SI-7006)

This safety issue is related to the inappropriate execution of an approach at any point during the approach until reaching safe landing. This can lead to runway excursions, aircraft upset, terrain collision or airborne collision. It covers visual approaches. The following areas are reviewed in this safety issue:

- Management of the gliding 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 pilot to deviate from the normal pattern, choose an alternate landing location or continue with the approach; and
- Procedures and checklists for the flown approach, pilot training and the existing regulatory framework.

The main objectives of this safety issue are to train pilots to achieve stabilised approaches on correct speeds, and enhance pilot's decisions when the approach is unstable.

Inappropriate flight control inputs (SI-7016)

This safety issue includes occurrences where wrong or inadequate flight control inputs by the pilot or passenger are the cause of the occurrence.

Incorrect glider assembly before flight (SI-7017) (Amended)

This safety issue includes an incorrect assembly, or rigging, of sailplanes during flight preparation. The issue includes the incorrect insertion of the main wing bolt(s) and connection of control surfaces.

In-flight decision-making (SI-7004) (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/or avoiding or recovering from weather-related incidents. This is exacerbated by social and pier pressures pushing the pilot to take unnecessary risk, instead of turning around, deviate to another airfield or perform a safe out landing, 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.

High wind encounter (CC effect) (SI-7013)

It is the encounter of high wind, including crosswind and gust conditions during the landing or the take-off. It includes the preparation and precautions to be taken for the approach and landing and the take-off, and the information received on weather phenomena, either from external sources or from the aircraft systems. It also includes the certified capabilities of the aircraft type to perform the landing in strong wind conditions, the SOPs and training of the pilot. It also includes the accuracy of the perception of the wind of the pilot performing the approach.

Off-field landings (SI-7011)

This issue tracks off-field landings which are quite common while gliding; however, it is also quite common for gliders to hit objects during the landing causing substantial damage to the aircraft.

Pilot incapacitation (SI-7001) (Amended)

Lack of oxygen and other events leading to incapacitation of the person on board the aircraft. Medical conditions like heart attack or stroke cannot be predicted and are not included in this issue.

Training, experience, and competence of individuals (SI-7008)

This safety issue relates to the pilot's training, experience, and competence to handle the required tasks in flying the aircraft from launch until landing, 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.

Under/overshoot (SI-7012)

The fact that sailplanes do not normally have an engine and cannot abort the landing and perform a go-around, the likelihood of overshooting or undershooting the landing area is higher than with powered aircraft.

Winch launch failures (SI-7002)

The pilot's ability/inability to cope with interruptions of the winch launch procedure. This also includes cable break (simulated or reality) and wing drop during take-off and includes failures of the winch system.

8. Balloons — BA

Commission Regulation (EU) 2018/395, creating a dedicated legal framework for the air operations of balloons within the European Union, was published on 5 March 2018. This regulation covers key aspects of balloon operations, including pilot licensing, airworthiness, maintenance and operational procedures, addressing the need for a consistent and safe approach to ballooning across Europe.

In September 2020, EASA published the Balloon Rule Book, a comprehensive document consolidating the various legal requirements, AMC and GM related to balloon operations. This rule book facilitates compliance for balloon operators by bringing together the requirements established under Commission Regulation (EU) 2018/395 into one accessible resource. It is part of EASA's Easy Access Rules, which aim to provide clear and accessible guidance to all operators.

The rule book addresses several critical safety areas, including operational safety, maintenance and flight planning, ensuring that balloon operators adhere to the highest safety standards. In the context of the safety issues identified for this portfolio, some of the relevant rules from the Balloon Rule Book are as follows:

- BOP.BAS.130 – Flight preparation. This rule ensures that the pilot-in-command is familiar with meteorological and aeronautical information relevant to the flight, including understanding the balloon's size and inertia.
- BOP.BAS.175 – Use of restraint system. This rule specifically addresses the need for restraint systems during critical phases of flight, such as landing, or in turbulent conditions.
- BOP.ADD.430 – Endangering. This rule explicitly prohibits flights that could endanger the aircraft, ensuring that pilots are not pressured to fly in unsafe conditions.

Additionally in September 2024 EASA issued Safety Information Bulletin (SIB) 2024-12 which addresses the need for balloon pilots to use approved restraint systems during flights, particularly during landings. The bulletin emphasises the importance of using restraints to prevent pilot ejection during hard landings, even when not explicitly required by requirements.

The EASA ongoing work in this area continues to align with broader efforts to ensure safe air operations across all aviation sectors. As part of this safety framework, the 2024 edition of EPAS Volume III introduced a dedicated Balloons section for the first time, which initially addressed five safety issues. This year, the scope has been widened to include seven specific safety issues related to balloon operations. Of the five originally identified issues, one has been removed as non-relevant, and one of the remaining four has been amended. Two of the current Balloons portfolio SIs have been flagged as affected by the climate change (CC effect). Weather forecasts are becoming less reliable, and weather systems are experiencing more variability, including increased frequency of severe weather events. This has led to a reduction in the number of flyable days for balloons as unpredictable wind patterns and sudden storms result in more challenging and unsafe flying conditions.

The safety issues in the portfolio are sorted into the 'Assess – Elevated priority index', 'Assess – Normal-to-low priority index', 'Mitigate – define', 'Mitigate – implement', and 'Monitor' categories, which provide a snapshot of their status within the European SRM process by priority. The safety issue prioritisation method is described in the Introduction of this Volume. To understand each safety issue better, please click on the safety issue in the list to access their description. All safety issues are now grouped by their nature: systemic issue (an issue affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome) and contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome).

List 8-1: Balloon operations — balloon safety issues per category & priority

Assess – Elevated priority index

Facilitates Step 2: Assessment of safety issue

NIL

Assess – Normal-to-low priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Powerline collisions (SI-6001)
- Presence and use of pilot restraints (SI-6002)
- Pressure to fly (SI-6003) (CC effect)

Contributing issue:

- Pre-flight planning and preparation (SI-6008) **(New)** (CC effect)

Mitigate – define

Facilitates Step 3: Definition and programming of safety actions

NIL

Mitigate – implement

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

NIL

Monitor

Facilitates Step 5: Safety performance measurement

Systemic issues and hazards in a context:

- Inadequate ground obstacle clearance (SI-6006) (Amended)
- Use of non-certified parts in critical balloon structure/equipment (SI-6012) **(New)**

Contributing issue:

- System reliability and ageing structures (SI-6014) **(New)**

Inadequate ground obstacle clearance (SI-6006) (Amended)

During take-off or landing, obstacles such as trees or buildings may block the pilot's view. Poor visibility or situational awareness can result in a collision with these obstacles. Maintaining minimum safe altitude and constant observation of surroundings is essential.

Powerline collisions (SI-6001)

Powerline strikes pose a significant risk in ballooning, often resulting from poor visibility or inadequate flight planning. Pilots must maintain strong situational awareness and re-plan effectively, especially in low-visibility conditions. Avoiding powerlines requires continuous assessment of the flight environment and proactive decision-making.

Pre-flight planning and preparation (SI-6008) (CC effect) (New)

The key difference between pre-flight planning and preparation for balloons and pre-flight planning and preparation for other types of aircraft lies in the unique weather briefing and preparation that balloon pilots must consider during pre-flight preparations. Unlike powered aircraft, balloons rely entirely on wind currents for navigation, meaning that pilots must conduct detailed assessments of wind patterns at different altitudes to determine potential flight paths and to adhere to maximum wind limitations. Additionally, balloon pilots need to be highly aware of landing site availability, as balloons cannot change direction mid-flight or land precisely on runways, unlike airplanes or helicopters. This reliance on natural elements and the lack of direct control over the flight path require more extensive and specific planning in ballooning compared with other types of aviation.

Presence and use of pilot restraints (SI-6002)

Balloon pilots are required to use restraint systems on balloons with basket compartments or where turning vents are installed. The use of restraints is mandatory for the pilot-in-command — at least during landing. In scenarios or configurations where this is not explicitly required, pilots are still encouraged to use restraints to enhance safety, especially during hard landings or unpredictable weather conditions. Safety Information Bulletin (SIB) 2024-12 emphasises the importance of using restraints to prevent pilot ejection during hard landings, even when not explicitly required by requirements.

Pressure to fly (SI-6003) (CC effect)

Balloon pilots, especially in commercial operations, often face pressure to fly due to financial and organisational factors. This pressure can lead to hazardous decision-making, such as flying in unfavourable weather conditions, which increases the risk of accidents. The pressure is most likely to occur when there are tight schedules, marginal weather forecasts or operational commitments, such as large group flights, where cancellations could result in significant losses for the business or customer dissatisfaction.

System reliability and ageing structures (SI-6014) (New)

As balloons age, the reliability of their structural components gradually decreases. Over time, exposure to weather conditions, repeated use and material fatigue can compromise the integrity of these critical systems. Regular inspections, maintenance and part replacements are essential to prevent failures caused by ageing components. The issue here focuses on the natural degradation of certified parts and systems, which may become less reliable due to long-term use and environmental wear.

Use of non-certified parts in critical balloon structure/equipment (SI-6012) (New)

The use of non-certified or unapproved parts increases the likelihood of mechanical failure, especially in key areas such as burners, valves and envelope materials, which are critical for safe operation. Balloon operators must ensure that all replacement parts meet safety certification standards to avoid potential accidents due to equipment failure.

