Note on bundling the Safety Issues related to fatigue:
SI-3005 addresses fatigue across all aviation personnel other than flight and cabin crew. By contrast, SI-0039 focuses exclusively on flight and cabin crew within the FTL/FRM regulatory framework. The two SIs are complementary and intentionally form a total system approach: SI-0039 concentrates on aircrew specific rules and oversight, while SI-3005 targets cross domain culture, technology, scientific evidence and implementation support for non-crew roles. To avoid duplication of activities, this BIS report includes one action on the quality improvement of safety data related to non-aircrew staff.

Executive Summary

1. Why intervene?

This document updates the previous version of the Best Intervention Strategy (BIS) for Aircrew Fatigue (version year 2019). The BIS assumes that the responsibility to manage fatigue risks is shared principally between operators and crew members but also national competent authorities. This is an aspect that has shaped all regulatory interventions, and a crucial point mentioned during all safety promotion tasks.

The safety analysis (Appended to BIS) studied data collected in the European Central Repository of occurrences from 2019 to 2023. While there have been **no aircrew fatigue related occurrences confirmed to be a serious incident or accident in CAT** scheduled and charter **aeroplane operations** in this period, there was a **significant increase** for both absolute numbers and rates of **reported fatigue related occurrences observed in 2023**. The rate of reported fatigue related occurrences in 2023 is 21 per one million flights.

However, the analysis of the content of fatigue reports does not allow us to draw clear qualitative or quantitative conclusions.

2. Proposed actions in the Best Intervention Strategy "Aircrew Fatigue"

This Bis analyses a combination of new actions and actions from the previous BIS that are still relevant.

When performing the analysis, EASA relied primarily on information from its standardisation and oversight activities. However, it is recognised that a more accurate picture of the issues related to fatigue and FTL/FRM would only be possible when considering implementation and oversight information that is currently available only to the NCAs and operators.

The actions proposed in this BIS should be also addressed and coordinated through the Advisory Bodies (namely the Air Ops TeB and FTL/FRM Expert Groups).

The principles enshrined in the strategy can be summarised as follows –

- Ensure that FTL regulations and their effectiveness continues to be evaluated
- Shared responsibility concept is re-enforced by all stakeholders
- Strengthen the standardisation activities related to FTL/FRM oversight
- Strengthen effectiveness of FTL/FRM oversight by the NCAs
- Promote and improve quality level of fatigue reporting, including occurrences

The actions have remained fairly stable since the last version of the BIS (2019), however the expected deliverables of some of the actions have been updated to reflect new realities of the industry.

Best Intervention Strategy BIS15 "Aircrew Fatigue (SI-0039)"

#	Action title	Action type	Benefit*	EASA resources	2025	2026	2027	2028
1	Event dedicated to FTL/FRM.	SPT.0116	Medium	Mission budget: 1mission x 1000 euro x 5 experts = 5 000 euros	Conference - Q1	Conference – Q1		Conference - TBD
2	RMT.0492 Development of FTL rules for CAT operations of emergency medical services by aeroplanes (AEMS) RMT.0493 Update and harmonisation of the FTL rules for CAT by aeroplanes for air taxi And single-pilot operations.	RMT. 0492 RMT.0493	High	2025-2027: 0,1 FTE/year	1. Opinion	2. EDD	1. Workshop with AB	
3	Further actions following study of the effectiveness of FTL - Phase 2 of the research.	New Others	Medium	EASA 0.2 FTE/year	TBD			
4	EASA Standardisation - focus on FTL/FRM during OPS standardisation inspections.	STD	Medium	Refer to STD budgets.		Ongoing		
5	Provide better guidance on issues related to fatigue reporting	NEW SPT	Medium	2026-2028: 0.1 FTE/year				Safety Promotion / Guidance Documents
6	ECCAIRS Taxonomy Update	NEW Others	Medium	2026-2027: 0.2 FTE/year [More resources to be considered for the full review by the NoA, not limited to EASA resources]		Review by Network of Aviation Safety Analysts (NoA) and FTL/FRM expert groups	Update of Taxonomy [provisional timeline – subject to overall taxonomy updating process]	
7	Data collection and analysis related to handling of fatigue reports, and results of FTL/FRM oversight.	New MST	Medium	2028: 0.2 FTE				Survey to MS

Apart these aircrew actions, and as introduced in the top grey box above the Executive Summary, the annex B "SIA SI-3005 Fatigue in non-aircrew personnel" recommended to work on taxonomy refinements (linked to action 6 above) and clearer guidance for those coding fatigue occurrences for non-aircrew personnel. It is proposed to use the current Member States Tasks for these purposes:

- MST.0002 Promotion of SMS
- MST.0043 Improvement of data quality in occurrence reporting

BIS Report – Table of content

1 Issue analysis

1.1 General description

Addressing aircrew fatigue is crucial for ensuring the safety and well-being of flight personnel. Effective intervention strategies for managing aircrew fatigue involve a combination of regulatory, operational, organisational, and individual approaches.

Economic, social and regulatory factors all have a contributing role to the issue of aircrew fatigue. Aircrew fatigue may be a controversial subject due to the inherent challenges in balancing safety requirements with operational efficiency, the subjective nature of fatigue, social and economic considerations, and resistance to change within the industry. Finding common ground and implementing effective fatigue management strategies require ongoing collaboration and a nuanced understanding of the multifaceted nature of the issue.

The Safety Issue Assessment in Appendix A has been used for the issue analysis. This analysis of fatigue data was performed to identify safety risks to update the previous BIS version 2019. It is important that all stakeholders understand their responsibilities and consequences of reporting, including quality of reports which would directly impact an effective fatigue risk analysis.

1.1.1 Flight Time Limitations (FTL) regulations and their effectiveness

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 based on 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.

Prescriptive limitations have been designed to discipline operators’ crew scheduling practices, but they often become ineffective on the day of operation. In day-to-day operations, where roster changes, long delays, maintenance problems, commercial pressure and circadian disruption are frequent occurrences, the effectiveness of prescriptive limits is in fact undermined. The risks arising from crew members’ fatigue in real operations can only be mitigated when the prescriptive FTL are being supported by an effective fatigue risk management process.

Two approaches are today referred to as best industry practices that may complement prescriptive FTL: an appropriate fatigue risk management (appropriate FRM) within the operator’s safety management system (SMS) and a robust fatigue risk management system (FRMS). Action#3 relates to this issue.

1.1.2 Shared Responsibility

The prevention of fatigue is one of the key responsibilities of an operator’s executive management (e.g. Accountable Managers and nominated persons), its crew rostering and crew dispatch personnel, and, last but not least, the crew members themselves.

National competent authorities are also directly involved, as they are responsible for the approval and oversight of operator’s FTL schemes and management systems where fatigue risk management could be a key component.

Therefore, the concept of shared responsibility underpins this BIS and will be re-enforced. Actions #1, 3 and 4 relate to this issue.

1.1.3 Standardisation activities and oversight effectiveness

FTL/FRM topics are still part of the OPS standardisation visits in Member States. Around 20% of the total undertaking non-compliances (UNC) raised during standardisation visits in 2022 and 2023 are related to FTL/FRM topics. This shows that more action is needed to ensure a uniform implementation of the rules and to ensure that the competent authorities discharge their oversight obligations effectively.

The main non-compliances identified through standardisation are:

- Lack of operational robustness (ORO.FTL.110) of operators' rosters;
- Fatigue risk management is not effectively implemented;
- Individual Flight time specification schemes (IFTSS) are not customised by the operator;
- Procedures for assignment of an FDP following standby preventing a more than 18 hours awake time are not correctly set up or implemented;
- Times related to pre-flight and post-flight duties do not reflect the type of operation;
- NCAs' procedures for approval of IFTSS do not ensure that operators' IFTSS are customised for the operation.

This shows that competent authority's oversight and uniform implementation of the FTL/FRM rules, together with an assessment of the inspector's competence, still requires attention and efforts. Action#4 is linked to this issue.

1.1.4 Results of the Safety Analysis

1.1.4.1 Fatigue Reporting[1]

Fatigue may be difficult to predict or diagnose. In some cases, there could be wrong subjective self-assessment, most likely due to insufficient experience or inadequate training. Any management system, however, cannot be effective without sufficient objective and subjective data. This also applies to fatigue risk management. Aircrew fatigue reports are a substantial part of the subjective data gathering that feeds the operator's fatigue risk management processes.

There are also other objective and subjective reasons why fatigue remains not adequately captured or unreported, such as poor safety culture in the operator's organisation, fear of dismissal or demotion, etc.

[1] Fatigue is a reportable occurrence under Regulation (EU) 2015/1018.

1.1.4.2 Commander's Discretion

The safety analysis looked at occurrence reports with a particular focus on issues typically linked to fatigue. One of the most common issues reported by operators, crew representatives and national competent authorities is Commander's Discretion (CMD). The Agency also receives a considerable amount of Confidential Safety Reports (CSRs) linked to this provision. As shown in the safety analysis (4.3.1), the use of commander's discretion has increased in recent years. There is a need for competent authorities to review and operators to be aware of the adequate use of 'commander's discretion' – so it is not already foreseen in the roster planning and scheduling but is really used for unforeseen circumstances.

1.1.4.3 States reporting occurrences

Around 50% of all occurrences are stemming from operators of 4 states. This could imply that reporting culture as well as practices to integrate fatigue related occurrences within the ECR are widely differing among the EASA member states (some states are integrating all fatigue related occurrences, some partially, some not at all). The majority of all fatigue related occurrences in the analysis involved Spanish operators (26%) and Sweden (13%) followed by Belgium, Germany, and Switzerland that would cover more than half of all occurrences.

1.1.4.4 Other Areas

The safety analysis, included a review of occurrences through keywords which could be associated with crew fatigue related to:

- acclimatisation,
- duty time extension,
- standby duty,
- long night duty,
- reduced rest period,
- rest time less than required,
- duty time,
- Awake time, or
- controlled rest.

1.1.4.5 Limitations of the analysis

The analysis of the fatigue reports in the European Central Repository (ECR) shows that there is no homogenous approach for integration of the fatigue related occurrences in the repository by all competent authorities. Some Member States integrate all occurrences, some integrate parts, some do not integrate at all.

Also, the information available in the occurrence records is lacking the required level of detail to allow an understanding of the outcomes of the investigation and analysis of those occurrences, which does not allow to validate whether present FTL and FRM provisions are sufficient to address this contributing safety issue.

Follow-up information is also not always available in the records. As indicated in the Safety Analysis, out of the 100% of occurrences analysed (311 events), due to data quality issues, the analysis is limited to 49% of the occurrences, while 39% are in an unclear state (unable to derive conclusions), which however could be related to fatigue issues.

All this limits the possibility to derive final conclusions on this topic and requires additional sources of information to be reviewed, such as outcomes of oversight activities in the area of FTL/FRM.

Actions # 5,6 and 7 are linked with these issues.

1.2 Who is affected?

The actions proposed by this BIS will affect European operators and their flight and cabin crew members. The proposed actions will also affect activities and resources of MS's competent authorities and EASA.

1.3 Past and existing actions

1.3.1 Past Actions

Flexibility provisions and support material

To support the implementation of FTL requirements, EASA held multiple FTL workshops throughout the FTL rollout phase and provided on-site support to a number of MS. A webinar on fatigue risk management in Cargo and On-Demand operations was held on 15 March 2021. This interactive online workshop provided examples on implementation of FRM in cargo and on-demand operations. An exchange on the technological support of FRM was also provided. Other workshops on FRM for fixed wing operators were held in January 2024 in Vienna and in February 2025 in Madrid. These were co-hosted with AustroControl and AESA respectively, with participation of competent authorities, industry and social partners.

EASA also undertook initiatives aimed at providing implementation support to competent authorities in need and is available for further assistance. EASA developed FTL/FRM Inspector's checklists[2], which were first published in 2019, complemented in December 2022, and updated in 2024. A collection of good practices in the implementation of FTL requirements was made available to competent authorities in Q1 2025. This has completed remaining actions under SPT.0118.

[2] https://www.easa.europa.eu/en/domains/air-operations/air-operations-general

In addition, EASA partnered with FTL/FRM experts from MS and industry to solve ad hoc implementation issues and respond to everyday queries from interested individuals or organisations. As a result of this partnership, EASA has updated its FAQs[3] and updated the tools for evaluation of operator's IFTSS.

Ad-hoc support measures were provided to all MS during the Covid-19 pandemic breakdown. After assessing the initial impact of the outbreak on all types of operations, and consulting the Advisory Bodies, EASA published guidelines to support FTL-related flexibility provisions under Article 71(1) of the BR.

The Guidelines were intended to help operators identify mitigation measures while performing risk assessments, and support MS in granting exemptions in the context of the pandemic. These flexibility provisions were essential to allow continuity of operations during challenging periods where crew members were not allowed to make use of proper rest facilities. A total of 184 exemptions issued by MS under Article 71(1) of the BR were notified to EASA.

Regulatory Tasks

During the adoption of EU Flight Time Limitation (FTL) requirements for scheduled and charter airline operations, the European Parliament and the Commission instructed EASA to perform a continuous review of the effectiveness of those requirements. The mandate included an assessment of the impact on aircrew alertness of the following Flight Duty Periods (FDPs):

1. Duties of more than 13 hours at the most favourable time of the day;
2. Duties of more than 10 hours at the least favourable time of the day;
3. Duties of more than 11 hours for crew members in an unknown state of acclimatisation;
4. Duties including a high level of sectors (more than 6);
5. On-call duties such as standby or reserve followed by flight duties; and
6. Disruptive schedules.

The review process started in 2017 with the commissioning of a scientific study. In view of the large scope of the task, it was decided to split the set of six FDPs into two groups (FTL#1 and FTL#2). The commissioned study started by ranking the six FDPs according to their potential to induce fatigue, identifying 'duties of more than 10 hours at the least favourable time of the day' and 'disruptive schedules' as the most fatiguing FDPs, leaving the remaining four FDPs for evaluation in a future study.

The comprehensive report on the results of the FTL#1 study[4] directly related to the two top-ranking FDPs findings was published by EASA on 18 February 2019. The report points to increased levels of crew fatigue for all night duties as well as for disruptive duties, especially 'late finishes'.
Under RMT.0492, EASA amended the FTL requirements to address the recommendation of the FTL#1 study. An NPA[5] was submitted to focused consultation of the ABs in Q3 2023, and the final amendments were adopted in December 2023.[6]

[3] https://www.easa.europa.eu/faq/19202
[4] https://www.easa.europa.eu/document-library/general-publications/effectiveness-flight-time-limitation-ftl-report
[5] NPA 2023-103.
[6] EASA ED Decision 2023/023/R

In 2021/2022 EASA launched the second phase of the scientific research project (FTL#2), intended to study the effectiveness of the remaining four duties of interest in providing adequate protection from potential consequences of fatigue and, if necessary, make recommendations for improvement. A study of controlled rest in the cockpit was also included; FTL#2 specifically addressed the use of controlled rest and whether it should be promoted as a fatigue mitigation strategy. The results of the study have been published on the EASA website. More details on findings, can be found under action#3 in this document.

In 2023, EASA launched a comparative study to analyse the current national rules legislating FTL for helicopter operations. The study analysed the current rules in 9 EASA MS and 4 non-EASA states. Following this study, a task force was established to produce a concept paper on future shape and concepts for FTL rules for helicopter commercial operations. The concept paper was finalised in 2024; however, RMT.0494 has been put on hold a re-prioritisation of rulemaking activities.

1.3.2 Existing Actions

Table 1 – List of current actions

Action number	Type. Code	Owner	Objective – Intended impacts
RMT	.0492	FS.2	Development of FTL rules for CAT operations of emergency medical services by aeroplanes (AEMS)
RMT	.0493	FS.2	Update and harmonisation of the FTL rules for CAT by aeroplanes for air taxi and single-pilot operations
SPT	.0116	FS.2	Supporting the implementation of appropriate fatigue risk management (appropriate FRM) or a fatigue risk management system (FRMS) by operators and their oversight by competent authorities through the organisation of webinars/workshops/conferences on specific topics to share information and best practices.

1.4 List of proposed actions

Based on the SIA and the status of the existing actions, it is recommended to propose the following new actions.

Table 2 – List of proposed actions

Action type	Owner	Objective – Intended impacts
MST	FS.2	Data collection and analysis related to handling of fatigue reports, and results of FTL/FRM oversight.
SPT	FS.2 / SM.1	Provide better guidance to crew, operators and NCA's on issues related to fatigue reporting.
RM activity	FS.2	Improve the regulatory text surrounding controlled rest in the cockpit.
Others (non-EPAS action)	NoA	Update ECCAIRS taxonomy

1.4.1 Baseline scenario – What would happen if there were no additional actions?

Safety is typically measured by the number of occurrences and fatalities. Even when something goes wrong, accident investigators may find little evidence of fatigue events, except after a deep analysis of flight crew sleep history.