9. Airworthiness

Existing product-related Safety Risk Portfolios, such as those for commercial air transport aeroplanes or rotorcraft, may have collected in the past safety issues that adversely affected the initial and continued airworthiness of the type design, or continuing airworthiness. They may have identified safety issues related to operational suitability data (OSD), continuing airworthiness and/or associated organisations/competent authorities (i.e. design, production, continuing airworthiness management, maintenance). These portfolios were however essentially flight-operations-centric.

An Airworthiness Safety Risk Portfolio was, therefore, developed in 2023 by the Agency to focus on safety issues related to airworthiness and environmental certification, and continuing airworthiness[10]. Integrating the lessons learnt from the B737 MAX accidents in the European SRM process and centralising airworthiness-related safety issues in one place, were instrumental in the decision to establish that portfolio.

Safety issues relevant to the airworthiness portfolio are defined where:

- they adversely affect more than one product type or part, more than one organisation, and/or more than one competent authority;
- they would need to be controlled by other means than selective and reactive mitigating controls, such as airworthiness directives (ADs), safety directives (SDs), or inspection/standardisation findings;
- they are framed to scenarios mainly controlled by design, production, maintenance, continuing airworthiness management organisations, and their competent authorities.

The first edition of the Airworthiness Safety Risk Portfolio was published as part of the EPAS Volume III 2024 edition. Unless the safety issue is categorised '(Amended)', the title and/or description have not been modified compared with the last revision of EPAS Volume III.

The safety issues in the portfolio are sorted into the 'Assess – Elevated priority index', 'Assess – Normal-to-low priority index', 'Mitigate – define', 'Mitigate – implement', and 'Monitor' categories, which provide a snapshot of their status within the European SRM process by priority. The safety issue prioritisation method is described in the Introduction of this Volume. To understand each safety issue better, please click on the safety issue in the list to access their description. All safety issues are now grouped by their nature: systemic issue (an issue affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome) and contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome).

In 2024, the assessment of the safety issue on inadequate management of repetitive defects (SI-9001) was delivered, closing the SRM step 2.

The safety issues identified by the lessons learnt from the B737 MAX accidents, which were previously categorised under 'Assess' in 2023, were transferred to 'Mitigate' in 2024.

In addition to the existing CM-SA-002 on 'Flight crew human factors assumptions in aircraft and system safety assessments' (SI-9002), several deliverables were published late 2023 and throughout 2024, aiming to improve the consideration of human factors in aircraft certification. These included:

- CM-21.A-A-003 on 'Analysis of occurrence reports and determination of potential unsafe conditions originated by human performance issues on large aeroplanes' (SI-9003) addressed to design approval holders of large aeroplanes;

10 In the context of Regulation (EU) No 748/2012 and Regulation (EU) No 1321/2014.

- a revision of SIB 2023-08 on 'Reporting of occurrences involving human interventions linked to flight deck design, operating procedures, training, or a combination thereof', addressed to commercial air transport operators of CS-25/ JAR-25/ FAR-25 aeroplanes (SI-9003); and
- NPA 2024-02, strengthening the systematic reporting of occurrences or occurrence trends involving human interventions by CAT operators to the design approval holder, as part of RMT.0392 'Regular update of the air operations rules' (SI-9003).

These two safety issues, and the published deliverables, contribute to the strategic priority identified in EPAS 2023-2025 Volume I Section 3.3.4 'Ensure operational safety in initial and continuing airworthiness' by improving the 'safety assessment of human factors in aircraft certification' (Section 3.3.4.2).

In 2024, deliverables associated with the safety issues related to development assurance (SI-9004) and the change product rule (SI-9005) were also published. These included:

- CM-DASA-002 on 'Development Assurance Considerations in Product Certification', addressing the scope of development assurance applicability and the means of compliance when developing products to be certified by EASA or when installing certified products or ETSO articles on aircraft; and
- NPA 2024-04, introducing non-controversial recommendations made by the Change Product Rule International Authorities Working Group on point 21.A.101, as part of the RMT.0031 Subtask 3. This rulemaking task covers the regular update of Commission Regulation (EU) No 748/2012 and the AMC and GM.

SI-9006 has been renamed 'Shortcomings in design and maintenance instructions resulting in maintenance errors', and its description has been amended, to reflect the scope of the safety issue.

In 2024, the research project RES.0008 on integrity improvement of Rotorcraft Main Gear Box (MGB) was completed, supporting the safety issue on helicopter rotor and transmission system failures (SI-9007). The research project was initiated by the safety recommendations from AIB-Norway following the EC225 LN-OJF fatal accident. The research project mainly aimed at addressing: the resilience of the rotor and rotor drive systems to failure of individual components; and the reliability and tolerance to flaws of integrated bearing races subject to rolling contact fatigue.

Related to the safety issue on hazardous conditions following helicopter ditching (SI-9009), the research project RES.0009 on new flotation systems was completed late 2023. Objective was to provide answers to technical issues regarding the feasibility of providing a step change in occupant survivability following capsize of a helicopter through the introduction of an air pocket scheme utilising flotation units mounted high up on the helicopter fuselage. These technical issues were initially raised through the RMT.0120 and associated NPA 2016-01 proposing enhanced post capsize survivability features (air pocket) for CS 27 and CS 29 update.

A new safety issue is introduced in the airworthiness safety risk portfolio, namely 'oxygen-fed fire in the flight deck' (SI-9012). This safety issue has been identified based on investigation report and study provided by safety investigation authorities.

List 9-1: Airworthiness safety issues per category & priority

Assess – Elevated priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Oxygen-fed fire in the flight deck (SI-9012) (New)
- Shortcomings in design and maintenance instructions resulting in maintenance errors (SI-9006) (Amended)

Assess – Normal-to-low priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Use of airstair for passenger embarking/disembarking on large transport aeroplanes (SI-9008)

Mitigate – define

Facilitates Step 3: Definition and programming of safety actions

Systemic issues and hazards in a context:

- Outdated certification bases established for major changes to type certificates (SI-9005)
- Inadequate management of repetitive defects (SI-9001) (Amended)

Mitigate – implement

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

Systemic issues and hazards in a context:

- Insufficient consideration of flight crew human factors in the continued airworthiness process of the type design (SI-9003)
- Hazardous conditions following helicopter ditching (SI-9009)
- Helicopter rotor and transmission system failures (SI-9007)
- Limited application and inadequate oversight of development assurance (SI-9004)

Monitor

Facilitates Step 5: Safety performance measurement

Systemic issues and hazards in a context:

- Insufficient consideration of flight crew human factors in functional hazard assessments (SI-9002)

Contributing issues:

- ADELTs, ELTs and PLBs malfunctions (SI-9010)

ADELTs, ELTs and PLBs malfunctions (SI-9010)

This issue refers to failures and malfunctions of automatically deployable emergency locator transmitters (ADELTs), emergency locator transmitters (ELTs) and personal locator beacons (PLBs). It includes, in particular, the cases when these systems do not perform as required after impact, or when there is an unintentional deployment or activation of these systems. The failure of activation of these systems can increase the risk of post-impact fatalities.

Hazardous conditions following helicopter ditching (SI-9009)

This safety issue includes all hazards endangering the survivability of the helicopter occupants after a ditching has been performed. In addition to the helicopter emergency floatation system (EFS) malfunctions, it includes the hazards related to an evacuation after a helicopter capsizing such as issues with the emergency exit suitability, signage, the internal and external emergency lighting, the life raft deployment from the cabin or externally, defective or unsuitable survival suits, the inadequate crew and passenger training for underwater escape and the use emergency and safety equipment such as life jackets and emergency breathing systems.

Helicopter rotor and transmission system failures (SI-9007)

This safety issue relates to technical failures, malfunctions, and defects of the helicopter main rotor (ATA 62), main rotor drive system (ATA 63), tail rotor (ATA 64) and tail rotor drive system (ATA 65), contributing to an unsafe operational outcome.

Inadequate management of repetitive defects (SI-9001) (Amended)

This safety issue addresses repetitive defects of aircraft systems which may adversely affect aircraft operations and airworthiness if not managed properly.

Managing repetitive defects is multi-dimensional and requires collaboration between all stakeholders in the airworthiness domain, including operators, type certificate holders, continuing airworthiness management and maintenance organisations.

CAMOs hold the main responsibility to manage such defects. Their role, as prescribed by Regulation (EU) No 1321/2014, is to ensure the airworthiness of the aircraft and arrange the rectification of defects. Identification of repetitive defects is a challenge, as well as their technical assessment and resolution. The CAMO interfaces with all other organisations involved.

AMOs are tasked by the CAMOs to perform the necessary maintenance resulting from the AMP or from defect identification. Reporting information from AMO to CAMO may be essential in the management of repetitive defects.

Aircraft operators and flight crews operate the aircraft and are exposed to defects. The flight crew is expected to report them through the aircraft technical log to inform the CAMO. On the other hand, the CAMO should ensure that the flight crew has all information necessary to perform the flight, which may include informing the flight crew of specific defects that could occur in a repetitive manner.

DAHs are responsible for the design of the aircraft. Once informed by the CAMO, they should support the investigation with a view to solving the issue and/ or proposing mitigating actions.

Repetitive defects can be difficult to identify and rectify, and their root causes have the potential to remain latent over long periods of time. They may eventually affect the safe operation of aircraft, particularly when combined with other defects, or when they occur on highly integrated systems, potentially having an impact on automation and/ or on flight crew workload. Besides, the management of repetitive defects involves multiple activities including continuing airworthiness management, aircraft maintenance, flight operations and design. This translates into additional challenges, such as information sharing, communication or interpretation issues, which can ultimately affect how well repetitive defects are managed and hence potentially threaten flight safety. There have been cases where repetitive defects were identified as contributing factors to fatal accidents of large aeroplanes in commercial air transport.

Insufficient consideration of flight crew human factors in functional hazard assessments (SI-9002)

Functional hazard assessments (FHAs) are key elements within the safety assessment process for showing compliance with CS 25.1309. They support the compliance demonstration by ensuring that:

- the identification of failure conditions is complete;
- the classification of failure conditions is correct and adequately substantiated.

The consequences of failure conditions and the severity thereof may be mitigated by relying on flight crew actions. Whether these mitigations are valid directly affects the classification and subsequently the safety objectives.

Recent experience has shown that a disparity may exist between:

- the observed flight crew behaviours; and
- the underlying assumptions about flight crew recognition, interpretation, and response that applicants have made during the design certification process.

These discrepancies have resulted in a number of safety recommendations. While guidance on 25.1302 clearly states that both normal and non-normal conditions have to be covered, there is no guidance material defining a structured HF methodology for validation of the FHA assumptions with respect to flight crew behaviour.

Insufficient consideration of flight crew human factors in the continued airworthiness process of the type design (SI-9003)

During the design phase of the human/machine interface in the flight deck, the type certificate applicant must demonstrate compliance with the HF requirements, anticipating potential in-service events related to HP and implementing design-related mitigations. The type certificate applicant must therefore ensure that the design of the flight deck considers a comprehensive set of design principles that are very close to what is well described in the literature under the concept of usability. The ultimate intent of designing a usable flight deck is to prevent as much as practicable any kind of HP issues in both normal and abnormal situations (including failure conditions), and to allow the management thereof should they occur.

Experience has shown that, despite the best efforts made during the initial airworthiness process of the type design, actual flight crew behaviour or performance in service may deviate from what was initially expected by the DAHs and the certification authorities. Such deviations in both normal and abnormal situations (including failure conditions) may have safety consequences and result in serious incidents/accidents if going further unnoticed.

DAHs and certification authorities normally rely on the continued airworthiness process of the type design to further capture and manage design weaknesses, assumptions invalid over time, etc. In such a context, it is therefore paramount that air operators systematically report to the DAHs occurrences involving HP aspects detected by the flight crew during the operator's flight operations and/or detected by the instructor during the operator's simulator training. It is equally paramount that the DAHs investigate these occurrences and are able to determine potential unsafe conditions originated from HP issues.

The existing regulatory material for occurrence reporting and continued airworthiness of the type design does not however fully address these key elements when it comes to HP.

Limited application and inadequate oversight of development assurance (SI-9004)

Demonstration of compliance with system-safety-related certification specifications requires addressing development errors (i.e. errors in requirements, design or implementation). Development assurance activities are the means to minimise the likelihood of development errors occurring within the development life cycle of the aircraft, systems and equipment. These activities are implemented by applicants through development assurance plans and processes at aircraft, system and equipment levels, the acceptability of which are assessed by the Agency against the objectives contained in SAE ARP 4754/ EUROCAE ED-79 'Guidelines for Development of Civil Aircraft and Systems'.

Recent experience has shown however that while applicants understand the development assurance process and underlying activities, they do not always consider that development assurance directly contributes to aircraft/ system safety. Analysis of occurrences, reports from safety investigation authorities and certification reviews draw the attention to:

- limited scope of applicability (exacerbated by the change product rule, ref. SI-9005),
- loose application of the process,
- low level of oversight from the applicant itself (internal and suppliers) and authorities, and/ or
- compliance artefacts almost inexistent or of poor quality.

Outdated certification bases established for major changes to type certificates (SI-9005)

When defining the applicable certification basis for a major change to a type certificate, Regulation (EU) No 748/2012 introduces flexibility under conditions for selecting an earlier amendment of a certification specification instead of the amendment in effect on the date of application for the change.

Experience has shown that the use of this flexibility can sometimes be extensive by, for instance:

artificially reducing the scope of significant changes and related changes with preceding and/or succeeding sets of non-significant major changes, or

applying the exception conditions at equipment/component level while the use of the equipment/ component by other systems at aircraft level is significantly changed,

possibly impairing the initial intent of the Regulation that introduces this flexibility, namely requirement 21.A.101 of Part 21 which is known as the change product rule. As indicated in the related GM 21.A.101, the intent of the change product rule is to enhance safety by incorporating to the greatest extent practicable the latest requirements into the certification basis for the changed product.

Besides, it is recognised that the change product rule brings along its inherent complexity, involving different options, steps and concepts which are sometimes open to different interpretations and to negotiations. Its application on products nowadays is complex, either because of the ever-higher integration of systems (and of systems and structure) or because of the increase in process-based/ aircraft level requirements (human factors, system safety, development assurance, security, cybersecurity, etc.). The output of the process, the certification basis, is equally getting more and more complex and less and less intelligible. This complexity has the tendency to distract the authority and applicant resources and move their focus away from design safety.

Oxygen-fed fire in the flight deck (SI-9012) (New)

A fire is defined as the combustion of a fuel by oxygen, and occurs when oxygen, fuel and heat combine to create a self-sustaining chemical reaction. If any of these three elements is absent, the fire cannot initiate. The pressure and concentration of oxygen affect the flammability of a material: the greater the quantity of oxygen present, the easier for the material to ignite, the faster and more extensive the combustion and the higher the temperatures. In the specific case of an oxygen-fed fire, any surrounding material is considered flammable material (i.e. fuel), meaning that only two elements need to be present to initiate the fire: an oxygen-enriched environment (e.g. due to an oxygen leakage) and an ignition source.

Firefighting aboard an aircraft is based on eliminating the oxygen present in the air. In an oxygen-fed fire, the oxygen is however provided in an abnormal quantity, thereby rendering the installed standard fire extinguishers inefficient. Their use may even worsen the situation in the flight deck by creating a highly noxious environment (e.g. halon-based fire extinguishers). The crew oxygen system is no longer usable, as it is directly involved in the undesirable sequence of events. The required portable breathing equipment installed in the flight deck, besides only providing a time-limited protection (15 min), may also become inaccessible due to the immediate vicinity to the fire. The current standard emergency procedures for smoke and fumes, developed to mitigate fires of a

different nature from the oxygen-fed ones, are therefore not suitable to fight an oxygen-fed fire in the flight deck. Firefighting such fire situations within the narrow environment of a flight deck with the duty to keep control of the aircraft adds even more complexity to that issue.

Accident investigation reports show that an oxygen-fed fire, characterised by a rapid spread and intense heat, occurring in the confined space of a flight deck, may quickly escalate into an uncontrolled fire, adversely affecting the aircraft structure and systems critical for ensuring continued safe flight and landing.

Shortcomings in design and maintenance instructions resulting in maintenance errors (SI-9006) (Amended)

Maintenance-related occurrence reports collected under the mandatory occurrence reporting scheme for large aeroplanes over the period January 2005 to December 2011 (UK CAA CAP1367, 2016) showed that 'installation error' and the 'use of approved data' were the most frequent types of errors. Since then, a considerable body of evidence on maintenance errors has been further established, highlighting issues arising from shortcomings in design and maintenance instructions (Royal Aeronautical Society, 2022), which also echoed in the investigation reports of serious incidents and accidents over the past decade.

The deeper systemic issue arises not from the individual performing maintenance activities but from the design approval holder that produced the design and maintenance instructions, e.g. poor accessibility or visibility, ambiguous or misleading maintenance instructions. A key contributing factor for both incorrect installation and failure to follow instructions is the lack of mistake-proofing or error mitigation in aircraft design. Errors can also exist in maintenance instructions, and lack of or insufficient verification can result in difficult-to-use maintenance instructions. In addition, oversight activities indicate that inaccurate, incomplete or ambiguous maintenance instructions are not systematically reported by maintenance organisations or by continuing airworthiness management organisations to the design organisations.

Solely relying on warning and caution messages in maintenance instructions, markings or independent inspections to detect maintenance errors, whereas the hazard can be eliminated by careful design, is not considered suitable. As an example, an incorrect assembly that looks right or is believed to function correctly to one maintenance person may equally look right/ appear to function correctly to a second maintenance person during an independent inspection.

Although the European Continuing Airworthiness Regulation (Regulation (EU) No 1321/2014) and the associated guidance material clearly address the application of human factors principles, accidents and incidents related to maintenance errors continue to occur. Since maintainability can be designed in, specifying maintainability requirements early at the design stage of the aircraft system development is considered paramount in mitigating maintenance errors. Introducing the systematic use of human-centred design for maintenance would contribute to reducing the likelihood of maintenance errors and prevent further escalation into accidents or serious incidents. Maintenance errors not only affect the safety of flight but also can be very costly to the air operators and organisations involved in continuing airworthiness.