Today the risks arising from crew members fatigue in real operations are being mitigated when the prescriptive FTL is supported by an effective fatigue risk management process. EASA and the Members States' competent authorities are increasingly looking for strategies to support operators under their oversight better manage aircrew fatigue in everyday operations, at organisational and personal level.

However, without new, or updated, safety actions addressing the safety risks identified in section 1, risks resulting from aircrew fatigue will remain.

1.4.2 Objectives

The objectives are to manage and reduce the effects of aircrew fatigue.

A simple objective assessment may conclude that the prevalence of aircrew fatigue will never be eliminated, however the principle of reducing safety risks as low as reasonably practicable should drive these actions.

1.4.3 List of proposed actions

While the specific objectives of the actions are detailed in the subsequent sections, the general objective is to develop the best intervention strategy to address the safety issues on aircrew fatigue with safe and efficient measures. Actions 1-5 are actions that have been updated from previous BIS version 2019, while Actions 5,6 and 7 are newly proposed actions.

Action number #	Action title	Action type	Action status
1	Event dedicated to FTL/FRM.	SPT.0116	Updated existing action
2	RMT.0492 Development of FTL rules for CAT operations of emergency medical services by aeroplanes (AEMS) RMT.0493 Update and harmonisation of the FTL rules for CAT by aeroplanes for air taxi and single-pilot operations.	RMT. 0492 RMT.0493	Updated existing action
3	Further actions following study of the effectiveness of FTL - Phase 2 of the research.	NEW Others	New proposed action
4	EASA Standardisation - focus on FTL/FRM during OPS standardisation inspections.	STD	Updated existing action
5	Provide better guidance on issues related to fatigue reporting	NEW SPT	New proposed action
6	ECCAIRS Taxonomy Update	NEW Others	New proposed action
7	Data collection and analysis related to handling of fatigue reports, and results of FTL/FRM oversight.	New MST	New proposed action

Assessment of the revised and new actions

1.5 ACTION #1. - Events dedicated to FRM (SPT.0116)

1.5.1 What is the action?

Continuing from the success of the conferences held in Vienna in 2024 with the collaboration of Austro Control and in Madrid in 2025 with the collaboration of AESA, more events jointly organised by EASA and a volunteering NAA, will:

- Emphasise to NAAs, stakeholders and aircrew associations that aircrew fatigue is an aviation safety risk that needs to be mitigated to a level as low as reasonably practicable;
- Clarify the need to apply fatigue risk management in addition to prescriptive requirements through the operator's safety risk management (SRM) process by applying appropriate fatigue risk management principles and tools (appropriate FRM) or through a fully-fledged fatigue risk management organisation structure, policy and procedures (aka FRMS);
- Emphasize the importance of fatigue (risk) management training, from two perspectives:
    - aircrew training on their respective responsibilities for compliance with FTL requirements and on individual strategies for proper management of their highly fatiguing duties; and
    - training of operators' management and crew rostering personnel on the implementation of appropriate FRM or FRMS;
- Encourage safety culture, including fatigue reporting culture, and holding of regular surveys among aircrews at MS or operator's level;

- Collect feedback.

1.5.2 What will the action achieve?

This safety promotion task has an expected medium safety benefit. It is aimed at continuing to raise knowledge on fatigue risk management methods and tools and the need of dedicated FRM training, the shared responsibility principle, as well as to encourage fatigue reporting culture. As a result, it is expected that aircrew and operators would better understand and discharge their respective responsibilities and commit to an appropriate FRM or FRMS.

1.5.3 What is the technical content of the action?

The technical content of the actions will be explanatory material in the form of presentations.

1.5.4 Interfaces to be considered

This action requires coordination between EASA and the MS that will volunteer to host an event on their territory. The competent authority of a volunteering State will put in place organisational and logistic measures for the event, while EASA will promote it so that operators and authorities from other States be able to attend.

The hosting MS will be invited to contribute to EASA presentations with their own material or contributions from operators, scientific community and social partners. EASA's experts will coordinate all presentation materials for the event and answer questions from the participants.

1.5.5 How will the action be monitored?

The effectiveness of the SPT will be monitored through surveys or questionnaires during the events.

1.6 ACTION # 2: RMT.0492 Development of FTL rules for CAT operations of emergency medical services by aeroplanes (AEMS) and RMT.0493 FTL rules for CAT by aeroplane for air taxi operations and single-pilot operations taking into account operational experience and recent scientific evidence

1.6.1 What is the action?

RMT.0492 & RMT.0493 already delivered NPA 2017-17[7], and a focused consultation (NPA 2024-106) in 2024. An Opinion is planned for 2025.

Within RMT.0492 a separate subtask was established to specifically address the recommendations from FTL#1 Study on effectiveness of EU FTL. This subtask was completed with the publication of ED Decision 2023/023/R.

[7] https://www.easa.europa.eu/sites/default/files/dfu/NPA%202017-17.pdf

1.6.2 What will the action achieve?

RMT.0492 & RMT.0493 aim to provide a level playing field across EU for on-demand emergency medical services (EMS) operators and air taxi operators of fixed wing aircraft, proposing a harmonised regulatory approach on the basis of state-of-the-art rules. So far, the regulatory framework in this domain has been patchy, consisting of Subpart Q of Annex III to Commission Regulation (EC) No 859/2008 in combination with various national requirements on FDPs, standby, inflight rest and split duty, which filled the gaps in Subpart Q.

1.6.3 What is the technical content of the action?

RMT.0492 & RMT.0493 will produce an Opinion in 2025, which will consider the comments received following the consultations of NPA 2017-17 and NPA 2024-106.

1.6.4 Impact analysis

RMT.0492 & RMT.0493 are supported by an Impact Assessment (IA).

1.6.5 Time implementation

Opinion – 2025; implementation 2027.

1.7 ACTION # 3. Further actions following results of the research study of the effectiveness of FTL - Phase 2 (RES.0006).

1.7.1 What is the action?

In 2021/2022 EASA launched the second phase of the scientific research project on the effectiveness of EU FTL (FTL#2) intended to study four duties of interest in providing adequate protection from potential consequences of fatigue and, if necessary, make recommendations for improvement.

The research specifically examined four types of potentially fatigue-inducing flight duty periods (FDPs):

- Flight duties exceeding 13 hours, starting in the most favourable time of day;
- Duties longer than 11 hours when crew members' acclimatization status is unknown;
- Duty periods that include a high number of flight sectors (more than six);
- On-call duties followed by flight operations, especially those not associated with airport standby.

Additionally, the study examined the use of *controlled rest* during flight duties and the conditions under which flight crew make use of it.

Over 300 flight and cabin crew members across eight airlines provided detailed reports on their levels of alertness, fatigue, and sleep during actual duties, offering valuable insight into the human experience behind the regulations.

1.7.1.1 Findings of the Study

The study highlighted several core findings, which are summarised below:

- There is no objective universal measure of fatigue, but subjective assessment tools, while imperfect, are appropriate for operational field research.
- The current FTL limits are largely effective in managing fatigue risk.
- Duty duration remains the strongest predictor of fatigue, alongside start time, prior sleep quantity, and time awake.
- Limiting either duty duration or number of sectors in isolation is not enough; both must be considered together for fatigue mitigation.

1.7.1.2 Proposals by the research team

- Appropriate FRM should be applied for all flight duty periods (FDPs) lasting 10 hours or more, and for FDPs of 9 hours or more when crew are not acclimatized.
- The existing 18-hour awake time cap should remain, but measures should be taken to ensure crew maximize sleep opportunities before long duties.
- Controlled rest should be used not only in response to unexpected fatigue but also proactively to manage predictable fatigue. A new Acceptable Means of Compliance (AMC) should support this.
- Future studies should address additional topics such as sleep before duty, the effect of combining FDPs, seasonal variations, and standby outside normal daytime hours.

1.7.1.3 Results from study

The results of this second research study, available publicly on the EASA website, have deepened the understanding of fatigue risks in commercial aviation and validated the current regulatory approach.

The study provided a data-driven basis for potential future evolution of the regulatory framework. Future research should examine controlled rest for cabin crew, which was not covered in this study.

While no immediate safety-critical issue has been identified, the insights gained will shape further research needs under Article 9b of Regulation (EU) 965/2012 and guide the next steps in ensuring safe, sustainable aircrew scheduling.

1.7.2 What will the action achieve?

The action will achieve more clarity in terms of controlled cockpit rest as highlighted in the next section.

1.7.3 Description of the activity on controlled rest

In 31% of night flights ≥ 10 hrs pilots used controlled rest in response to unexpected fatigue but also to proactively manage anticipated fatigue. The evolving use of controlled rest was recognized as a positive development, meriting further review and policy development.

EASA is proposing to handle the findings of the research as follows -

A) Further assessment to be done in the FTL/FRM expert group. If necessary further research could be proposed on controlled rest, including expanding the scope to cabin crew which was not covered in previous studies, ***OR;***

B) Development of support /regulatory material for controlled rest which may lead to issuance of best practices, or guidelines for implementation etc. It could also lead to amendment of the current rules, if considered necessary.

1.7.4 Time implementation

Any actions will be taken in line with the established process. After consultation of the above proposal a more accurate timeline will be known.

1.7.5 Implementation cost

Depending on the decision this could take up to 0.2 FTE per year over the course of the next years, with some involvement of the stakeholders in the FTL/FRM Expert Group.

Question for the Advisory Bodies
The Competent Authorities and the aviation industry are invited to comment these proposals and express support or otherwise on both actions.

1.8 ACTION # 4. Standardisation on FTL/FRM

1.8.1 What is the action?

EASA conducts standardisation inspections of the MS competent authorities in the air operations domain. Areas inspected usually include FTL/FRM requirements, i.e. already today EASA standardises FTL/FRM implementation. EASA will continue to include the review of FTL/FRM implementation during the programmed standardisation activities, using a risk-based approach. Standardisation results show a relatively high number of non-compliances related to FTL implementation.

1.8.2 What will the action achieve?

This action is intended to prevent incorrect and ineffective implementation of FTL/FRM requirements through focused standardisation and thus achieve a uniform level of implementation across EU.

1.8.3 What is the technical content of the action?

EASA will carry out standardisation inspections based on established plans. The inspections shall be carried out in accordance with Commission Implementing Regulation (EU) No 628/2013[8], as well as with the approved methodology and tools.

1.8.4 Impact Analysis

The impact of this action does not have any measurable qualitative measures. The results of the standardisation activities are considered for future rulemaking or support activities.

1.8.5 Time implementation

- Ongoing

1.8.6 Implementation cost

- No extra costs are foreseen for the specific action.

1.9 ACTION #5 Provide better guidance to crew, operators and NCA's on issues related to fatigue reporting. (NEW - SPT-TBA)

1.9.1 What is the action?

This action intends to provide guidance to operators and NCA's on the issue of fatigue reporting. This topic has been raised at various FTL/FRM Expert group meetings and the FRM conferences in Vienna and Madrid. This action will build on material used during the Covid-19 pandemic.[9]

1.9.2 What will the action achieve?

This action could provide crew, operators and NCA's better guidance on:

- Minimum information required by crew to ensure a reporting provides a complete context;
- Standardised use of taxonomy to enable a more structured monitoring and analysis of these in the future;
- Risk assessment and processing of fatigue reports by operators;

[9] https://www.easa.europa.eu/community/topics/fatigue-management

- Risk assessment and use of ECRS of fatigue reports by NCA's;
- More homogenous approach to fatigue occurrences in ECCAIRS;

1.9.3 What is the technical content of the action?

The technical content of the action will be either in the form of a Guidance leaflet or other promotional material.

1.9.4 Impact Analysis

This action will increase awareness on the importance of fatigue reporting in a management system. This action will provide more clarity on the follow-up during oversight of the NCA's.

1.9.5 Time Implementation

Q2 – 2028

1.9.6 Implementation cost

EASA 0.1 FTE for 2027/2028.

1.10 ACTION #6 Update the ECCAIRS taxonomy for fatigue reporting – NEW – NOT AN EPAS ACTION

1.10.1 What is the action?

The analysis and monitoring by existing ECCAIRS taxonomy regarding fatigue is limited and does not optimally facilitate this task. Therefore, it is proposed that the existing ECCAIRS taxonomy for event types is amended to better capture fatigue related occurrences and enable a more structured monitoring and analysis of these in the future. Refer to Safety Analysis section 4.5.4 for details. To produce the guidance on the usage of newly proposed and updated taxonomy to facilitate proper implementation (coding).

This action is necessary to complement the EPAS actions. EASA will work with the NoA to develop it.

1.10.2 What will the action achieve?

Better capture of fatigue related occurrences and improved monitoring and analysis.

1.10.3 What is the technical content of the action?

Updated taxonomy in ECCAIRS system.

NOTE – This action may be related to MST.0043 and potentially provide safety promotion inputs to promote good data quality in fatigue occurrence reporting.

1.10.4 Impact Analysis

The updated taxonomy should provide better clarity on assessment of fatigue reports. It should also allow a better fatigue data analysis for the safety review. It will support better analysis by using the large language models as well.

1.10.5 Time implementation

The updated taxonomy is expected by Q4 2027.

1.10.6 Implementation cost

EASA 0.2 FTE for 2026/2027/2028 plus resources provided by NoA members for this action.

1.11 ACTION #7 Data collection and analysis related to fatigue reports and FTL/FRM oversight. (NEW -MST.TBA)

1.11.1 What is the action?

Data collection through surveys with all the Member State NCA's related to aircrew fatigue reports and FTL/FRM oversight.

1.11.2 What will the action achieve?

This action could provide the Agency and all stakeholders with information related to:

- NCA FTL/FRM audits and inspection results;
- FTL/FRM oversight activities;
- The approval/oversight of operator's appropriate FRM and associated challenges;
- The most common non-compliances (operators and NCAs);

- Information related to prevalence of fatigue reporting in the member states;
- Information related to quality and content of fatigue reports.
- Standardise approach to ERCS use on fatigue reports (in collaboration with NoA dedicated working group).

1.11.2.1 Standardised safety performance indicators and metrics on FTL.

The action could also complement the work being performed by the Agency on standardisation of Safety Performance Indicators on operational robustness and metrics retrieved from the operators. Performance indicators for operational robustness of rosters should support the operator in the assessment of the stability of its rostering system, but also help the competent authorities in their oversight. The use of consistent standardised metrics could also help the better trending of indicators.

It is proposed that a common broad framework and methodology of capturing such data could be used at European level.

1.11.3 What is the technical content of the action?

The technical content of the action will be a survey hosted by the Agency platform.

NOTE – This action may be related to MST.0043 and potentially provide safety promotion inputs to promote good data quality in fatigue occurrence reporting.

1.11.4 Impact Analysis

This action is expected to provide quantitative data from NCAs. The survey results could provide an informed decision on future intervention strategy actions.

1.11.5 Time Implementation

Q4 – 2028.

1.11.6 Implementation cost

EASA 0.2 FTE for 2027. MS action is required but this is not quantifiable due to different oversight and data gathering systems.

1.12 Postponed or Discarded actions

These actions that have been included in the previous BIS version have been either postponed or discarded.

Action title	Objective	Reason for postponing / discarding it

Standardisation – Focused on FTL/FRM (Action#4 in previous BIS)	Increase focus of standardisation inspections of the MS.	This action will be embedded in the current action (EASA standardisation). Due to resource constraints no additional FTL/FRM standardisation activities are foreseen to be conducted. FTL/FRM will still be one of the main focus of the standard inspection programme.
Implementation support mechanism dedicated to FTL/FRM (Action#6 in previous BIS)	Provide a support mechanism to NAAs in developing competence of the inspectors in oversight of FTL/FRM.	Action removed as this is part of the strategic priority in EPAS Version 2024 3.1.6.1 where such deficiencies are identified through standardisation. Since the inception of the only one mission has been conducted in 2019 and since then no other NCA has requested such specific support from EASA. This means that SPT.0117 has been partially covered by the publishing of Inspectors Checklists under SPT.0118 and is partially covered by a new SPT under action#6, resulting in the removal of SPT.0117.
Implementation Support (A Workshop) (Action#2 in previous BIS)	Perform a workshop dedicated to NCAs FTL/FRM issues.	This specific action is removed. The support of implementation of appropriate FRM, and other key issues are included under SPT.0116.
RMT.0494	FTL rules for helicopter commercial operations	Action has been put on hold until further review due to prioritization exercise.
RMT.0495	FTL rules for aeroplane commercial operations other than CAT	Action has been put on hold until further review due to prioritization exercise.