Use of airstair for passenger embarking/disembarking on large transport aeroplanes (SI-9008)

An airstair is an integrated and retractable stair installed on the aeroplane at one exit so that passengers may board and alight the aeroplane. They eliminate the need for additional ground support equipment such as a mobile stairway or jetway, for passengers to board or exit the aeroplane.

While airstairs are certified as part of the aircraft design and have been approved for installation on multiple large aeroplanes, the applicable certification requirements do not explicitly address the expected level of safety in the case of use for embarking/disembarking passengers. Note that mobile stairs provided by handling agents at airports are required to meet minimum design standards[11] including stair width and side barriers of a minimum height. As mentioned by recommendation 48 in the research project EASA.2008.C18 on CS-25 cabin

11 For instance, BS EN 12312-1:2013 Aircraft ground support equipment: specific requirements - part 1: passenger stairs.

safety requirements published in 2009, there are no regulations governing the height, angle or slip resistance of the steps, or the provision of handrails and side barriers for airstairs. Back in 2007, following four occurrences of personal injury resulting from small children falling through or over the airstair handrails, the FAA published Special Airworthiness Information Bulletin (SAIB) NM-07-47 to owners and operators of 737 series airplanes equipped with forward airstairs, in order to recommend the incorporation of service bulletins, adding warning placards to the risers on the airstair steps and door jams, as well as anti-skid material to the side beams and top stair of the airstairs. The warning placards advised to hold a child's hand while they are on the airstairs. Boeing had also revised the flight attendant manual advising to pay particular attention to persons with small children or those with special needs.

Occurrence data over 2018-2023 for commercial air transport of passengers on large aeroplanes showed an adverse trend in the number of occurrences where passengers sustained injuries when embarking/disembarking the aeroplane. A common element in these occurrences was the use of airstair by the passengers, as opposed to the use of other airport/aircraft support ground equipment for embarking/disembarking.

10. Air traffic management/air navigation services — ATM/ANS

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

Regarding the main key risk areas for this domain, refer to Figure 1 'KRAs by aggregated ERCS score and number of risk-scored ATM/ANS occurrences' Appendix 8 'Advanced statistics for ATM/ANS' to ASR 2024. These key risk areas 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. The risk picture of this domain identifies the key risk areas of greater concern that are airborne collision, runway excursion, and aircraft upset.

The safety issues in the portfolio are sorted into the 'Assess – Elevated priority index', 'Assess – Normal-to-low priority index', 'Mitigate – define', 'Mitigate – implement', and 'Monitor' categories, which provide a snapshot of their status within the European SRM process by priority. The safety issue prioritisation method is described in the Introduction of this Volume. To understand each safety issue better, please click on the safety issue in the list to access their description. All safety issues are now grouped by their nature: systemic issue (an issue affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome) and contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome).

Since the last EPAS edition the titles of 5 safety issues have been amended. SI-2006, SI-2008, SI-2009 and SI-2027 have been renamed to better address the nature of these safety issues. The safety issue 'High energy runway conflict' (SI-2005) has been deleted and integrated into SI-2006 and SI-2007. The former SI-2030 has been moved to the NCO portfolio (SI-4010).

The highest SIPI score safety issue in the portfolio is 'Inappropriate clearance due to undetected occupied runway' (SI-2006) followed by 'Deconfliction with aircraft operating with a malfunctioning or non-operative transponder' (SI-2002), 'Use of more than one language on frequency' (SI-2029), and 'Landing/take-off/crossing without a clearance' (SI-2007).

Refer to Appendix A for the link between safety issues and key risk areas.

The safety issue assessment has been completed for 'Deconfliction with aircraft operating with a malfunctioning transponder or non-operative transponder' (SI-2002). This safety issue is now at the BIS stage for impact assessment of the proposed mitigating actions.

List 10-1: ATM/ANS safety issues per category & priority

Assess – Elevated priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Inappropriate clearance due to undetected occupied runway (SI-2006) (Amended)

Assess – Normal-to-low priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Landing/take-off/crossing without a clearance (SI-2007)
- Airborne conflict with an unmanned aircraft system (UAS) (SI-2014)
- Level bust (SI-2004)
- Lack of understanding and monitoring of system performance interdependencies (SI-2022)

Contributing issues:

- Use of more than one language on frequency (SI-2029)
- Mass diversions (SI-2032) (CC effect)
- Cybersecurity (SI-5017C) in ATC (Amended)
- Airborne sector overload (SI-2019) (CC effect)
- Insufficient weather information available to ATC (turbulence/windshear/convective weather) (SI-2008) (Amended)
- Failure of surveillance services (SI-2017) (CC effect)
- Unreliable provision of weather information (wind on ground) (SI-2009) (Amended)
- Failure of air-ground communication service (SI-2018) (CC effect)
- Failure of navigation services (SI-2016) (CC effect)

Mitigate – define

Facilitates Step 3: Definition and programming of safety actions

Systemic issues and hazards in a context:

- Airspace infringement (SI-2025)

Contributing issues:

- Deconfliction with aircraft operating with a malfunctioning or non-operative transponder (SI-2002)
- Inefficient conflict detection with the closest aircraft (SI-2003)

Mitigate – implement

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

Systemic issues and hazards in a context:

- ACAS RA not followed (SI-2001)

Monitor

Facilitates Step 5: Safety performance measurement

Systemic issues and hazards in a context:

- Lack of effectiveness of safety management systems (SI-2026)
- Safety issues raising from new technologies and automation (SI-2015)

Contributing issues:

- Inadequate ATCO-pilot operational radio communication (SI-2027) (Amended)
- Inadequate procedure design and obstacle publication (SI-2028)

ACAS RA not followed (SI-2001)

The 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 aircraft ignore the ACAS RA, react excessively late, do not follow the instruction regarding vertical rate precisely or respond in opposite direction. Flight crews are required to comply immediately with all resolution advisories (RAs), unless doing so would endanger the aircraft. Similarly, ATCOs are required not to provide further ATC instructions once the flight crew reports the RA. The appropriate responses which flight crew and ATCOs are expected to demonstrate in the event of an ACAS RA are outlined in ICAO and EU regulatory documentation.

Airborne conflict with an unmanned aircraft system (UAS) (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. Authorised UAS operations in the 'specific' category may include UAS flights at altitudes at which other (manned) aircraft will fly, and therefore these could possibly pose risks as well. For example, failure of the UAS guidance and control system or degradation of technical systems supporting e-identification, geo-fencing, detect and avoid, (self)-separation or collision avoidance, could increase the risk of airborne collision with a UAS. Also, HF issues and unintended remote pilot/operator errors could result in airspace violations, procedural deviations, and altitude deviations (thereby increasing the risk of airborne collision). This safety issue is exacerbated by the fact that UAS are often not detected by ground equipment and/or on-board conspicuity devices of other aircraft.

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 ATCOs and pilots.

Airborne sector overload (SI-2019) (CC effect)

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 degradation of ATM system performance, 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.

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 increase the ATCOs' 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.

Cybersecurity in ATC (SI-5017C) (Amended)

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. Link with SI-5017 'Cyberattacks'.

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

When an aircraft with a non-operative transponder or malfunctioning transponder operates in an airspace where aircraft must be equipped with a secondary surveillance radar (SSR) transponder, the incorrect information transmitted by the transponder increases the risk of airborne collision or terrain collision. 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 RAs 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 the existing procedures suffice in mitigating the risk posed by aircraft operating without a functioning transponder.

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

Failure of the air–ground communication system may degrade the performance of the communications service and increase safety risk to an unacceptable level. Air–ground communication refers to aeronautical fixed and mobile services to enable air-to-ground voice or data communication for ATC purposes. Common failures in voice communications include radio equipment malfunction (in the air and on the ground), loss of communication, blocked frequency, radio interference, and sleeping VHF receiver problem. Another key mode of the air–ground communication service is controller–pilot data link communications (CPDLC), which allows ATCOs to transmit non-time-critical messages to an aircraft as an alternative to voice communications. Common failures in CPDLC include technical failure of the 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 they occur. The impact of the failure of air–ground communication service includes the entire provision of ATS.

Failure of navigation services (SI-2016) (CC effect)

Failure of navigation services can lead to the loss of the facilities and services (VOR, DME, ILS, GNSS, NDB) that support aircraft with positioning and time, and thus increase safety risk to an unacceptable level.

This could potentially lead to the situation that the crew does not know the correct position of the aircraft, or the indicated position is not correct. This could lead to the overload of the ATCOs when they are required to provide the missing information verbally or via the system. For example, a corrupted/interrupted ILS signal can lead to an unstabilised approach, go-around, and even CFIT.

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 of staff to deal with abnormal situations.

Failure of surveillance services (SI-2017) (CC effect)

Failure of surveillance services may degrade the performance of ATS and increase safety risk to an unacceptable level. Surveillance systems are used by air traffic control to determine the respective positions of aircraft to allow safe separation. Such systems include PSR, SSR, GNSS and automatic dependent surveillance – broadcast (ADS-B), wide area multilateration (WAM) and systems for processing and displaying surveillance data.

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 of staff to deal with abnormal situations.

Inadequate 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.

Inadequate ATCO-pilot operational radio communication (SI-2027) (Amended)

Good communication between ATCOs 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.

Inappropriate clearance due to undetected occupied runway (SI-2006) (Amended)

This safety issue could lead to runway incursions following a wrongly given clearance by the ATC either to a landing, crossing or taking off aircraft on/off an already occupied runway. This misdetection of an occupied runway can be triggered by human factors such as workload, fatigue and stress, but also by 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 on 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.

Inefficient conflict detection with the closest aircraft (SI-2003)

ATCOs may not detect a conflict between one aircraft and another aircraft close to it due to attention failure. Attention is a limited resource and numerous processes compete for it. In blind spot events the needed elements of attention — vigilance (maintaining awareness) and focus (concentration on the task) —are adversely affected by:

(1) competition for the attention resources from other tasks, attempts to remember, increased mental workload; and

(2) erosion of the attention resources by filtering mechanisms and physiological factors like distraction and fatigue.

ATCOs 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. 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 SI-2025 ‘Airspace infringement’.

Insufficient weather information (turbulence/windshear/convective weather) available to ATC (SI-2008) (Amended)

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.

Lack of effectiveness of safety management systems (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 ANSPs is imperative for an effective SMS functioning in an already ultra-safe industry, like aviation. However, the lack of competent and experienced inspectors and 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. This safety issue is mitigated through the SES Performance and Charging Scheme'.

Lack of understanding and monitoring of 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.

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

Aircraft landing, taking-off and crossing runways without clearance from the ATCO poses a 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 ATCOs 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-2032) (CC effect)

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 that alternate aerodromes have sufficient capacity, and diversions from many airports to one.

Safety issues raising from 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.

Unreliable provision of weather information (wind on ground) (SI-2009) (Amended)

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 of ensuring that accurate and timely weather information is provided to flight crew during the landing phase.

Use of more than one language on frequency (SI-2029)

This safety issue refers to the risk that occurs when using different languages at the same time on the ATC frequency. Despite that the default language of international aviation worldwide is English, local languages are used concurrently for air–ground communication. Under certain circumstances, pilots might prefer to use their native language to address controllers and controllers might address ground personnel in their native language. Having several aircraft on one frequency, the result might be that certain aircrews do not understand clearances given to an aircraft in the same airspace and the responses of the aircrew. Therefore, the aircrew might not be aware of what the other aircrew is about to do. This can lead to the loss of situational awareness of the involved parties with regard to the respective other traffic in the same airspace.

11. Aerodromes and ground handling — ADR/GH

The aerodromes and ground handling Safety Risk Portfolio was first developed by the Agency in 2017. This was done in collaboration with the Aerodromes and Ground handling Collaborative Analysis Group (CAG). This group was active in 2023 and dormant in 2024. For this cycle it was decided that apart from minor adjustments, no update of the safety issues in the ADR/GH Safety Risk Portfolio would be undertaken due to momentarily reduced capacity. Moreover, the ASR 2024 shows that the performance of the domain has improved: in 2023 the accident and serious incident rate in the domain decreased from 2.3 to 1.7 per 1 million aerodrome movements — see Chapter 7 of ASR 2024. There were no fatalities and only one serious injury in this domain in 2023. This accident occurred at an aerodrome that does not apply the European rules for the safety of aerodrome design, operations and operators but is granted an exemption from their implementation due to having fewer than 10 000 commercial air transport passengers per year[12]. However, the exposure assumptions and therefore the SIPI scoring for the exposure related to each safety issue in this portfolio have been reviewed and entered, as part of a holistic review of the exposure assumptions across all portfolios.

The safety issues in the portfolio are sorted into the 'Assess – Elevated priority index', 'Assess – Normal-to-low priority index', 'Mitigate – define', 'Mitigate – implement', and 'Monitor' categories, which provide a snapshot of their status within the European SRM process by priority. The safety issue prioritisation method is described in the Introduction of this Volume. To understand each safety issue better, please click on the safety issue in the list to access their description. All safety issues are now grouped by their nature: systemic issue (an issue affecting the EU aviation system, linked with existing rules), hazard in a context (operational issues that may directly lead to an accident outcome) and contributing issue (a safety issue contributing to, or exacerbating, another safety issue; not directly leading to an accident outcome).

The ADR/GH Safety Risk Portfolio contains 31 safety issues. The safety issues with the highest SIPI score in the portfolio are 'Poor coordination and control of turnarounds' (SI-1010) and 'Ground staff movement around aircraft' (SI-1019). The safety issue 'Ground operations in low-visibility conditions' (SI-1018) has been moved from the status mitigate to assess because it is part of a safety assessment of runway safety precursors.

It should also be noted that three safety issues of the portfolio are affected by the climate change and are identified below by (CC effect) after the safety issue title.

Please refer to Appendix A to this Volume for the detailed links between safety issues and key risk areas. In terms of both aggregated ERCS score and number of contributing safety issues, the top key risk area for the aerodrome and ground handling domain is ground damage.

For more information on the key risk areas associated with the ADR and GH domain, please refer to Appendix 7 'Advanced statistics for Aerodromes and Ground handling' to the ASR 2024.

12 Based on the option provided to the Member States under article 2(7) of the EASA Basic Regulation.

➡ **List 11-1:** Aerodromes and ground handling safety issues per category & priority

Assess – Elevated priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Poor coordination and control of turnarounds (SI-1010)

Assess – Normal-to-low priority index

Facilitates Step 2: Assessment of safety issue

Systemic issues and hazards in a context:

- Ground staff movement around aircraft (SI-1019)
- Incorrect operation of ground support equipment (SI-1024)
- Ground operations in low-visibility conditions (SI-1018)
- Ground operations in extreme temperatures (SI-1044) (CC effect)
- Ground conflict during aircraft taxiing operations (SI-1001)
- Ineffective control of bird and wildlife (SI-1005)
- Ineffective control of passengers on the apron (SI-1009)
- Pushback operations incorrectly performed (SI-1028)
- Improper parking and positioning of aircraft (SI-1026)

Contributing issues:

- Poor maintenance and serviceability of runways/taxiways (SI-1032)
- Worker fatigue leading to human error (SI-1039)
- Poor safety reporting culture of organisation (SI-1038)
- Errors in load sheets and other documentation/systems (SI-1022)
- Poor or inadequate runway/taxiway design and layout (SI-1029)
- Ineffective control of airside works (SI-1008)
- Poor maintenance and serviceability of ground support equipment (SI-1033)
- Poor or inadequate apron/stand design and layout (SI-1003)
- Poor or inadequate design of ground support equipment (SI-1013)

Mitigate – define

Facilitates Step 3: Definition and programming of safety actions

Systemic issues and hazards in a context:

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

Mitigate – implement

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

Systemic issues and hazards in a context:

- Incorrect operation of air bridges/passenger boarding bridges (SI-1023)

Monitor

Facilitates Step 5: Safety performance measurement

Systemic issues and hazards in a context:

- Inadequate cargo loading in cargo aircraft (SI-1006)
- Inadequate handling of dangerous goods and lithium batteries (SI-1011)
- Ground operations in high winds, rain and thunderstorms (SI-1042) (CC effect)
- Ground operations in snow/ice conditions (SI-1043) (CC effect)
- Poor management of emergency/abnormal operations (SI-1015)
- Towing operations incorrectly performed (SI-1002)
- Fuelling operations incorrectly performed (SI-1017)
- Jet blast (SI-1021)

Contributing issues:

- Ground handling training programmes disruption (SI-5031)
- Poor maintenance and serviceability of apron/stand (SI-1031)

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

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.).

Errors in 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.

Fuelling operations incorrectly performed (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, contamination, misfuelling and incorrect fuel load and fuel quality, etc.

Ground conflict during aircraft taxiing operations (SI-1001)

This safety issue covers all potential ground conflict events that may occur when the aircraft is moving under its own power on the taxiway, such as collisions or near collisions with other aircraft, ground vehicles, ground equipment and ground infrastructure, or persons.

Ground handling training programmes disruption (SI-5031)

Over 2023, it was observed in many EASA Member State airports that the shortage of ground handling staff led to recruiting staff with low competence and experience. In addition to the issues faced for all aviation personnel in missing training and reduced recency, ground handling has the following unique factors:

- higher staff turnover requiring more frequent training;
- less secure job contracts in some companies leading to extensive loss of staff rather than furlough;
- seasonal staff recruitment (may or may not be a problem);
- seasonal recurrent training; for example, for winter operations.

Ground operations in extreme temperatures (SI-1044) (CC effect)

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, and thunderstorms (SI-1042) (CC effect)

Negative effects of high winds, intense rain and 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, especially potential collisions on ground. 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) (CC effect)

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 addresses the movement of ground personnel around the aircraft on the apron during the aircraft turnaround process, resulting in potential unsafe separation between the personnel and the aircraft. Such unsafe separations can cause fatal injuries due to an aircraft engine ingestion or jet blast, or due to direct collisions between the aircraft and the ground personnel. The safety issue considers all phases of the turnaround, in particular when:

- the aircraft moves under its own power, which is the case for almost all arrivals at the parking stand;
- the aircraft is moved during the pushback phase and the towing phase;
- any uncontrolled movement of the aircraft on the apron which is not caused by the aircraft own power;
- aircraft cross-bleed engine starts are performed and a high engine power is used in areas where only idle power is expected.