Analysis of impacts of proposed actions

1.13 Analysis of impacts

The impact of each action is described within each descriptor in Section 5.

Best Intervention Strategy

The update of the BIS is necessary to reflect the scenarios that the industry, and consequently all stakeholders, currently face. This is the first update following the recovery from Covid-19, thus some actions in the previous version have been completed or integrated into updated actions, while others have been discarded.

The three pillars (rulemaking, Member State tasks and safety promotion tasks) on which the previous BIS was based are still applicable. The intervention strategy is largely the same, however new actions should deliver a more robust and accurate picture of the issues surrounding aircrew fatigue. This will also promote the continued cooperation of all the affected stakeholders.

The proposed intervention strategy is aligned with the principle that everyone shares a responsibility when dealing with aircrew fatigue. This is fostered through the actions in the EPAS which are, rulemaking, standardisation, Member State actions and safety promotion. The input of the advisory bodies is necessary to ensure that the deliverables of each action are measured for effectiveness.

Addressing aircrew fatigue is crucial for ensuring the safety and well-being of flight personnel. Effective intervention strategies for managing aircrew fatigue involve a combination of operational, organisational, and individual approaches.

#	Action title	Action type	Benefit*	EASA resources	2025	2026	2027	2028
1	Event dedicated to FTL/FRM.	SPT.0116	Medium	Mission budget: 1mission x 1000 euro x 5 experts = 5 000 euros	Conference - Q1	Conference – Q1		Conference - TBD
2	RMT.0492 Development of FTL rules for CAT operations of emergency medical services by aeroplanes (AEMS) RMT.0493 Update and harmonisation of the FTL rules for CAT by aeroplanes for air taxi And single-pilot operations.	RMT. 0492 RMT.0493	High	2025-2027: 0,1 FTE/year	1. Opinion	2. EDD	1. Workshop with AB	
3	Further actions following study of the effectiveness of FTL - Phase 2 of the research.	New Others	Medium	EASA 0.2 FTE/year	TBD			
4	EASA Standardisation - focus on FTL/FRM during OPS standardisation inspections.	STD	Medium	Refer to STD budgets.		Ongoing		
5	Provide better guidance on issues related to fatigue reporting	NEW SPT	Medium	2026-2028: 0.1 FTE/year				Safety Promotion / Guidance Documents
6	ECCAIRS Taxonomy Update	NEW Others	Medium	2026-2027: 0.2 FTE/year [More resources to be considered for the full review by the NoA, not limited to EASA resources]		Review by Network of Aviation Safety Analysts (NoA) and FTL/FRM expert groups	Update of Taxonomy [provisional timeline – subject to overall taxonomy updating process]	
7	Data collection and analysis related to handling of fatigue reports, and results of FTL/FRM oversight.	New MST	Medium	2028: 0.2 FTE				Survey to MS

APPENDIX A – SAFETY ANALYSIS REPORT

Strategy & Safety Management Directorate
Safety Intelligence & Performance Department

Safety Analysis Report

Aircrew fatigue

Version 1

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Safety Analysis Report

Aircrew fatigue

Document ref.	Status	Date
Aircrew fatigue (FTL)	Version 1	17/12/2024
Contact name and address for enquiries:	Aigars Krastins aigars.krastins@easa.europa.eu European Aviation Safety Agency Safety Intelligence & Performance Department Postfach 10 12 53 50452 Köln Germany	
Information on EASA is available at:	www.easa.europa.eu	

Authorisation :			
	Name	Signature	Date
Prepared	A. Krastins		22/11/2024
Reviewed 1	C. Taliana		29/11/2024
Endorsed	SIRB		17/12/2024

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1	SIRB members
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1 Executive summary

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 to prevent aircrew from experiencing fatigue at levels that could put at risk the safety of flight operations.
This safety issue is included in the CAT Aeroplanes safety risk portfolio under number SI-0039. According to the SIPI score this safety issue is in upper end of medium risk level and requires an assessment. Thus, it was moved from the Step 5 (Monitor) to Step 2 (Assess) as part of the EU Safety risk Management process.

The statistics of fatigue related occurrences is reviewed, and analysis provided in this document to support an update of the existing BIS on Aircrew fatigue.

Review of occurrences does not allow to assess the detailed elements related to fatigue risk management FRM. For the rostering element, a review at the operator level is needed, most probably as part of the oversight activity.

All in all there have been significant number of occurrences reported, coded with fatigue event type value, over the review period from 2019-2023 for all aviation personnel with an increasing trend for the rate, occurrences per one million flights.

There is insignificant number of fatigue related occurrences for CAT Rotorcraft operations, thus making impossible to analyse these and derive conclusions.

When focusing on the aircrew related fatigue occurrences involving CAT fixed wing aeroplanes, overall a significant increase for both absolute numbers and rates are noticed for 2022 and 2023.

From the occurrences identified as aircrew fatigue related over 2019-2023, none of them do classify as serious incident or accident according to the ICAO Annex 13 and R996/2010 in the dataset for CAT fixed wing operations.

In terms of risk classification aggregated scores for 100 occurrences with ERCS scored, mainly for 2023 occurrences, the highest risk key risk areas are collision on runway (runway incursion by a vehicle – one occurrence high risk), aircraft upset and airborne collision.

There are four states of operator, where more than half of occurrences are stemming from. There could be different reasons for that, good reporting culture being one of them.

Unstable approaches has been one of the most common event type, however in terms of ERCS aggregated score, runway incursion by a vehicle, separation minima infringement and configuration warning related are the highest risk ones.

Flight delay has been the most common outcome event in terms of number of occurrences, however as per ERCS score, go arounds have been with the highest risk. It is important to note that go-arounds even being risky in their execution are safety nets that allow to repeat an approach for safe landings. Likewise performing a go-around in a state of fatigue could also lead to serious consequences.

The narrative review of occurrences with fatigue and other operational events (effect on flight safety) in 2023, allowed to confirm some operational consequences or effects on operations, however, out of 316 occurrences, only 155 were confirmed that there was as contribution from fatigue. This makes 21 occurrences per one Million flights. For comparison, the rate for GNSS outages and alterations occurrences in 2023 was 1 700 occurrences per one Million flights. The rate of turbulence encounters with injuries – 97 occurrences per one million flights.

At the same time data shows that reporting is differing from one member state to another. For full assessment, information from member states' oversight activities are needed.

For the focus areas, the following can be concluded:

- Commander's discretion reports have significantly increased for 2022 and 2023 in both absolute numbers and rate. Associated events per numbers and aggregated ERCS score are duty time exceedance and extension.
- Vast majority of Duty time extension related occurrences have been experienced in 2020 during the pandemic.
- Even if the number of occurrences is low, there is a steady increase in occurrences where the term 'tired' is mentioned in the headline.
- Long night duty related occurrences, even with low number, have increased when compared with 2019, especially for 2020, 2022 and 2023.

Fatigue does contribute negatively on aviation safety; however, it cannot be taken in isolation. Final conclusions cannot be made, based solely on the European Central Repository data, additional sources of information need to be explored, such as information from authority oversight of the FTL and FRM.

The activity of assessment should be repeated once all occurrences since 2023 onwards are ERCS scored by authorities as per regulation.

2 Introduction

This safety analysis report is developed to support EASA review of the BIS for the SI-0039 Aircrew fatigue. This safety issue is included in the CAT Aeroplanes safety risk portfolio. According to the SIPI score this safety issue is in upper end of medium and requires a review as part of the EU Safety risk Management process.

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. Also FRM plays a significant role in containing this contributing issue.

The goal of this safety analysis paper is to review aircrew fatigue related occurrences to determine if the FTL and FRM schemes are fit for purpose and adequately contain this contributing issue. To do that, present fatigue related occurrence statistics, trends in the last past years and derive the categories of occurrences presenting a significant safety risk.
This includes in particular occurrences contributed by fatigue, caused by commander's discretion (due to various reasons), acclimatisation, duty time extension, standby duty, long night duty, reduced rest period, rest time less than required, duty time, or related with having flown multiple sectors, getting tired, and controlled rest.

In this report a distinction between fatigue (accrued over period of time due to lack of sufficient or adequate rest) and tiredness (getting tired by the long day of duty, or a day with many 'unexpected' events) is made.

3 The problem statement

Data source: ECR data, extracted on 20.03.2024
Scope: All / CAT fixed wing aircrew related, EASA MS operators
Timeframe: 2019-2023
The methods used: Event type factoring and narrative search.
Tools used: Power BI.
Exposure data used for rates: source Eurocontrol, CAT A internal in, departure from, arrival flights to EASA MS, Excludes Iceland. Not limited to the EU operators.
Data quality: contains duplicates, subject to the coding of event type in the occurrence records.

Analyse aircrew fatigue related occurrences in the ECR to detect undesirable trends, safety risks and, to extent possible, determine the adequacy of FTL and FRM to contain this contributing issue.

4 Analysis

4.1 Setting the scene – macro view

4.1.1 Fatigue related occurrences overview – all aviation domains and personnel

As shown in the Figure 1 below, in the timeframe from 2019 till end 2023 there have been more than 32 510 fatigue related occurrences registered in the European Central Repository (ECR) across all aviation domains and personnel. After the drop of such occurrences in absolute numbers during years affected by COVID-19 pandemic and associated low activity there has been a statistically significant increase during the recovery periods in 2022 and 2023. In absolute numbers, 2022 the pre-Covid 19 level was almost reached even the activity was lower than in 2019. In 2023 the highest number within the 2019-2023 period of almost 11 000 occurrences was reached. In terms of rate, the peak was also in 2023 (1 526).

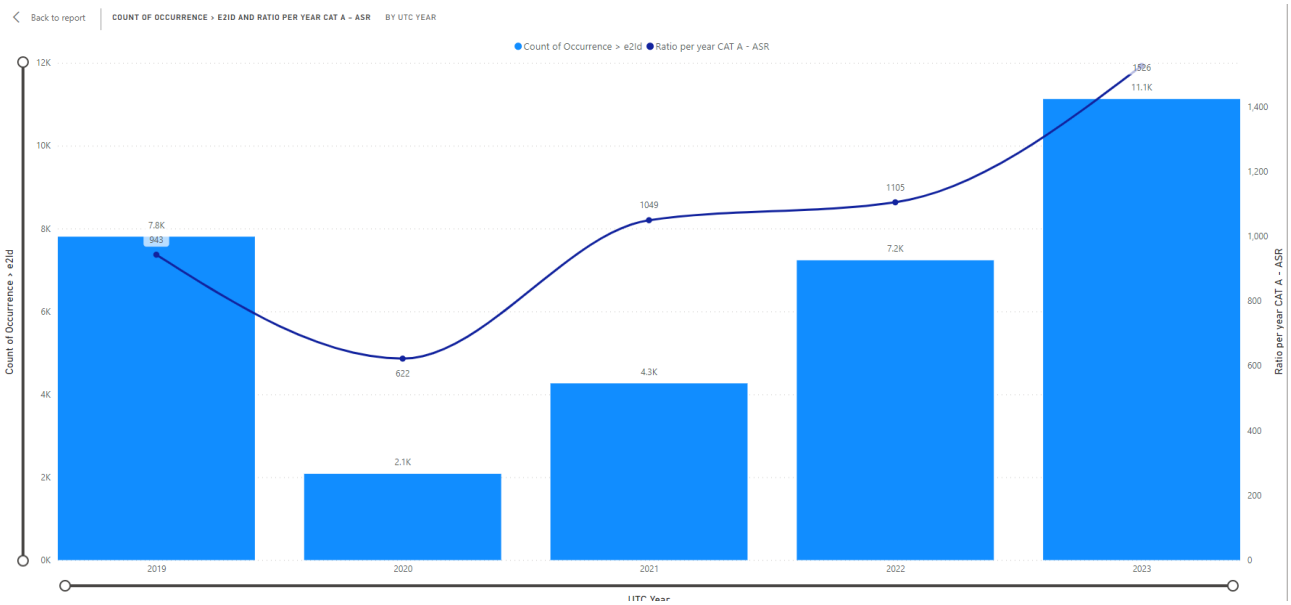

Figure 1: Distribution of fatigue related occurrences and rate per one million flights, all aviation domains, all personnel

The Figure 2 displays the year on year evolution of the fatigue related occurrences. In 2023 almost for all months the absolute numbers of fatigue related occurrences have been higher than in previous periods. In 2023 the peak has been over the summer months.

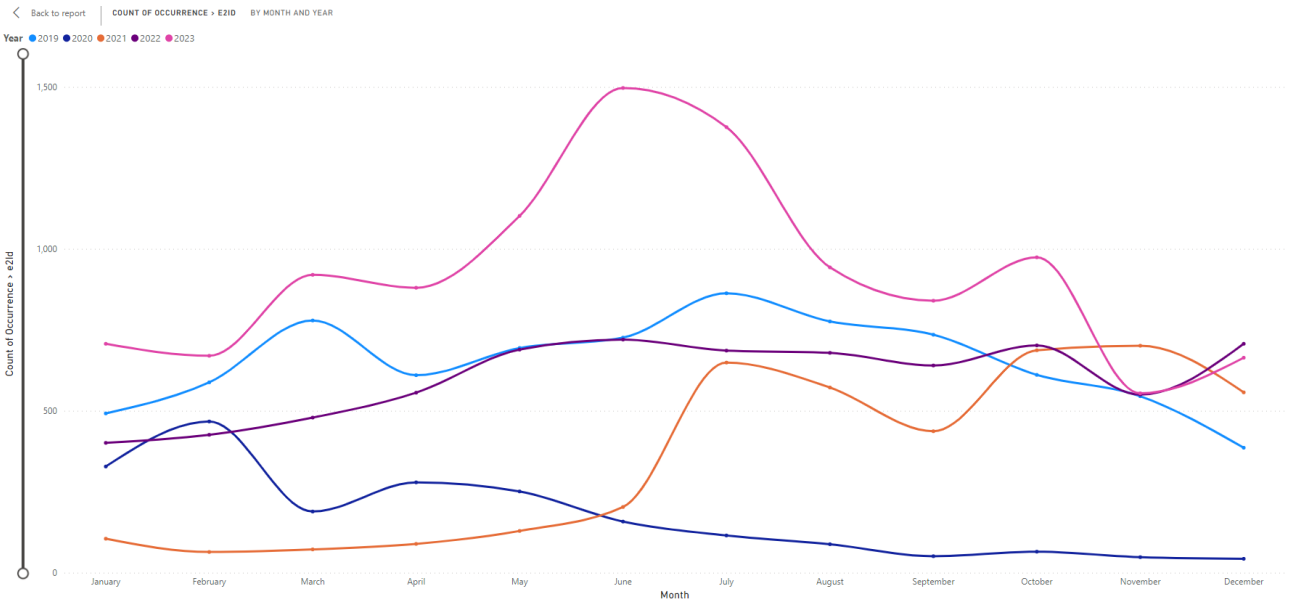

Figure 2: Distribution of fatigue related occurrences year on year, all aviation domains, all personnel

4.1.2 Fatigue related occurrences involving CAT Aeroplanes, all aviation personnel

There are around 26 170 fatigue related occurrences, involving CAT Aeroplanes operations, all aviation personnel. As shown in Figure 3, both the absolute numbers of occurrences and rate have increased and exceeding the 2019 level since 2022. Also the rate has been elevated since 2021 onwards with the peak in 2023 with 1 300 occurrences per one million flights.