This safety issue only addresses the unsafe separations of ground personnel moving by their own means on the apron; it does not include the movement of personnel when driving vehicles on the apron, which is addressed by SI-1024. This safety issue does not include the movement of passengers on the apron, which is addressed by SI-1009.

Improper 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 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 sufficient clearance from other aircraft and objects is ensured.

Inadequate cargo loading in cargo aircraft (SI-1006)

This safety issue covers 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.).

Inadequate handling of dangerous goods 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.

Incorrect operation of air bridges/passenger boarding bridges (SI-1023)

This safety issue covers the operation of air bridges or passenger boarding bridges (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 follows effective user training and the correct use of effective procedures and processes.

Incorrect operation of ground support equipment (SI-1024)

This safety issue covers the operation of both motorised and non-motorised ground support equipment (GSE) on the aerodrome movement area, which, if done incorrectly, may lead to collisions between aircraft and GSE or injuries to personnel or passengers.

This safety issue also includes the inadequate positioning or securing of GSE such as baggage trolleys/dollies, unit load devices (ULDs), steps, etc. when they are not in use. If done incorrectly, GSE 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.

Ineffective 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.

Ineffective control of bird and wildlife (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, aerodrome 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.

Ineffective control of passengers on the apron (SI-1009)

This safety issue covers the ineffective or 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.

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.

Poor coordination and control of turnarounds (SI-1010)

This safety issue addresses the poor or 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).

Poor maintenance and serviceability of apron/stand (SI-1031)

This safety issue covers the serviceability and maintenance of aprons/stands which, if not performed correctly, may lead to collisions, damage, and/or injuries, including FOD being ingested in aircraft engines or ejected by engines jet blast.

In a well-functioning operational environment, the serviceability and maintenance of aprons/stands are performed effectively and thus facilitate safe operations at aprons/stands.

Poor maintenance and serviceability of ground support equipment (SI-1033)

This safety issue covers the serviceability and maintenance of both motorised and non-motorised airport GSE including belt loaders, baggage trucks, catering trucks, fuel bowsers and pushback equipment, steps, baggage trollies/dollies, ULDs, which, if not performed correctly, may lead to damage and/or injuries. In a well-functioning operational environment, the serviceability and maintenance of airport GSE are performed effectively and thus facilitate safe operations of airport GSE.

Poor maintenance and serviceability of runways/taxiways (SI-1032)

This safety issue covers the serviceability and maintenance of runways/taxiways which, if not performed correctly, may lead to collisions, damage, and/or injuries, including FOD being ingested in aircraft engines or ejected by engines jet blast. In a well-functioning operational environment, the serviceability and maintenance of runways/taxiways are performed effectively and thus facilitate safe operations on runways and taxiways.

Poor management of 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.

Poor or inadequate 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.

Poor or inadequate design of ground support equipment (SI-1013)

This safety issue covers the design of both motorised and non-motorised airport GSE, including belt loaders, baggage trucks, catering trucks, fuel bowsers, pushback equipment, 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 GSE will prohibit occurrences where damage and/or injuries are sustained due to improper design of the GSE.

Poor or inadequate 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.

Poor safety reporting culture of organisation (SI-1038)

This safety issue relates to lack of (or still limited) safety reporting culture in organisations of the aerodrome and ground handling sector. The safety issue addresses in particular the following aspects associated with poor reporting culture:

- some safety events go unreported due to fear of repercussions, lack of awareness of and training on occurrence reporting and just culture;
- safety occurrences reported to authorities (according to Regulation (EU) No 376/2014) and/or organisations are not always shared between the organisations involved in the occurrence. For example, a report submitted by an airline or an aerodrome operator 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.

In a well-functioning organisational environment, the reporting culture and just culture within the organisation facilitates the systematic and accurate reporting of safety events by ground staff to ensure that a safety assessment is carried out.

Pushback operations incorrectly performed (SI-1028)

This safety issue covers the management, handling and coordination of the pushback, which, 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.

Towing operations incorrectly performed (SI-1002)

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. It includes both towing performed with nose gear elevation (towbar-less, no person in cockpit), as well as towing with towbar (person in cockpit). In this safety issue, towing operation out of a parking position (pushback) is not included — this is addressed in SI-1028.

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.

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Portfolio	SI nature	SI ID	Safety issue title	Key risk area
ADR and GH	Hazard in a context	SI-1001	Ground conflict during aircraft taxiing operations	Ground damage
ADR and GH	Hazard in a context	SI-1002	Towing operations incorrectly performed	Ground damage
ADR and GH	Hazard in a context	SI-1004	Baggage and cargo loading in passenger aircraft	Aircraft upset
ADR and GH	Hazard in a context	SI-1005	Ineffective control of bird and wildlife	Aircraft upset
ADR and GH	Hazard in a context	SI-1006	Inadequate cargo loading in cargo aircraft	Aircraft upset
ADR and GH	Hazard in a context	SI-1009	Ineffective control of passengers on the apron	Other injuries
ADR and GH	Hazard in a context	SI-1010	Poor coordination and control of turnarounds	Aircraft upset
ADR and GH	Hazard in a context	SI-1011	Inadequate handling of dangerous goods and lithium batteries	Fire, smoke and pressurisation
ADR and GH	Hazard in a context	SI-1015	Poor management of emergency/abnormal operations	Ground damage
ADR and GH	Hazard in a context	SI-1017	Fueling operations incorrectly performed	Fire, smoke and pressurisation
ADR and GH	Hazard in a context	SI-1018	Ground operations in low-visibility conditions	Collision on Runway
ADR and GH	Hazard in a context	SI-1019	Ground staff movement around aircraft	Other injuries
ADR and GH	Hazard in a context	SI-1021	Jet blast	Ground damage
ADR and GH	Hazard in a context	SI-1023	Incorrect operation of air bridges/passenger boarding bridges	Ground damage
ADR and GH	Hazard in a context	SI-1024	Incorrect operation of ground support equipment	Ground damage
ADR and GH	Hazard in a context	SI-1026	Improper parking and positioning of aircraft	Ground damage

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
ADR and GH	Hazard in a context	SI-1028	Pushback operations incorrectly performed	Ground damage
ADR and GH	Hazard in a context	SI-1042	Ground operations in high winds, rain and thunderstorms (CC)	Ground damage
ADR and GH	Hazard in a context	SI-1043	Ground operations in snow/ice conditions (CC)	Excursion
ADR and GH	Hazard in a context	SI-1044	Ground operations in extreme temperatures (CC)	Ground damage
ADR and GH	Contributing issue	SI-1003	Poor or inadequate apron/stand design and layout	Ground damage
ADR and GH	Contributing issue	SI-1008	Ineffective control of airside works	Ground damage
ADR and GH	Contributing issue	SI-1013	Poor or inadequate design of ground support equipment	Ground damage
ADR and GH	Contributing issue	SI-1022	Errors in load sheets and other documentation/systems	Aircraft upset
ADR and GH	Contributing issue	SI-1029	Poor or inadequate runway/taxiway design and layout	Collision on runway
ADR and GH	Contributing issue	SI-1031	Poor maintenance and serviceability of apron/stand	Ground damage
ADR and GH	Contributing issue	SI-1032	Poor maintenance and serviceability of runways/taxiways	Excursion
ADR and GH	Contributing issue	SI-1033	Poor maintenance and serviceability of ground support equipment	Ground damage
ADR and GH	Contributing issue	SI-1038	Poor safety reporting culture of organisation	Other injuries
ADR and GH	Contributing issue	SI-1039	Worker fatigue leading to human errors	Aircraft upset
ADR and GH	Contributing issue	SI-5031	Ground handling training programmes disruption	Aircraft upset
Airworthiness	Systemic issue	SI-9001	Inadequate management of repetitive defects	Aircraft upset
Airworthiness	Systemic issue	SI-9002	Insufficient consideration of flight crew human factors in functional hazard assessments	Aircraft upset
Airworthiness	Systemic issue	SI-9003	Insufficient consideration of flight crew human factors in the continued airworthiness process of the type design	Aircraft upset

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
Airworthiness	Systemic issue	SI-9004	Limited application and inadequate oversight of development assurance	Aircraft upset
Airworthiness	Systemic issue	SI-9005	Outdated certification bases established for major changes to type certificates	Aircraft upset
Airworthiness	Systemic issue	SI-9006	Shortcomings in design and maintenance instructions resulting in maintenance errors	Aircraft upset
Airworthiness	Hazard in a context	SI-9007	Helicopter rotor and transmission system failures	Aircraft upset
Airworthiness	Hazard in a context	SI-9008	Use of airstair for passenger embarking/disembarking on large transport aeroplanes	Other injuries
Airworthiness	Hazard in a context	SI-9009	Hazardous conditions following helicopter ditching	Other injuries
Airworthiness	Hazard in a context	SI-9012	Oxygen-fed fire in the flight deck	Fire, smoke and pressurisation
Airworthiness	Contributing issue	SI-9010	ADELTs, ELTs and PLBs malfunctions	Other injuries
ATM/ANS	Systemic issue	SI-2022	Lack of understanding and monitoring of system performance interdependencies	Airborne collision
ATM/ANS	Systemic issue	SI-2026	Lack of effectiveness of safety management systems	Airborne collision
ATM/ANS	Hazard in a context	SI-2001	ACAS RA not followed	Airborne collision
ATM/ANS	Hazard in a context	SI-2004	Level bust	Airborne collision
ATM/ANS	Hazard in a context	SI-2006	Inappropriate clearance due to undetected occupied runway	Collision on runway
ATM/ANS	Hazard in a context	SI-2007	Landing/take off/crossing without a clearance	Collision on runway
ATM/ANS	Hazard in a context	SI-2014	Airborne conflict with an unmanned aircraft system (UAS)	Airborne collision
ATM/ANS	Hazard in a context	SI-2015	Safety issues raising from new technologies and automation	Airborne collision
ATM/ANS	Hazard in a context	SI-2025	Airspace infringement	Airborne collision

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
ATM/ANS	Contributing issue	SI-2002	Deconfliction with aircraft operating with a malfunctioning or non-operative transponder	Airborne collision
ATM/ANS	Contributing issue	SI-2003	Inefficient conflict detection with the closest aircraft	Airborne collision
ATM/ANS	Contributing issue	SI-2008	Insufficient weather information available to ATC (turbulence/ windshear/convective weather)	Aircraft upset
ATM/ANS	Contributing issue	SI-2009	Unreliable provision of weather information (wind on ground)	Aircraft upset
ATM/ANS	Contributing issue	SI-2016	Failure of navigation services (CC effect)	Airborne collision
ATM/ANS	Contributing issue	SI-2017	Failure of surveillance services (CC effect)	Airborne collision
ATM/ANS	Contributing issue	SI-2018	Failure of air-ground communication service (CC effect)	Airborne collision
ATM/ANS	Contributing issue	SI-2019	Airborne sector overload (CC effect)	Airborne collision
ATM/ANS	Contributing issue	SI-2027	Inadequate ATCO-pilot operational radio communication	Airborne collision
ATM/ANS	Contributing issue	SI-2028	Inadequate procedure design and obstacle publication	Terrain collision
ATM/ANS	Contributing issue	SI-2029	Use of more than one language on frequency	Collision on runway
ATM/ANS	Contributing issue	SI-2032	Mass diversions (CC effect)	Airborne collision
ATM/ANS	Contributing issue	SI-5017C	Cyber security in ATC	Airborne collision
Balloons	Systemic issue	SI-6002	Presence and use of pilot restraints	Aircraft upset
Balloons	Systemic issue	SI-6003	Pressure to fly (CC effect)	Obstacle collision in flight
Balloons	Hazard in a context	SI-6001	Powerline collisions	Obstacle collision in flight
Balloons	Hazard in a context	SI-6006	Inadequate ground obstacle clearance	Obstacle collision in flight
Balloons	Hazard in a context	SI-6012	Use of non-certified parts in critical balloon structure/equipment (system reliability)	Aircraft upset

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
Balloons	Contributing issue	SI-6008	Pre-flight planning and preparation (CC effect)	Obstacle collision in flight
Balloons	Contributing issue	SI-6014	Ageing structures	Fire, smoke and pressurisation
CAT A	Systemic issue	SI-0041	Effectiveness of safety management	Aircraft upset
CAT A	Systemic issue	SI-0044	Volume and quality of the information in NOTAMs	Excursion
CAT A	Systemic issue	SI-0046	Laser illumination	Aircraft upset
CAT A	Systemic issue	SI-0051	Encoding of the required navigation performance approaches (RNP APP) in flight management systems (FMS)	Terrain collision
CAT A	Systemic issue	SI-0058	Ambiguity in operational requirements and lack of authority oversight for non-revenue flights	Aircraft upset
CAT A	Hazard in a context	SI-0001	Icing in flight (CC effect)	Aircraft upset
CAT A	Hazard in a context	SI-0002	Icing on ground (CC effect)	Aircraft upset
CAT A	Hazard in a context	SI-0003	Adverse convective weather (turbulence, hail, lightning, ice) (CC effect)	Aircraft upset
CAT A	Hazard in a context	SI-0003A	Hail (CC effect)	Aircraft upset
CAT A	Hazard in a context	SI-0006	Runway surface condition (CC effect)	Excursion
CAT A	Hazard in a context	SI-0007	Approach path management	Excursion
CAT A	Hazard in a context	SI-0010	Inappropriate flight control inputs	Aircraft upset
CAT A	Hazard in a context	SI-0011	Fuel Contamination and quality	Aircraft upset
CAT A	Hazard in a context	SI-0012	Wake vortex encounter	Aircraft upset
CAT A	Hazard in a context	SI-0014	Alignment with wrong runway	Excursion
CAT A	Hazard in a context	SI-0015	Entry of aircraft performance data (CC effect)	Aircraft upset

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
CAT A	Hazard in a context	SI-0017	Gap between certified take-off performance and take-off performance achieved in operations (CC effect)	Excursion
CAT A	Hazard in a context	SI-0018	Clear air turbulence and mountain waves (CC effect)	Aircraft upset
CAT A	Hazard in a context	SI-0019	Handling and execution of go-arounds	Aircraft upset
CAT A	Hazard in a context	SI-0024	Wind shear (CC effect)	Aircraft upset
CAT A	Hazard in a context	SI-0025	Inadequate fuel management	Aircraft upset
CAT A	Hazard in a context	SI-0027	Carriage and transport of lithium batteries	Fire, smoke and pressurisation
CAT A	Hazard in a context	SI-0028	Excessive speed in the manoeuvring area	Other injuries
CAT A	Hazard in a context	SI-0034	Impact of GNSS interferences on civil aviation operations	Airborne collision
CAT A	Hazard in a context	SI-0035	False or disrupted instrument landing system (ILS) signal capture	Terrain collision
CAT A	Hazard in a context	SI-0037	Mishandling of non-precision approaches	Excursion
CAT A	Hazard in a context	SI-0042	Emergency evacuation	Other injuries
CAT A	Hazard in a context	SI-0045	Bird/wildlife strikes	Aircraft upset
CAT A	Hazard in a context	SI-0047	Disruptive passengers	Other injuries
CAT A	Hazard in a context	SI-0048	Explosive door openings on parked aeroplanes	Other injuries
CAT A	Hazard in a context	SI-0053	Congestion/interference of the electromagnetic spectrum (5G)	Terrain collision
CAT A	Contributing issue	SI-0009	Ineffective crew resource management (CRM)	Aircraft upset
CAT A	Contributing issue	SI-0039	Fatigue (FTL)	Aircraft upset
CAT A	Contributing issue	SI-0049	Flight crew incapacitation	Aircraft upset

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
CAT A	Contributing issue	SI-0052	Safety education of air passengers	Fire, smoke and pressurisation
CAT A	Contributing issue	SI-0054	Poor language proficiency causing communication breakdown	Airborne collision
CAT A	Contributing issue	SI-0059	Controller-pilot data link (CPDLC) miscommunication	Airborne collision
CAT A	Contributing issue	SI-5017A	Airline systems' vulnerability leading to disruptions due to cyberattacks	Security
HF/HP	Systemic issue	SI-3001	Senior management lacking competence and/or commitment to HF/HP principles	Airborne collision
HF/HP	Systemic issue	SI-3002	Lack of evaluation of adverse impact of culture on human performance	Airborne collision
HF/HP	Systemic issue	SI-3004	Integration of HF/HP principles into the organisation's management system	Airborne collision
HF/HP	Systemic issue	SI-3008	Knowledge development and sharing	Airborne collision
HF/HP	Systemic issue	SI-3009	Degradation of resilient performance of an organisation and/or individual	Other injuries
HF/HP	Systemic issue	SI-3012	Lack of industry-wide staff support programmes	Other (e.g. medical, etc.)
HF/HP	Systemic issue	SI-3014	Inadequate HF activities/HF specialist involvement and the effect on safety, efficiency, effectiveness, and project timeline	Other injuries
HF/HP	Contributing issue	SI-3003	Human factors competence for regulatory staff	Other injuries
HF/HP	Contributing issue	SI-3005	Fatigue and quality sleep	Airborne collision
HF/HP	Contributing issue	SI-3006	Heavy workload and misaligned tasks	Airborne collision
HF/HP	Contributing issue	SI-3007	Design and use of procedures	Airborne collision
HF/HP	Contributing issue	SI-3010	Impact of startle and surprise on flight crew management of safety-critical situations	Other injuries
HF/HP	Contributing issue	SI-3011	Training effectiveness and competence	Airborne collision