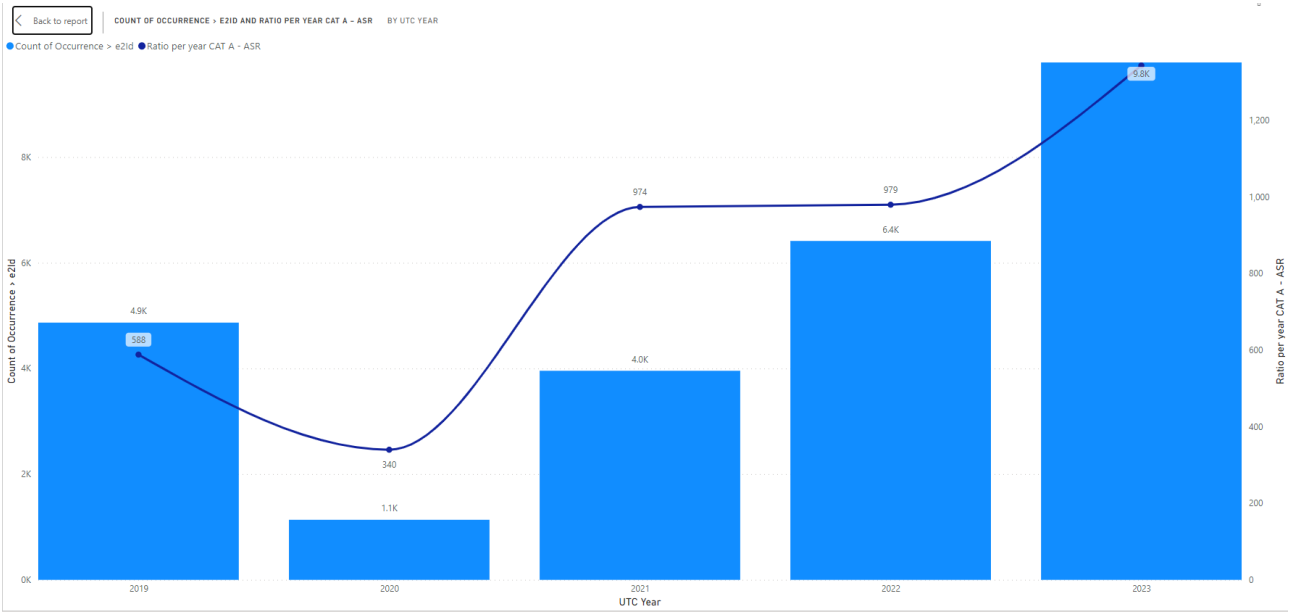

Figure 3: Distribution of fatigue related occurrences and rate per one million flights involving CAT A operated aircraft, all personnel.

In Figure 4 year on year situation is reflected. Also for CAT fixed wing fatigue related occurrences in absolute numbers have significantly exceeded the number of previous years. In 2023 also the increase during the summer months is more prominent than in previous years.

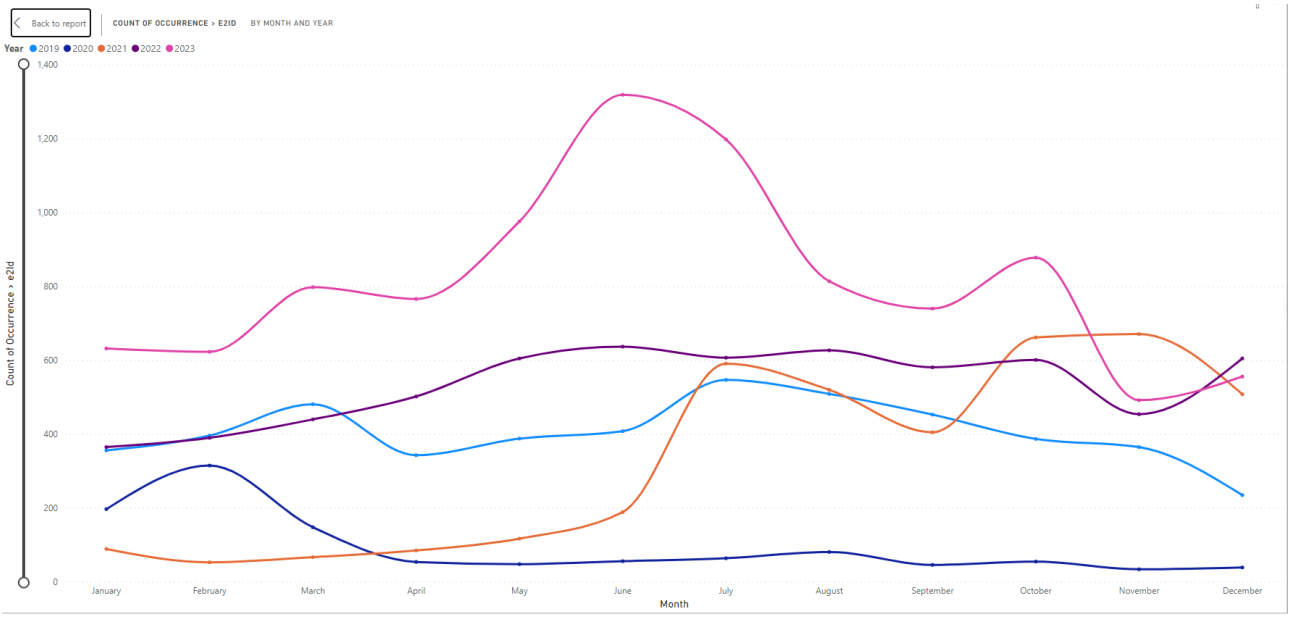

Figure 4: Distribution of fatigue related occurrences involving CAT A operated aircraft, all personnel, year on year.

4.1.3 Fatigue related CAT Rotorcraft occurrences

The ECR was reviewed also for aircrew fatigue related occurrences involving CAT Rotorcraft operations. However, there was insignificant number of four occurrences retrieved that does not allow further analysis of these occurrences.

4.2 Fatigue related CAT aircrew occurrences leading to operational events

In this chapter we take a closer focus on the aircrew fatigue related occurrences, which could have influenced the safety of operations. For an example, there has been an unstabilised approach, level bust, flat/slat speed exceedance and others, contributed by fatigue.
All in all there have been more than 800 occurrences in the data set, when fatigue event type was associated with another operational event type.
Figure 5 reflects the distribution of fatigue and operational events related occurrences over years in absolute numbers and rate. Years 2022 and 2023 are elevated for both values in comparison with previous years. The rate for 2023 has almost doubled when compared with 2019.

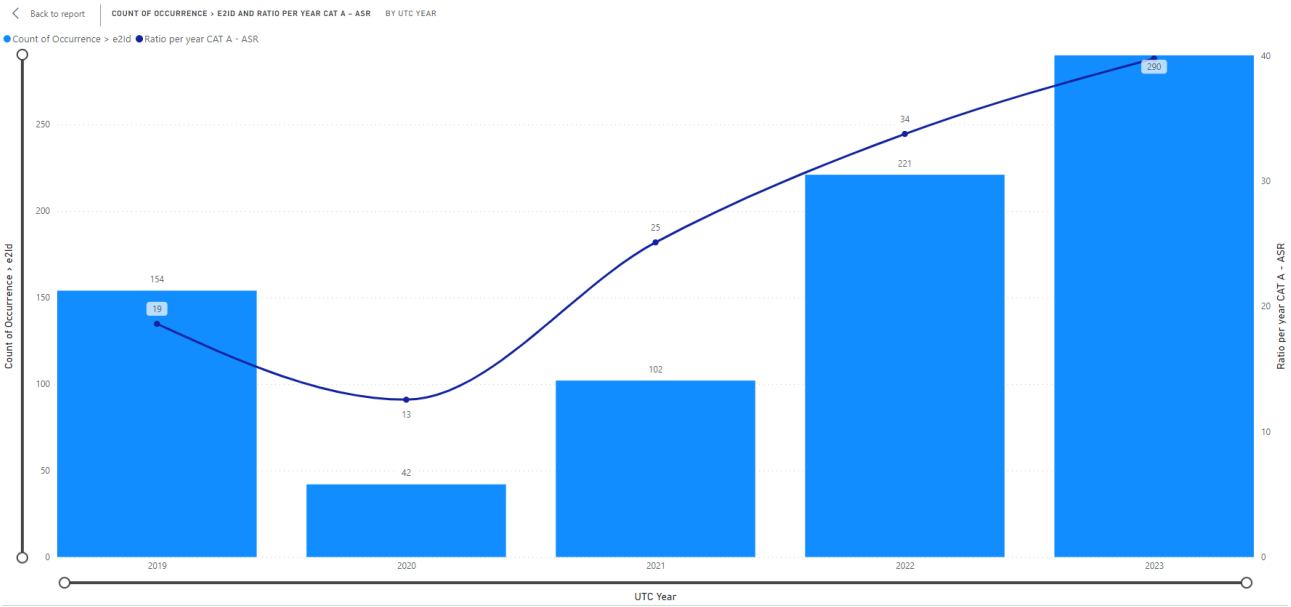

Figure 5: Distribution of fatigue and operational related occurrences involving CAT A operated aircraft, aircrew .

Figure 6 displays the year on year statistics of fatigue and operational related events in the tome period. In 2023 there has been an increase of such occurrences during the spring. In other years most occurrences occurred during the summer months. The interruptions of the e.g. dark blue and orange lines show months without reported occurrences.

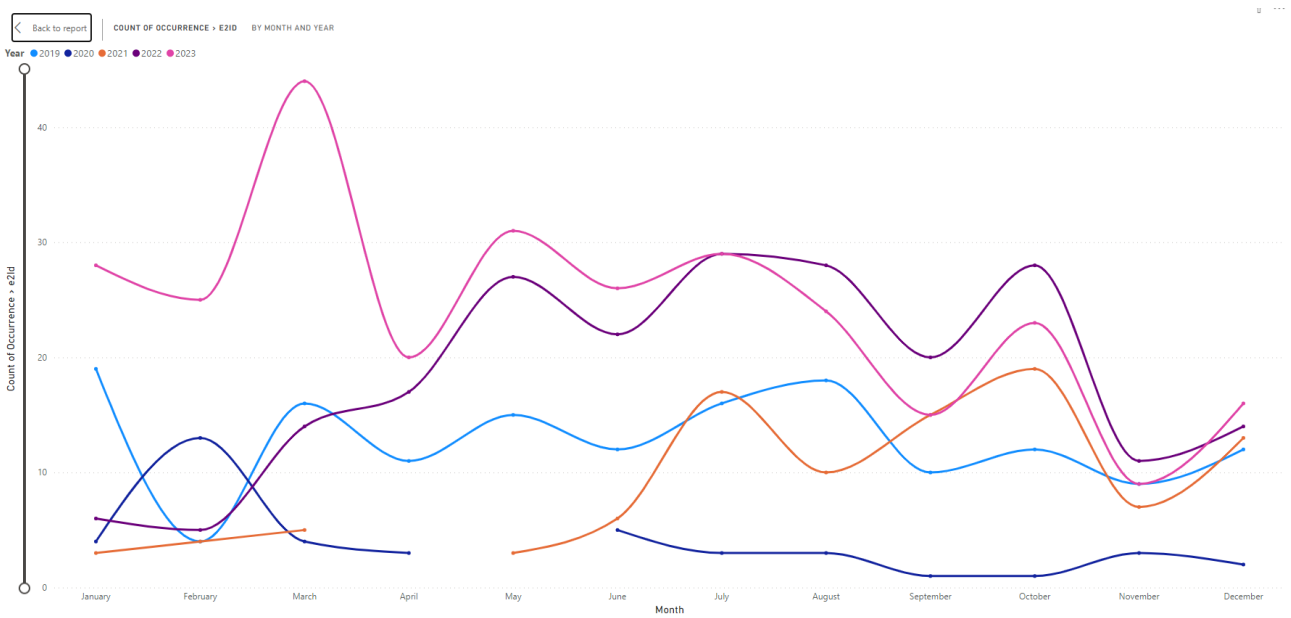

Figure 6: Distribution of fatigue and operational related occurrences involving CAT A operated aircraft, aircrew.

4.2.1 Event type analysis

The majority of operational events potentially associated with fatigue related occurrences have been Unstabilised approaches, Flight level deviations – level busts, Cabin exit – Arming/Disarming, and operation of flight controls. In some cases the following events have occurred that should be highlighted: flat/slat speed exceedance, communication by flight crew with ATC, clearance deviations, configuration setting errors, speed control related, deep/hard landings, loss of separation, fuel management related, performance calculations related, stop bar crossing and others.

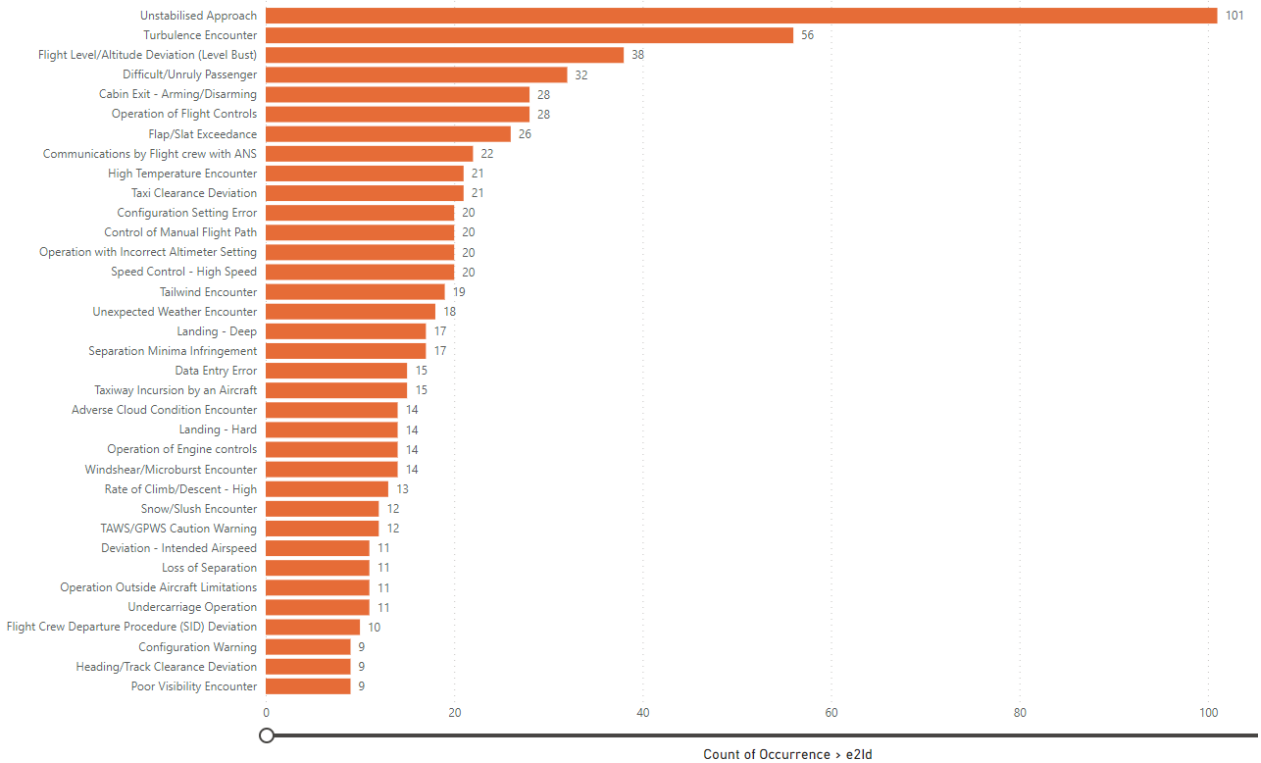

Figure 7: Distribution of fatigue and operational events (2019-2023) related occurrences (list curtailed)

Figure 11 presents the event types associated with the highest risk occurrences as per aggregated ERCS score. The runway incursion by a vehicle (not relevant for the aircrew fatigue, however), separation minima infringement and configuration warning related are the highest risk ones.