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
HF/HP	Contributing issue	SI-3015	Impact of degraded levels of attention or vigilance on human performance	Airborne collision
HF/HP	Contributing issue	SI-3016	Critical gaps in risk driven decision making in complex systems	Airborne collision
HF/HP	Contributing issue	SI-3018	Limitations to root cause analysis	Other injuries
HF/HP	Contributing issue	SI-3022	HF in multiple remote tower operations	Other injuries
HF/HP	Contributing issue	SI-3024	State of well-being and fit for duties	Airborne collision
NCO A	Hazard in a context	SI-4001	Handling of technical failures	Aircraft upset
NCO A	Hazard in a context	SI-4005	Approach path management on GA aeroplanes	Aircraft upset
NCO A	Hazard in a context	SI-4008	Inadvertent flight into IMC/scud running (CC effect)	Aircraft upset
NCO A	Hazard in a context	SI-4010	Airborne separation	Airborne collision
NCO A	Hazard in a context	SI-4013	Bird and wildlife strikes at smaller aerodromes/airfields	Aircraft upset
NCO A	Hazard in a context	SI-4014	Mass and balance	Aircraft upset
NCO A	Hazard in a context	SI-4019	Damage tolerance to UAS collisions	Airborne collision
NCO A	Hazard in a context	SI-4022 (SI-0001)	Icing in flight (CC effect)	Aircraft upset
NCO A	Hazard in a context	SI-4023	Risks associated with parachuting operations	Aircraft upset
NCO A	Hazard in a context	SI-4029	Inappropriate control input	Aircraft upset
NCO A	Hazard in a context	SI-4030	Carbon monoxide poisoning	Aircraft upset
NCO A	Contributing issue	SI-4003	In-flight decision-making	Aircraft upset
NCO A	Contributing issue	SI-4004	Training, experience and competence of individuals	Aircraft upset

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
NCO A	Contributing issue	SI-4007	Poor pre-flight planning and preparation	Aircraft upset
NCO A	Contributing issue	SI-4011	Fuel management in flight	Aircraft upset
NCO A	Contributing issue	SI-4012	Engine system reliability	Aircraft upset
NCO A	Contributing issue	SI-4015	Crosswind (CC effect)	Excursion
NCO A	Contributing issue	SI-4017	Knowledge of aircraft systems and procedures	Aircraft upset
NCO A	Contributing issue	SI-4021	Operational communication	Airborne collision
NCO A	Contributing issue	SI-4028	Other aircraft system reliability	Aircraft upset
Rotorcraft	Systemic issue	SI-8044	Ineffective safety management systems	Aircraft upset
Rotorcraft	Hazard in a context	SI-8019	Impaired visibility conditions except IMC	Terrain collision
Rotorcraft	Hazard in a context	SI-8021	Adverse weather encounter — effects other than IMC (CC effect)	Aircraft upset
Rotorcraft	Hazard in a context	SI-8024	Unanticipated yaw/loss of tail rotor effectiveness	Aircraft upset
Rotorcraft	Hazard in a context	SI-8026	Inadequate handling of loss of power in flight	Aircraft upset
Rotorcraft	Hazard in a context	SI-8027	Inadequate handling of simulated technical failures and abnormal procedures during a training flight	Aircraft upset
Rotorcraft	Hazard in a context	SI-8028	Inadequate airborne separation under VFR operation	Airborne collision
Rotorcraft	Hazard in a context	SI-8030	Bird and other wildlife hazard	Aircraft upset
Rotorcraft	Hazard in a context	SI-8031	Inadequate obstacle clearance during any flight phase	Terrain collision
Rotorcraft	Hazard in a context	SI-8036	Navigation-related issues	Terrain collision
Rotorcraft	Hazard in a context	SI-8037	Hoist-operations-related issues	Other injuries

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
Rotorcraft	Hazard in a context	SI-8038	External-sling-load-operations-related issues	Aircraft upset
Rotorcraft	Hazard in a context	SI-8040	Dynamic rollover	Excursion
Rotorcraft	Hazard in a context	SI-8041	Downwash adverse effects	Other injuries
Rotorcraft	Hazard in a context	SI-8042	Unruly passengers	Aircraft upset
Rotorcraft	Hazard in a context	SI-8048	On-board carriage of PEDs with lithium batteries	Fire, smoke and pressurisation
Rotorcraft	Hazard in a context	SI-8049	Interference by lasers	Aircraft upset
Rotorcraft	Hazard in a context	SI-8050	Loose object in the helicopter cabin	Terrain collision
Rotorcraft	Hazard in a context	SI-8051	Inadvertent flight into IMC (CC effect)	Terrain collision
Rotorcraft	Contributing issue	SI-8011	Lack of knowledge of aircraft systems and application of procedures	Aircraft upset
Rotorcraft	Contributing issue	SI-8012	Incorrect application of operational rules and procedures	Aircraft upset
Rotorcraft	Contributing issue	SI-8013	Ineffective application of crew resource management and multicrew cooperation	Aircraft upset
Rotorcraft	Contributing issue	SI-8014	Incorrect in-flight decision-making	Aircraft upset
Rotorcraft	Contributing issue	SI-8015	Inadequate training and competence transfer — initial and recurrent training	Aircraft upset
Rotorcraft	Contributing issue	SI-8016	Pilot fatigue	Aircraft upset
Rotorcraft	Contributing issue	SI-8017	Poor pre-flight planning and preparation	Aircraft upset
Rotorcraft	Contributing issue	SI-8022	Inadequate flight path management with the use of automation	Aircraft upset
Rotorcraft	Contributing issue	SI-8025	Vortex ring state	Aircraft upset
Rotorcraft	Contributing issue	SI-8034	Poor operational management at take-off and landing sites	Other injuries

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
Rotorcraft	Contributing issue	SI-8045	Insufficient safety culture of organisation	Aircraft upset
Rotorcraft	Contributing issue	SI-8046	Deficiencies and inconsistencies in operating manuals	Aircraft upset
Sailplanes	Hazard in a context	SI-7001	Pilot incapacitation	Aircraft upset
Sailplanes	Hazard in a context	SI-7002	Winch launch failures	Aircraft upset
Sailplanes	Hazard in a context	SI-7005	Airborne separation	Airborne collision
Sailplanes	Hazard in a context	SI-7006	Approach path management on sailplanes	Aircraft upset
Sailplanes	Hazard in a context	SI-7007	Aerotow	Aircraft upset
Sailplanes	Hazard in a context	SI-7011	Off-field landings	Obstacle collision in flight
Sailplanes	Hazard in a context	SI-7012	Under/overshoot	Obstacle collision in flight
Sailplanes	Hazard in a context	SI-7013	High wind encounter (CC effect)	Excursion
Sailplanes	Hazard in a context	SI-7016	Inappropriate flight control inputs	Aircraft upset
Sailplanes	Hazard in a context	SI-7017	Incorrect glider assembly before flight	Aircraft upset
Sailplanes	Contributing issue	SI-7004	In-flight decision-making	Aircraft upset
Sailplanes	Contributing issue	SI-7008	Training, experience, and competence of individuals	Aircraft upset
Systemic and conjunctural	Systemic issue	SI-5001	Reduced oversight by competent authorities	Aircraft upset
Systemic and conjunctural	Systemic issue	SI-5018	Shortage of operational and technical staff	Airborne collision
Systemic and conjunctural	Systemic issue	SI-5019	Reduced available financial resources	Aircraft upset
Systemic and conjunctural	Systemic issue	SI-5506	Flight route congestion (hotspots)	Airborne collision

Portfolio	SI nature	SI ID	Safety issue title	Key risk area
Systemic and conjunctural	Hazard in a context	SI-5101	Aircraft collision with space debris	Aircraft upset
Systemic and conjunctural	Hazard in a context	SI-5508	Non-standard and unplanned military activities outside the conflict zones	Airborne collision
Systemic and conjunctural	Hazard in a context	SI-5514	Separation with unidentified aircraft	Security
Systemic and conjunctural	Hazard in a context	SI-5515	Airspace infringements by military UAS, aircraft, missiles, or debris spilling over from conflict zones	Security
Systemic and conjunctural	Hazard in a context	SI-5530	Errors of civil aircraft identification by ground military forces and airborne assets outside the conflict zone	Security
Systemic and conjunctural	Contributing issue	SI-5002	Aviation personnel fatigue	Aircraft upset
Systemic and conjunctural	Contributing issue	SI-5017	Cyberattacks	Airborne collision
Systemic and conjunctural	Contributing issue	SI-5017B	Aircraft vulnerability leading to flight safety degradation due to cyberattacks	Security
Systemic and conjunctural	Contributing issue	SI-5020	Missing suppliers and low availability of parts	Aircraft upset
Systemic and conjunctural	Contributing issue	SI-5032	Short time available for training affecting training effectiveness	Aircraft upset
Systemic and conjunctural	Contributing issue	SI-5033	Knowledge transfer missed for new generation aviation personnel	Aircraft upset
Systemic and conjunctural	Contributing issue	SI-5034	Unrealistic staff resource planning causing flight delays or cancellations	Aircraft upset
Systemic and conjunctural	Contributing issue	SI-5102	Space weather effects on aviation	Aircraft upset
Systemic and conjunctural	Contributing issue	SI-5501A	GNSS signal manipulation leading to navigation or surveillance degradation	Terrain collision
Systemic and conjunctural	Contributing issue	SI-5504	Spare parts shortages (other than aircraft)	Airborne collision
Systemic and conjunctural	Contributing issue	SI-5532	Non-standard operational air traffic routings, reservation of military areas outside conflict zone	Airborne collision
Systemic and conjunctural	Contributing issue	SI-5533	Transition of a civilian airport to mixed civil-military operations	Airborne collision

EASA
European Union Aviation Safety Agency

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