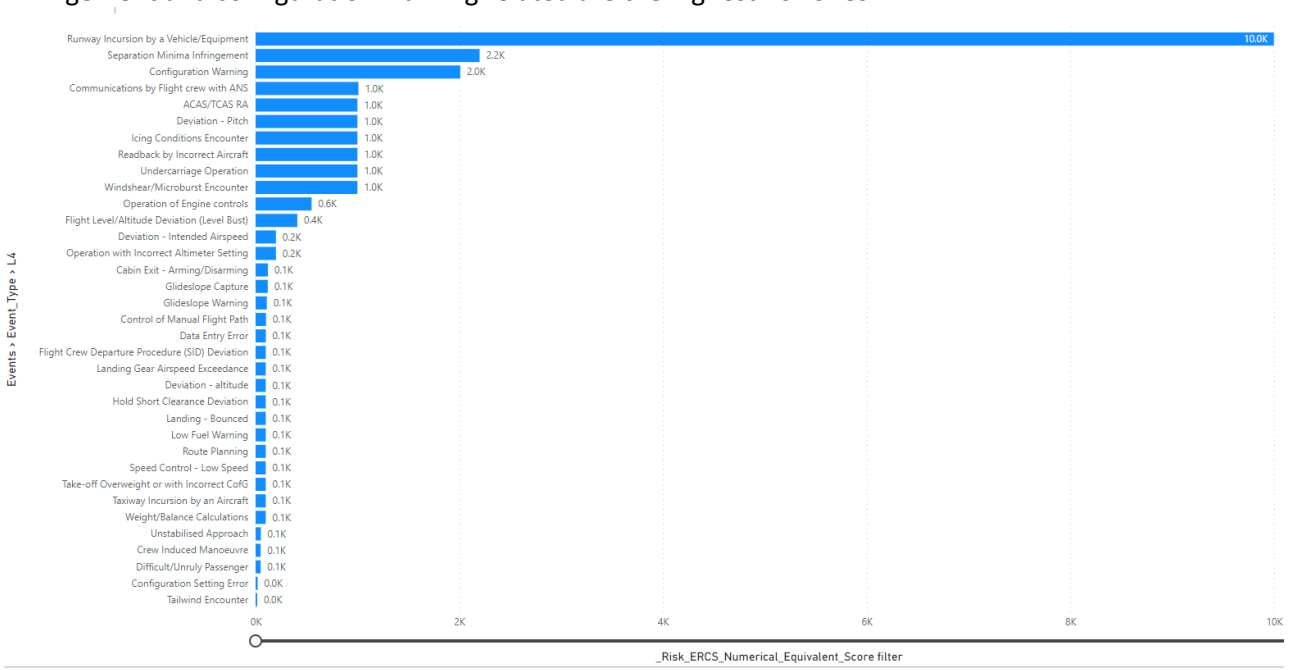

Figure 8: Distribution of fatigue and operational events (2019-2023) related occurrences per aggregated ERCS score (list curtailed)

Figure 12 reflects the absolute numbers and rate for unstabilised approaches events. The highest rate was in 2022. In 2023 there is a slight decrease.

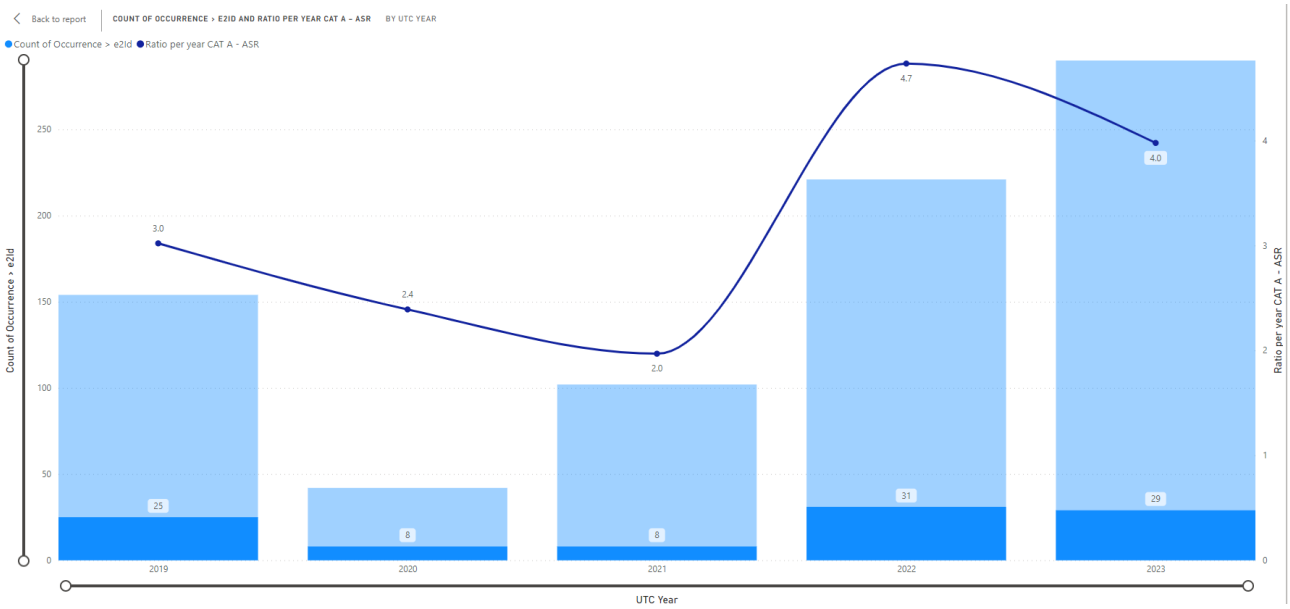

Figure 9: Distribution of fatigue and operational events related occurrences per operational event type – unstable approach

Figure 13 highlights the absolute number and rate for fatigue related level busts, there the increase for both absolute numbers and rate.

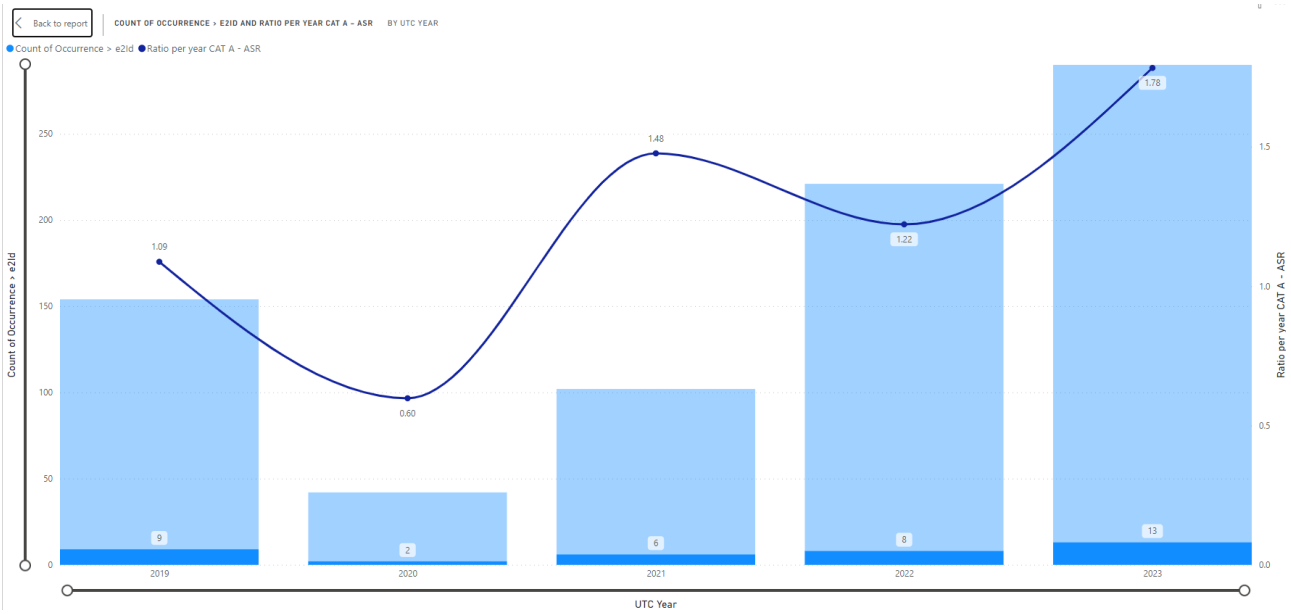

Figure 10: Distribution of fatigue and operational events related occurrences per operational event type – level bust

Figure 14 highlights the increase of absolute numbers and rate for operation of cabin exit – arming/disarming cases.

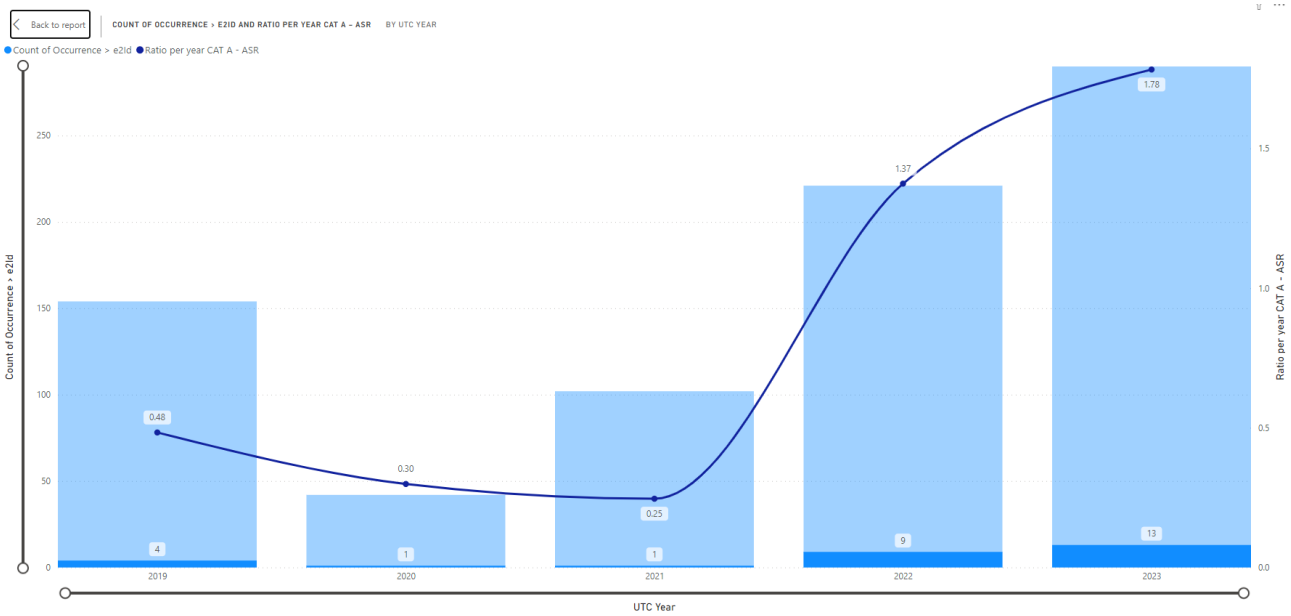

Figure 11: Distribution of fatigue and operational events related occurrences per operational event type – operation of cabin exit – arming/disarming

Figure 15 shows also the increase for operation of flight controls issues.

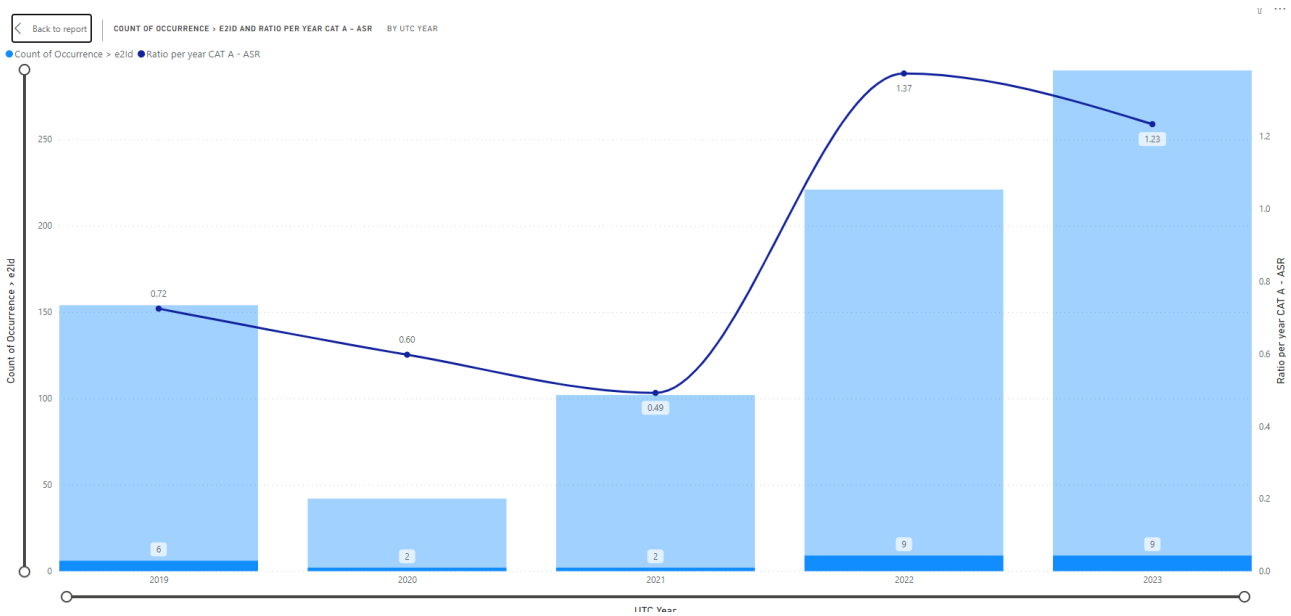

Figure 12: Distribution of fatigue and operational events related occurrences per operational event type – operation flight controls

Fatigue has contributed and may contribute to significant operational events.

4.2.1.1 Consequential events analysis

Now we take a closer look at the consequential events encountered in occurrences with fatigue contribution. As per Figure 16, in most cases there has been a flight delay. This consequence might have been also a reason for fatigue. Regarding the operational safety related outcomes in more than 50 cases there has been a landing executed after unstabilised approach. Also rejected landings and take-offs, delayed rotation, approaches below weather minima, and others. Medical incapacitation of a cabin crew has occurred in 32 cases.

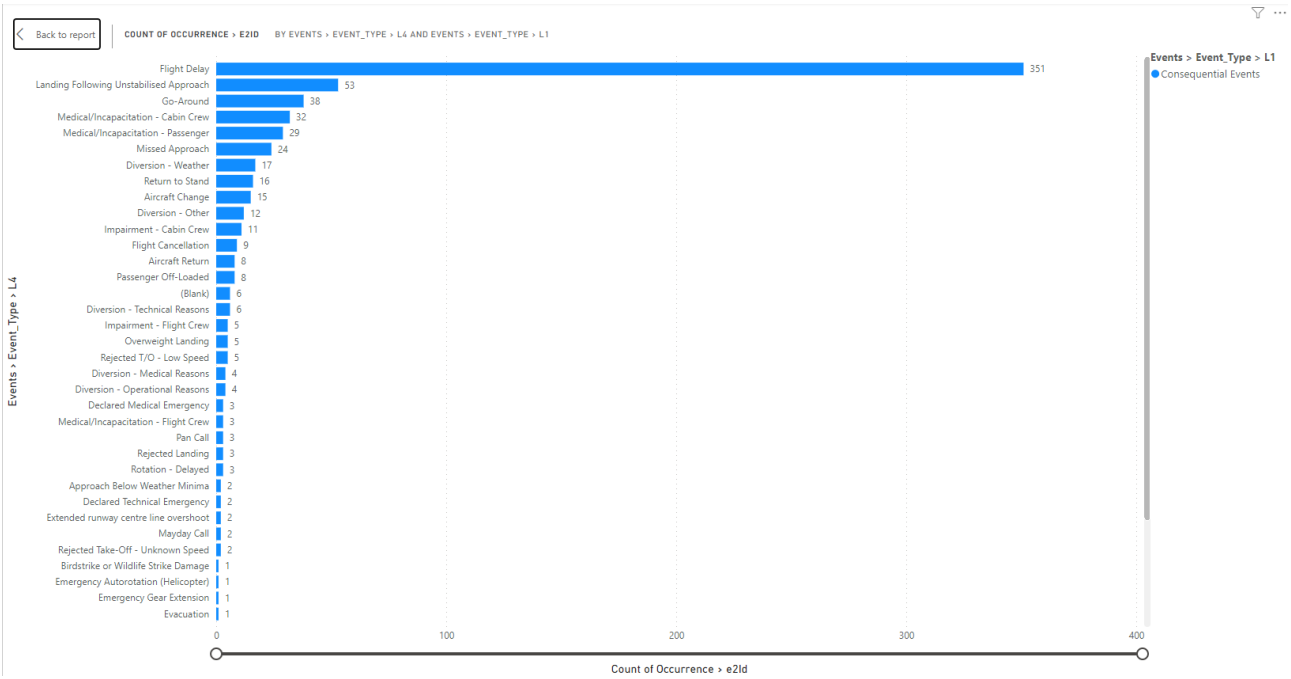

Figure 13: Distribution of fatigue related occurrences and consequential events related occurrences (list curtailed)

However as per Figure 17, in terms of aggregated ERCS score, for the scored occurrences, the highest risk consequential event type has been go-around, followed equally by flight crew impairment – and requiring a mayday call. It is important to note that go-around even risky in its execution is a safety barrier that allows to repeat an approach for a safe landing.

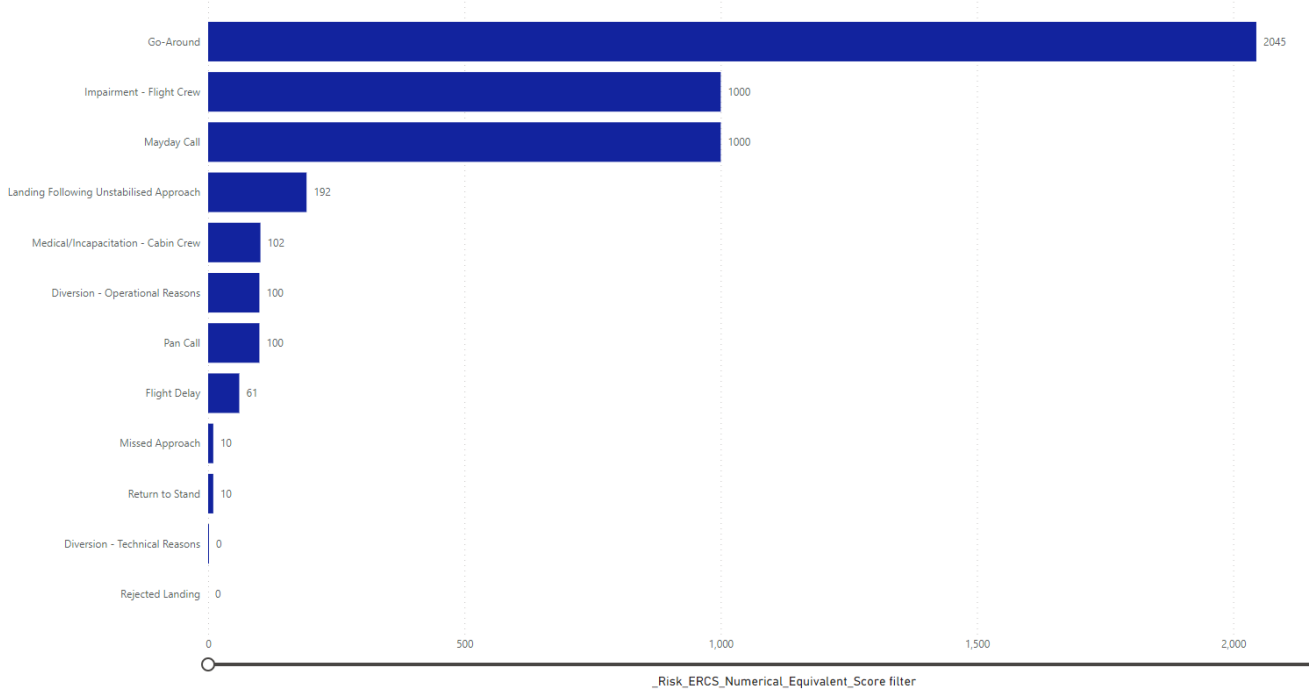

Figure 14: Distribution of fatigue related occurrences and consequential events related occurrences per ERCS aggregated score (list curtailed)

4.2.2 Occurrence class[10]

Almost all fatigue related occurrences, with effects on operations, have been classified as incidents in the European Central Repository (ECR) in the timeframe of 2019-2023.

In the ECR, there have been 4 occurrences classified by EASA Member State authorities as serious incidents in the timeframe 2019-2023 in the dataset for CAT fixed wing operations.

However, after review, none of these 4 could be confirmed as serious incidents as per ICAO Annex 13 and R996/2010. This is a data quality issue in the ECR.

There is one serious incident that occurred in early 2024 and the investigation is ongoing. Fatigue elements are normally included in the final reports of the safety investigation authorities. Based on preliminary information, this serious incident was an air proximity occurrence with TCAS Resolution Advisory triggered. ATCO fatigue had contributed to it (the night before he slept about 3 hours, that the quality of his sleep was low, that he had been sleeping for about 1 month with reduced hours of sleep compared to what is usual for him and with low quality, due to personal situation, the shift was morning shift and his chronotype is morning), no information about the flight crew fatigue. Thus this serious incident is outside the scope of this safety issue assessment.

[10] The classification of the occurrence in relation to its severity.

4.2.3 Occurrence categories[11]

Majority [560] occurrences are categorised as Other occurrence category that is used to categorise an occurrence that does not fall in any other occurrence category. It is followed by Navigation error [133] occurrence category and then by Cabin safety events related. Around 20 occurrences have had occurrence categories Abnormal runway contact, Airprox/ACAS alert/loss of separation and around 13 Loss of control inflight.

4.2.4 European risk classification scheme

Now we will look at occurrence distribution per aggregated ERCS – European Risk Classifications Scheme numeric values, to see the risk levels of occurrences within the period covered. It is worth mentioning that ERCS scoring became applicable as of January 1, 2023 according to COMMISSION IMPLEMENTING REGULATION (EU) 2021/2082.

It is premature to make a full analysis based on the ERCS aggregated scores, as this was becoming applicable as of Jan 2023, but nevertheless the information is included there. This exercise can be repeated in the next years. 709 occurrences (88%) out of 809 do not have ERCS score assigned. Thus ERCS is not expected to be completed for occurrence records prior this date.

Figure 7 shows the absolute numbers of occurrences per year versus the aggregated ERCS scores for occurrences having this value filled. The highest risk events occurred in 2023.

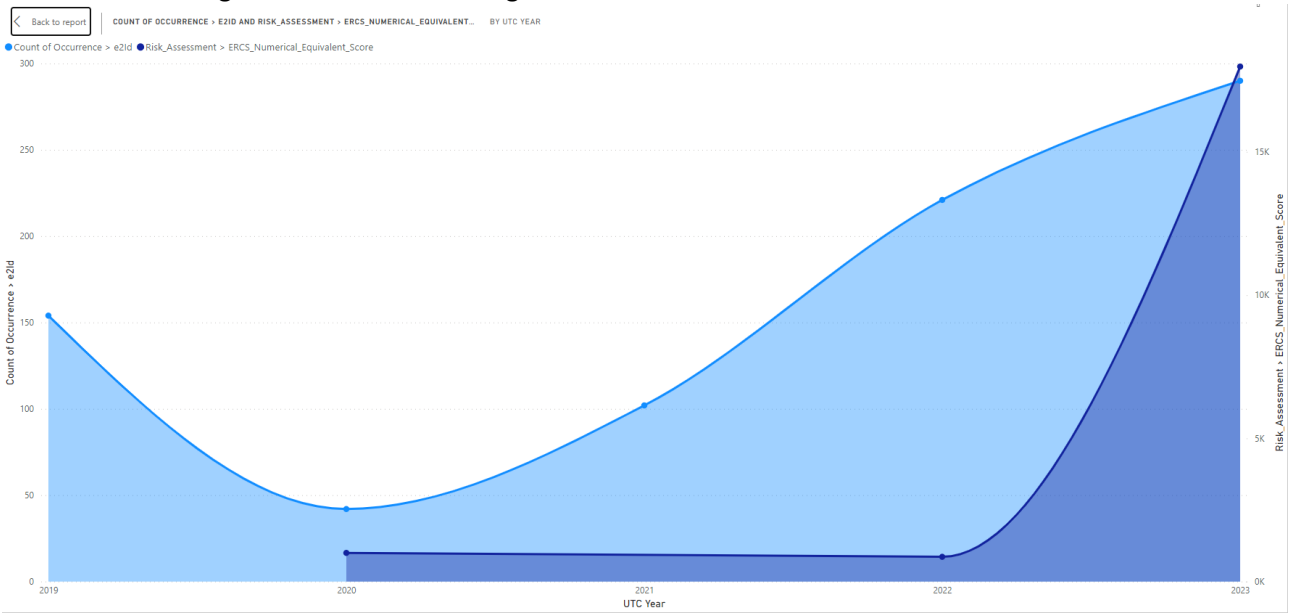

Figure 15: Distribution of fatigue and operational events related occurrences involving commercial air transport aeroplanes and aggregated ERCS scores

[11] The occurrence categories as developed by CAST/ICAO Common Taxonomy Team (CICTT). Commercial Aviation Safety Team [CAST] and International Civil Aviation Organization" [ICAO]. Each category has a unique name and identifier to permit common coding in accident/incident systems, a text definition, and usage notes to further clarify the category and aid in coding occurrences. An important element of the occurrence category design is that it permits the association of multiple categories with an occurrence. Multiple coding supports the primary focus of CICTT- accident PREVENTION, in which every pertinent element should be investigated, recorded, and analysed. Based on version October 2013 (4.6)

Figure 8 displays the distribution of fatigue and operational events related occurrences per key risk area and aggregated risk score, when this value is present in the database.

Here we can see that the highest key risk area per aggregated ERCS score is Collision on runway to which fatigue has or may have had contributed to. This is the result of one occurrence of runway incursion by a gardening vehicle.

The second is aircraft upset stemming from 39 occurrences (flap/slat speed exceedances, unstabilised approaches, control of manual flight path, deviation form airspeed).

The 3rd is airborne with aggregation from 12 occurrences (separation minima infringements, level busts, flight crew deviations from SID, data entry, operation with wrong altimeter setting).

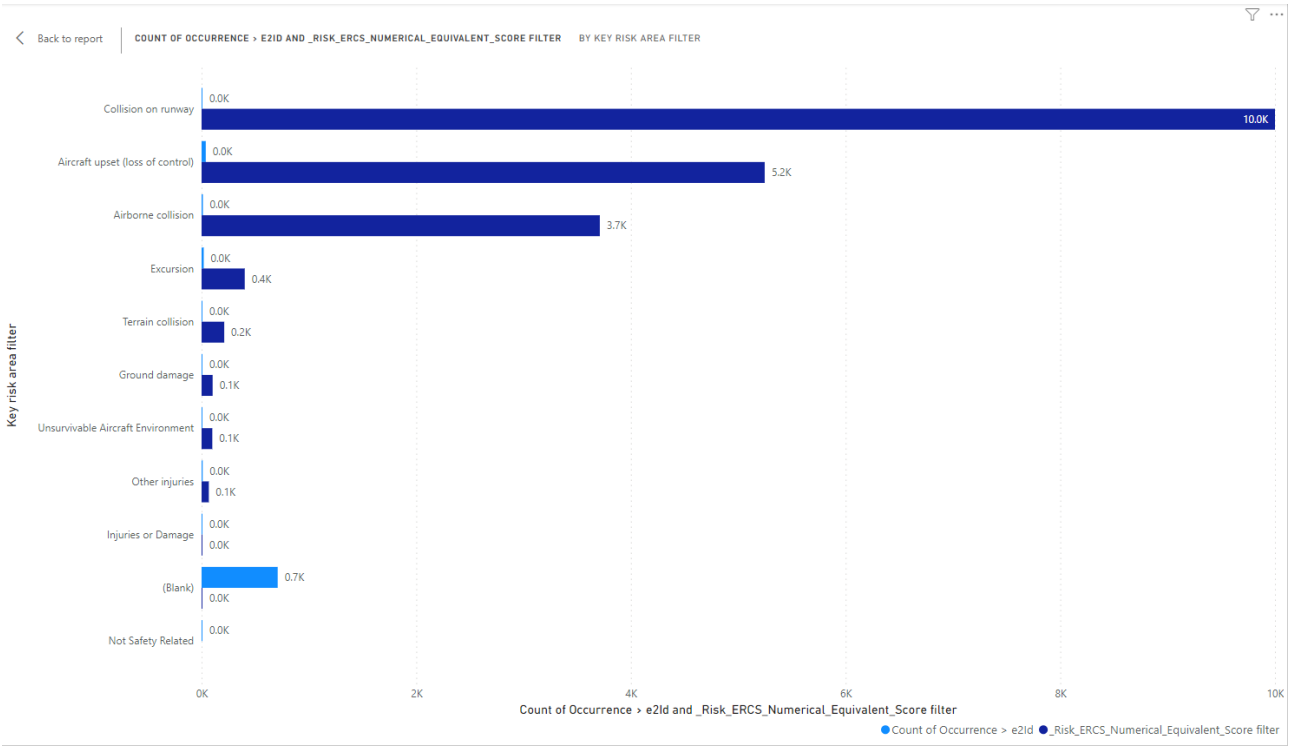

Figure 16: Distribution of fatigue and operational events related occurrences involving commercial air transport aeroplanes and aggregated ERCS scores

4.2.5 Per State of operator

The Figure 9 shows the distribution of occurrences per state of operator involved in these occurrences. The majority of all fatigue related occurrences in the analysis involved Spanish operators (26%) and Sweden (13%) followed by Belgium, Germany, and Switzerland that would cover more than half of all occurrences. Around 50% of all occurrences are stemming from 4 states of operator. This could imply that reporting culture as well as practices to integrate fatigue related occurrences within the ECR are widely differing among the EASA member states (some states are integrating all fatigue related occurrences, some partially, some not at all).

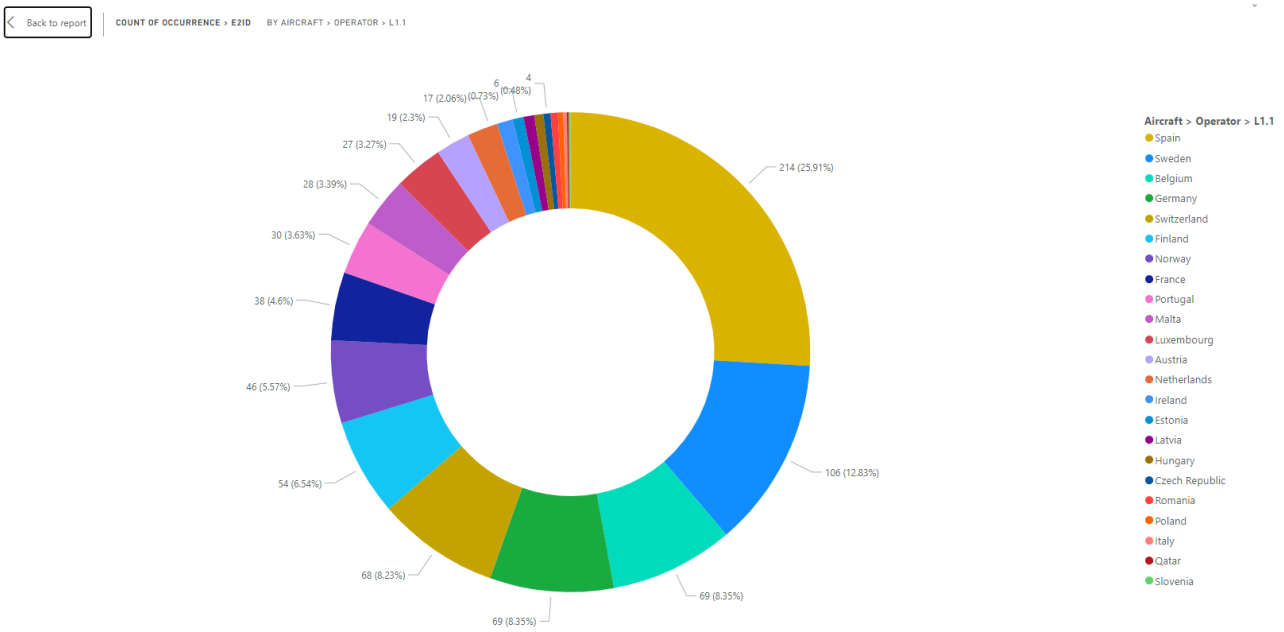

Figure 17: Distribution of fatigue and operational events related occurrences per state of operator

4.2.6 2023 occurrence with operational events – narrative review

A close review of occurrence narratives that occurred in 2023 was done, to get in immersive picture of how many of all the occurrences are confirmed to be contributed by 'fatigue' and which have an operational consequence.

In 2023 there were 316 occurrences (without duplicates), with operational events coded in the ECR. However, only 155 (or 49%) occurrences could be clearly attributed to the 'fatigue' event. That makes the rate of 21 occurrences per one Million flights. For comparison, the rate for GNSS outages and alterations occurrences in 2023 was 1700 occurrences per one Million flights. The rate of turbulence encounters with injuries – 97 occurrences per one million flights.

In 124 (or 39%) occurrences, 'fatigue' could not be directly not confirmed by the narrative text. These include cases, where crew reported to be tired or mentioned fatigue as a side factor (not a direct contributor), and others. This confirms the complexity of analysing fatigue reports based solely on text that may not provide a complete picture. Fatigue reporting is in the end a personal issue. The narrative text could only provide a narrow picture of the event leading to an occurrence or the person choosing to submit a report.

Furthermore, the comparison above represents a simple but not inter-related comparison to other current major events affecting aviation safety. GNSS outages and turbulence encounters are events that are not susceptible to subjective assessments.

The Table 1 shows the distribution of the 155 occurrences per event type level 1. Note that one occurrence may be assigned with more than one event type. The total shows the number of occurrences, not the number of assigned event types.

Events > Event_Type > L1	Count of Occurrence > e2Id
Operational	155
Personnel	155
Consequential Events	46
Organisational	21
Equipment	8
Total	**155**

Table 3: Occurrences per event type level 1.

Figure 18 lists presents the operational events per levels 3 and 4 that provide the right level of granularity to assess the event types. The occurrences contributed by fatigue that had resulted in aircraft handling issues (control of both automated and manual flight path, high rate of climb/descent, landing deep, etc.), Flight crew operation of equipment aspects (operation with incorrect altimeter setting, operation of flight controls, radio frequency error, operation of engine controls, fuel management, data entry error, configuration setting error), flight crew ATC clearance deviation (flight level/altitude deviation – level bust, hold short clearance deviation, landing clearance deviation). Regarding the flight crew/ATC communication – there have been occurrences of prolonged loss of communication.
Various issues with preflight planning. Several parameter exceedances, such as flap/slat exceedance, landing gear down airspeed exceedance, or airspeed exceedance. Also deviations from intended airspeed. Apron/ramp incursion, airborne conflicts (loss of separation).

For cabin crew – cabin safety related aspects contributed by fatigue have been cabin exit arming/disarming related, cabin/cockpit communication.

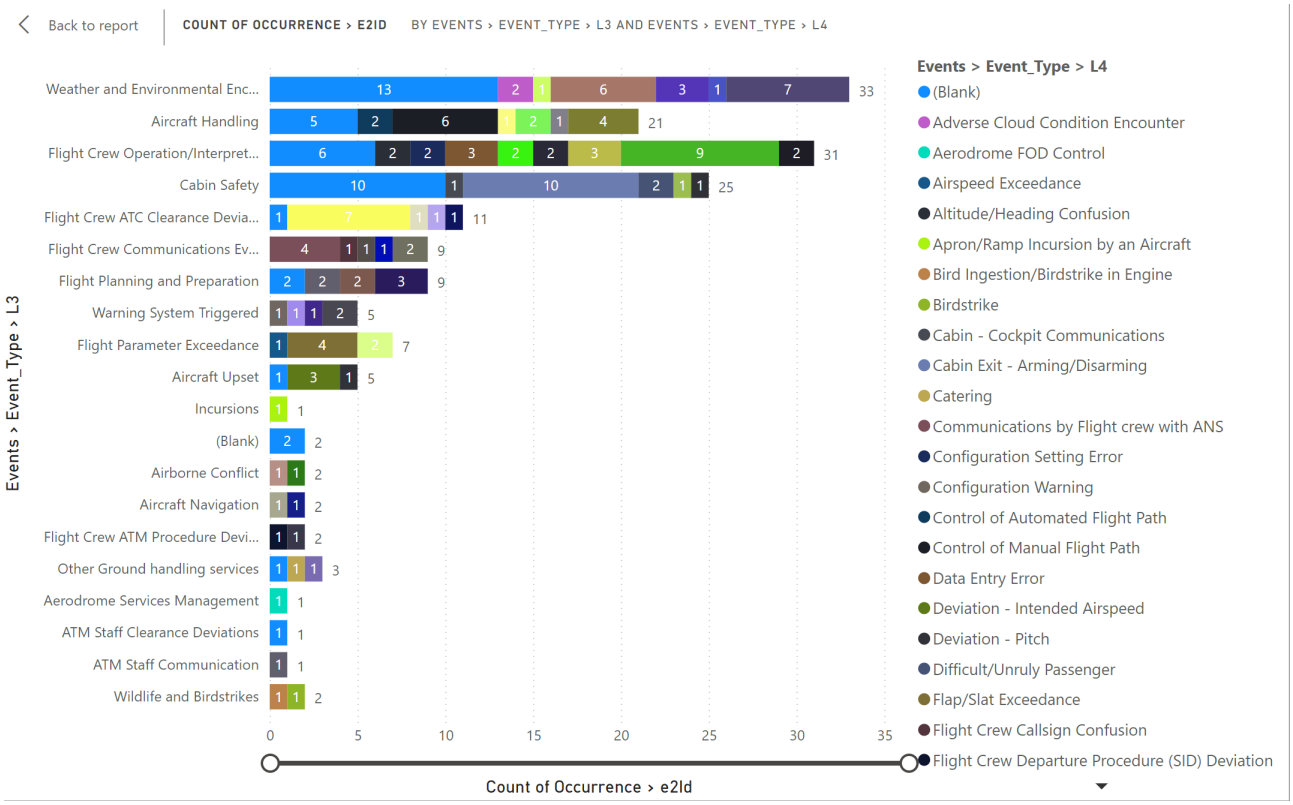

Figure 18: Operational event types per level 3 and 4.

In Figure 21 the distribution of occurrences per key risk areas are presented. Majority of occurrences, namely 80% do not have key risk area assigned by competent authorities of the member states. For the 31 (20%) occurrences with key risk area assigned, majority is leading towards runway excursions, aircraft upset and other injuries.

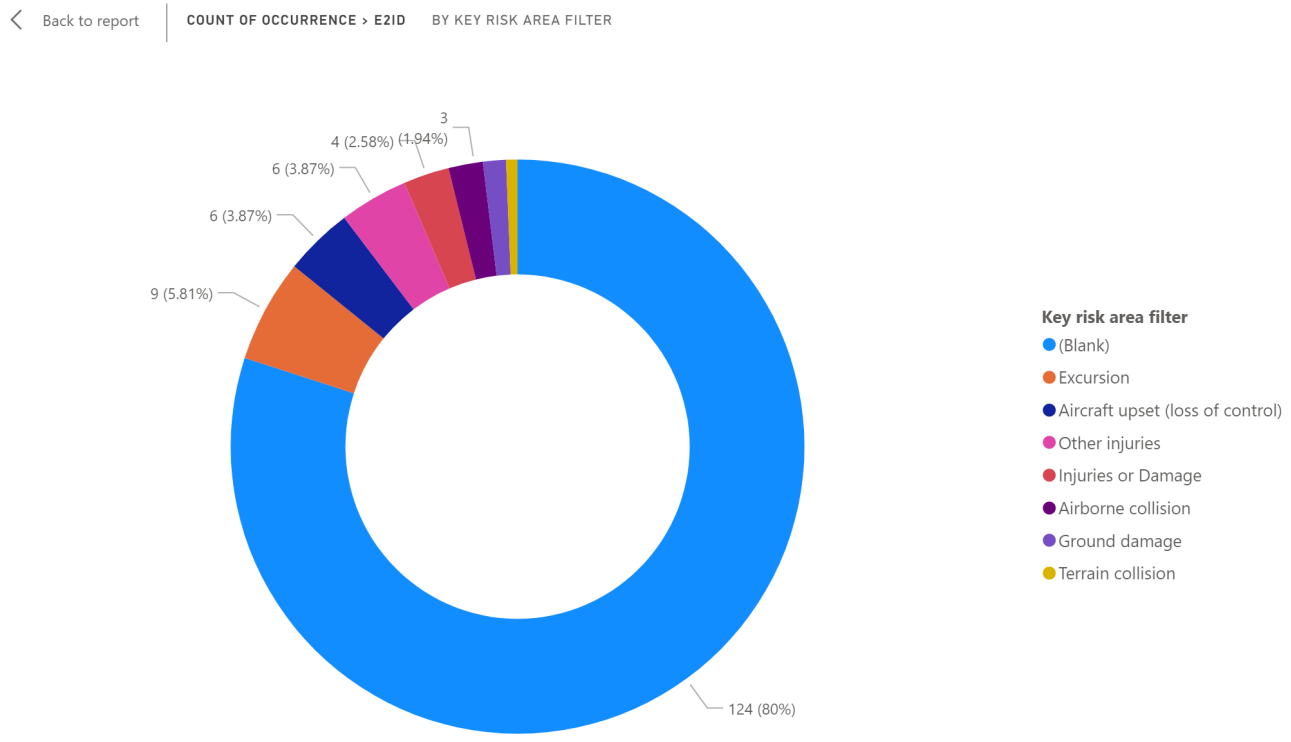

Figure 19: Key risk areas

Figure 20 shows the distribution of occurrences per month. There had been three peeks in March, January and July.

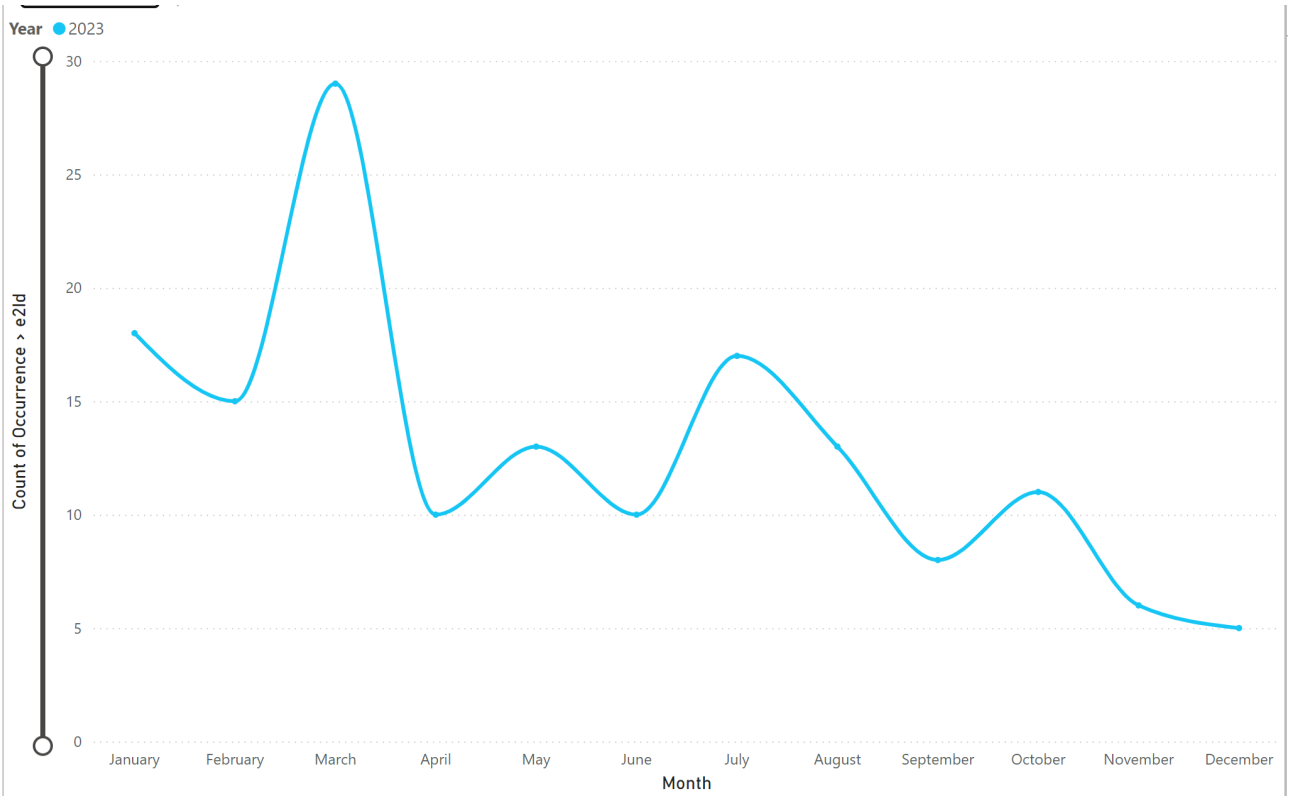

Figure 20: Distribution of occurrences per month

Figure 21 displays the distribution of events for 2023 fatigue related occurrences with effects on operations. In 16 occurrences issues related with flight crew staffing and scheduling, including cabin crew as reported.

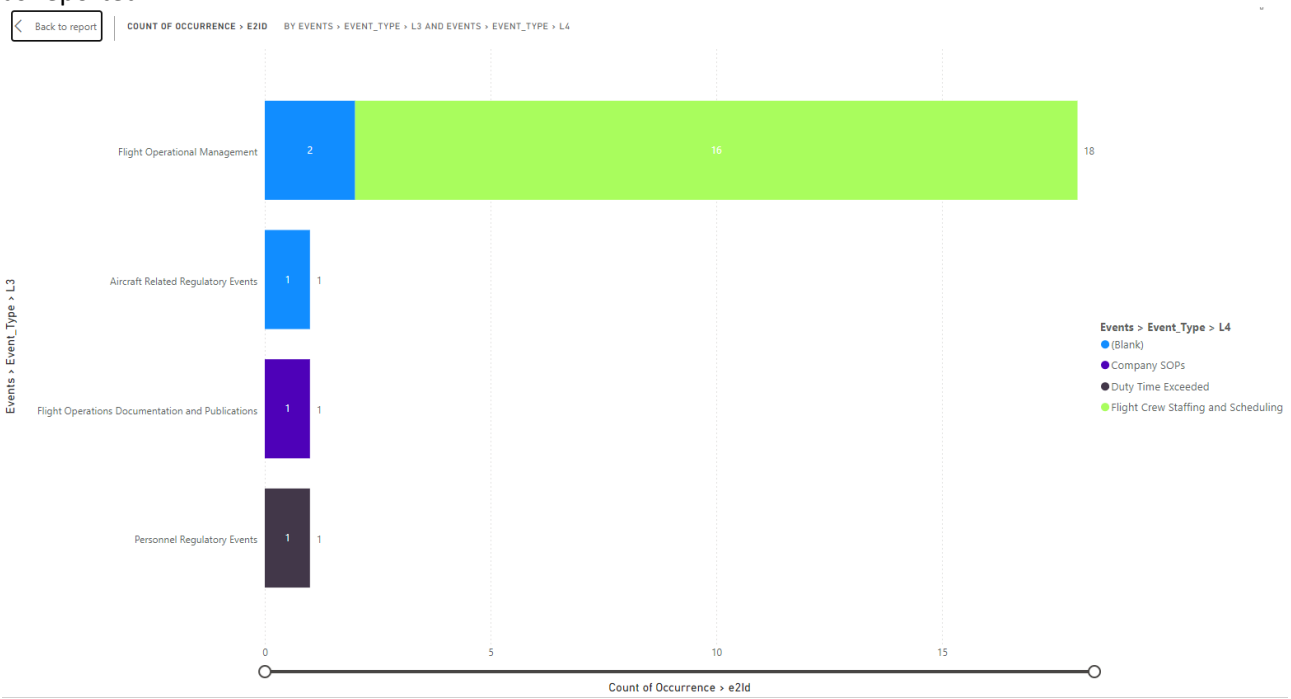

Figure 21: Distribution of organisational events

4.3 Focus areas review

In here the following focus areas will be reviewed: Commander's discretion, Duty time extension, Stand by duty, Rest time less than required, Tired, Acclimatisation, Multiple sector, Awake, Long night duty, and Controlled rest. These are stemming from the EASA SIB on traffic disruptions during summer, standardisation feedback, and identified factors from occurrences and discussions from subject forums.

4.3.1 Commander's discretion

To analyse the occurrences for the fatigue related occurrences having the commander's discretion component, the headline search for commander's discretion keywords was applied. The query returned close to 500 such occurrences for the review period. Figure 22 shows a step for 2022 and retaining it in 2023 for both absolute numbers and the rate.

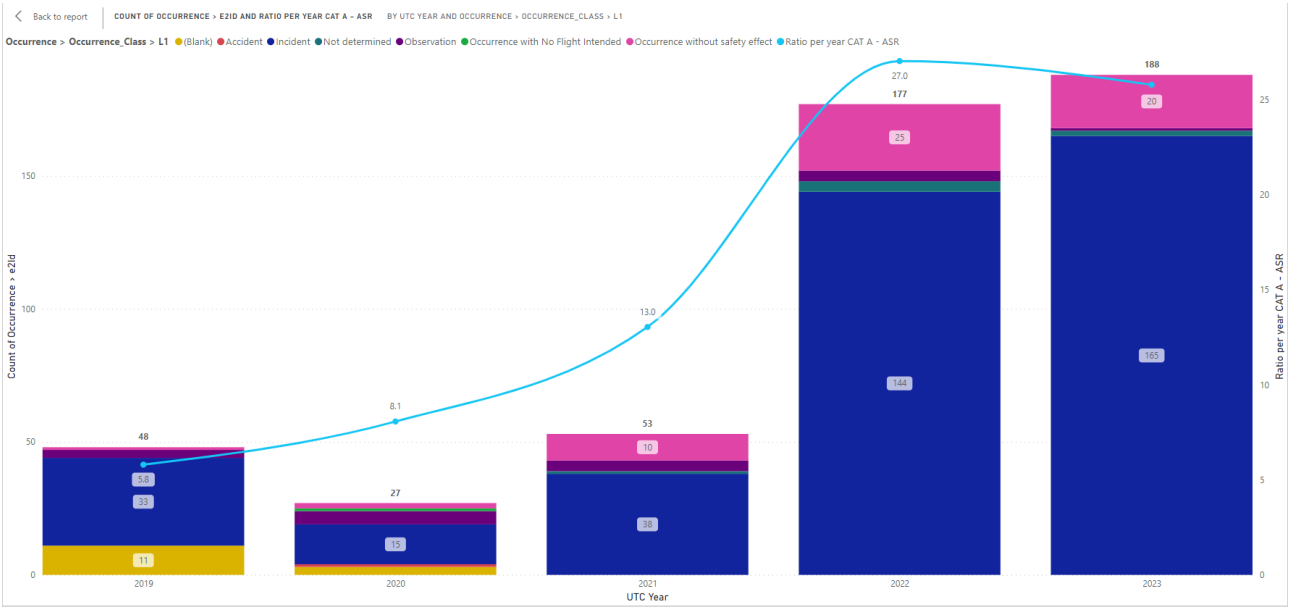

Figure 22: Distribution of commander's discretion keyword related occurrences and rate per one Million CAT IFR flights.

Figure 23 lists the event types associated with commanders discretion related occurrences. Majority of events have been Organisational events like duty time extension, duty time exceedance, crew below regulatory required minimum, or rest time less than required. Also in terms of ERCS, two highest are duty time extension, duty time exceedance event related scored occurrences. Most of consequences have been flight delays. Personnel related events mainly are fatigue related.

Operational events that may have triggered the commander's discretion, have been unexpected weather encounter, passenger boarding, closure of the aerodrome, performance calculations and windshear/microburst encounters related.

Majority of these occurrences have been reported by Swedish, German and Irish operators.

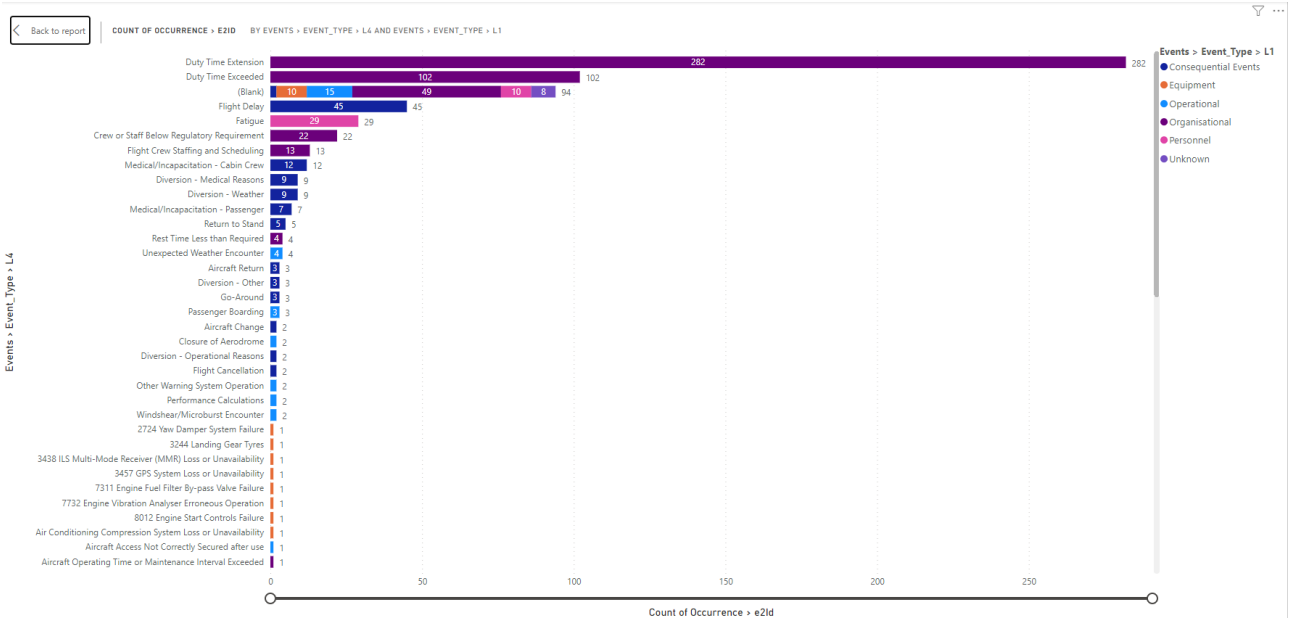

Figure 23: Distribution of commander's discretion keyword related occurrences and event types (list curtailed)

Taking a closer look at commanders discretion occurrences [29] with fatigue element in Figure 22, we can see that there has been an increase in 2023, when compared with previous years.

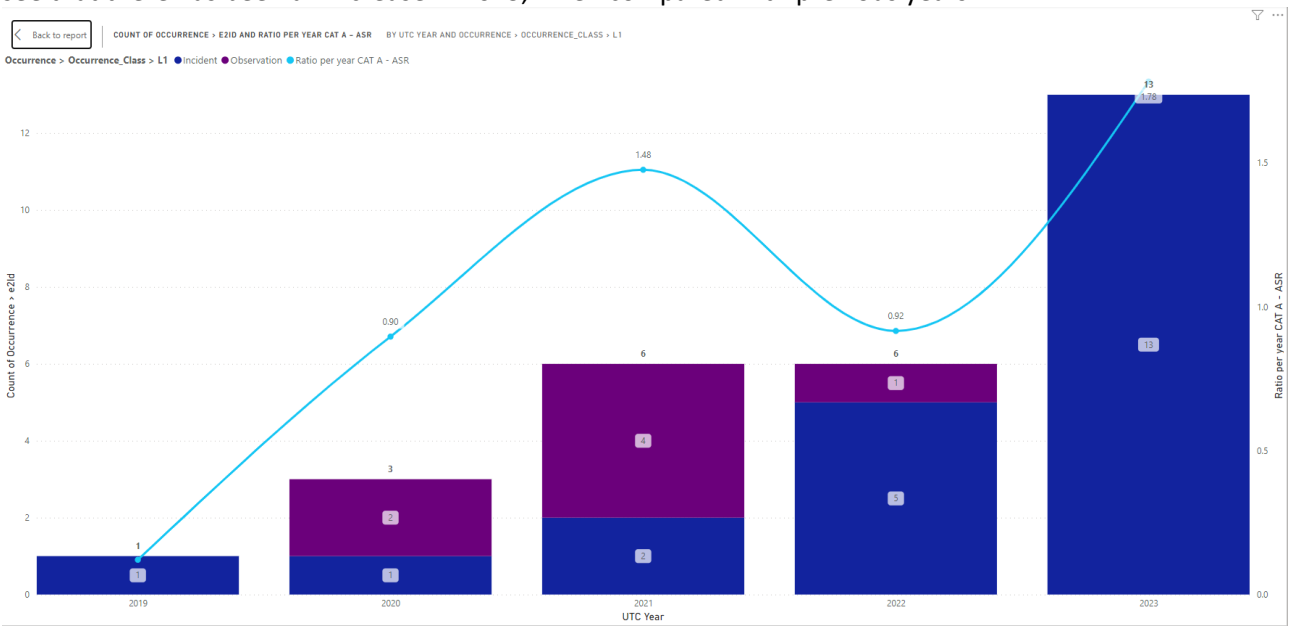

Figure 24: Distribution of commander's discretion keyword and fatigue related occurrences and rate

Figure 25 provides the distribution of event types for commander's discretion and fatigue related occurrences. There again the majority are Duty time extension related. Also Flight crew staffing and scheduling is appearing.

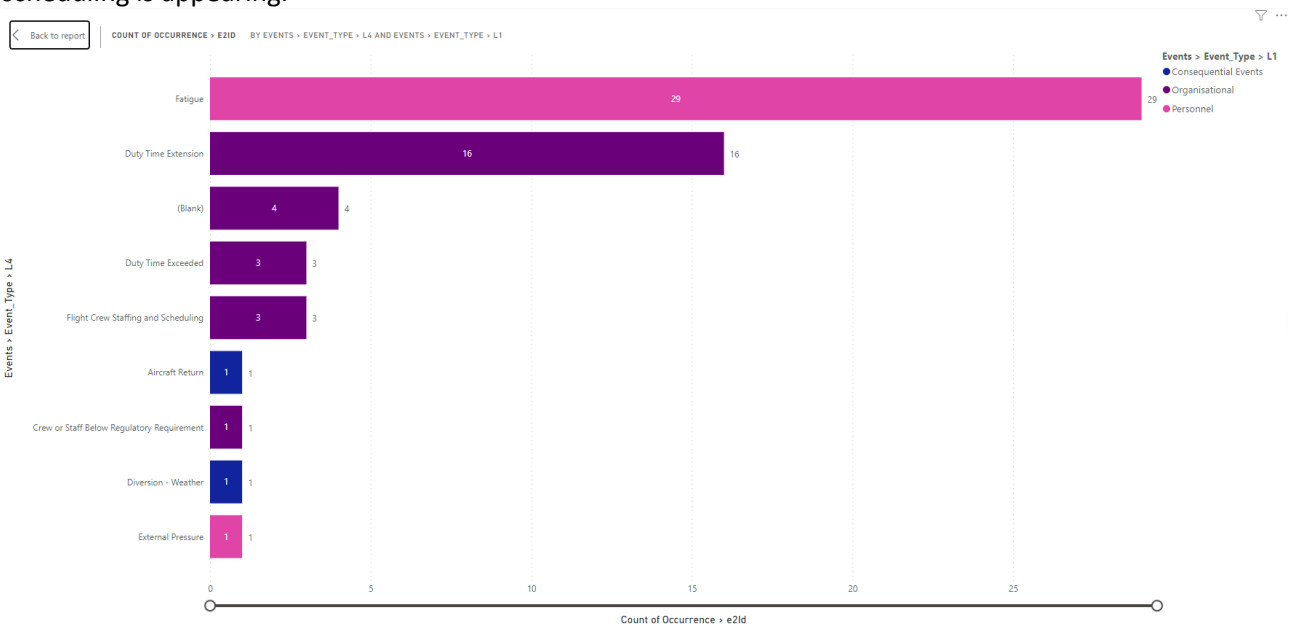

Figure 25: Distribution of commander's discretion keyword and fatigue related occurrences and event types

There is a need for competent authorities to review and operators to be aware of the adequate use of 'commander's discretion' – so it is not already foreseen in the roster planning and scheduling but is really used for unforeseen circumstances.

4.3.2 Duty time extension

If we look at the duty time extension related occurrences that cover the authorised or unauthorised extension of a person`s duty time, there have been more than 4100 such occurrences. Figure 26 reflects that there have been a significant step during the COVID-19 period of 2020. All the other years are comparable.

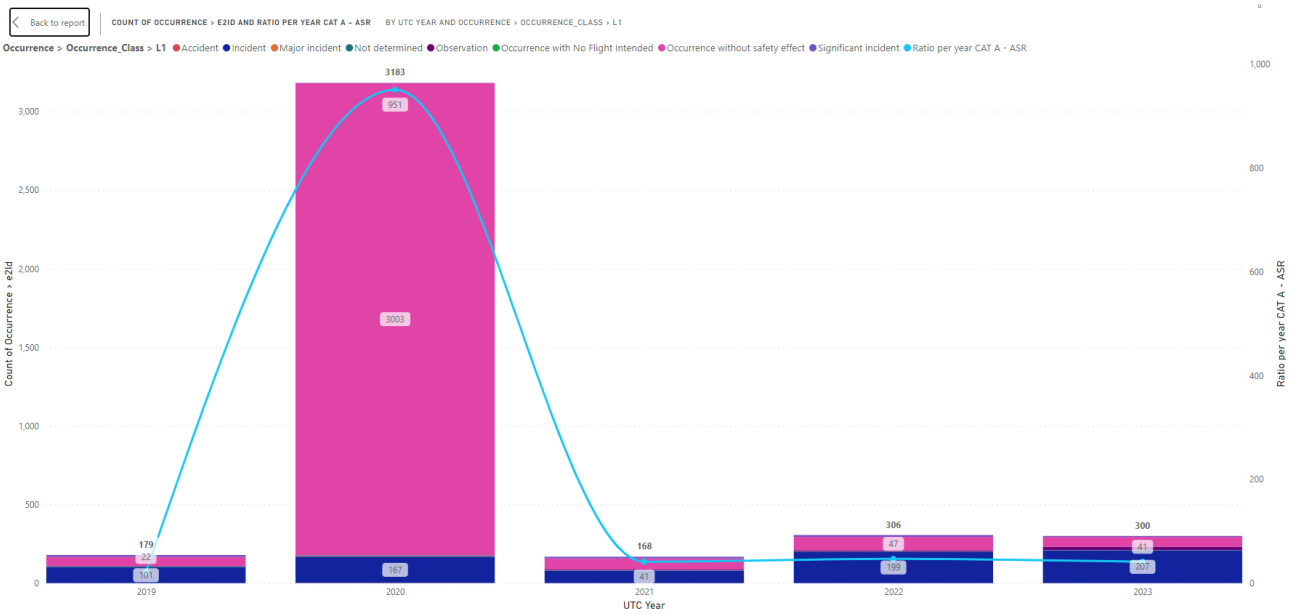

Figure 26: Distribution of commander's discretion keyword and fatigue related occurrences and event types

Figure 27 shows the event types encountered along the duty time extension. These have been mostly fatigue related. But also flight delay and flight crew staffing and scheduling related have occurred.

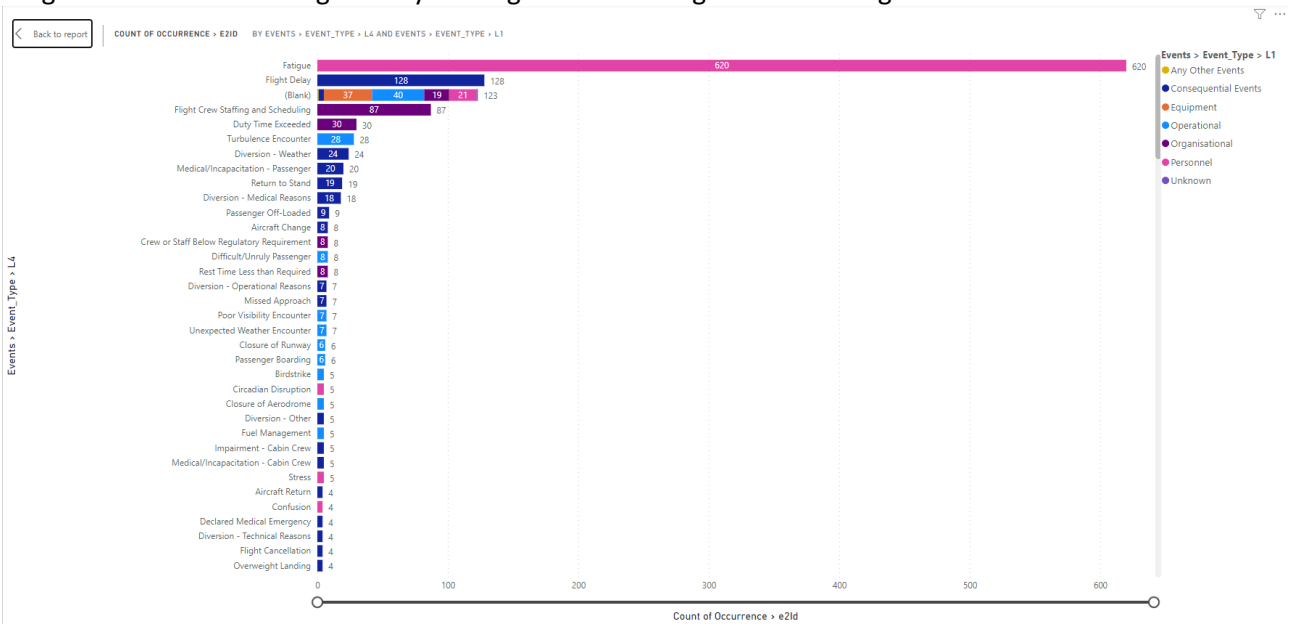

Figure 27: Distribution of duty time extension related occurrences (list curtailed)

Even there is a significant number of these occurrences, occurrences with operational consequences have been very limited.

4.3.3 Stand by duty

To retrieve standby duty related occurrences, headline search by relevant keyword was performed. There has been an insignificant number of such occurrences of 3 over the review period. In terms of events, these were flight crew staffing and scheduling related.

4.3.4 Rest time less than required

The rest time less than required by regulations occurrences amounting to 184 records has been distributed almost homogenously over the review period.

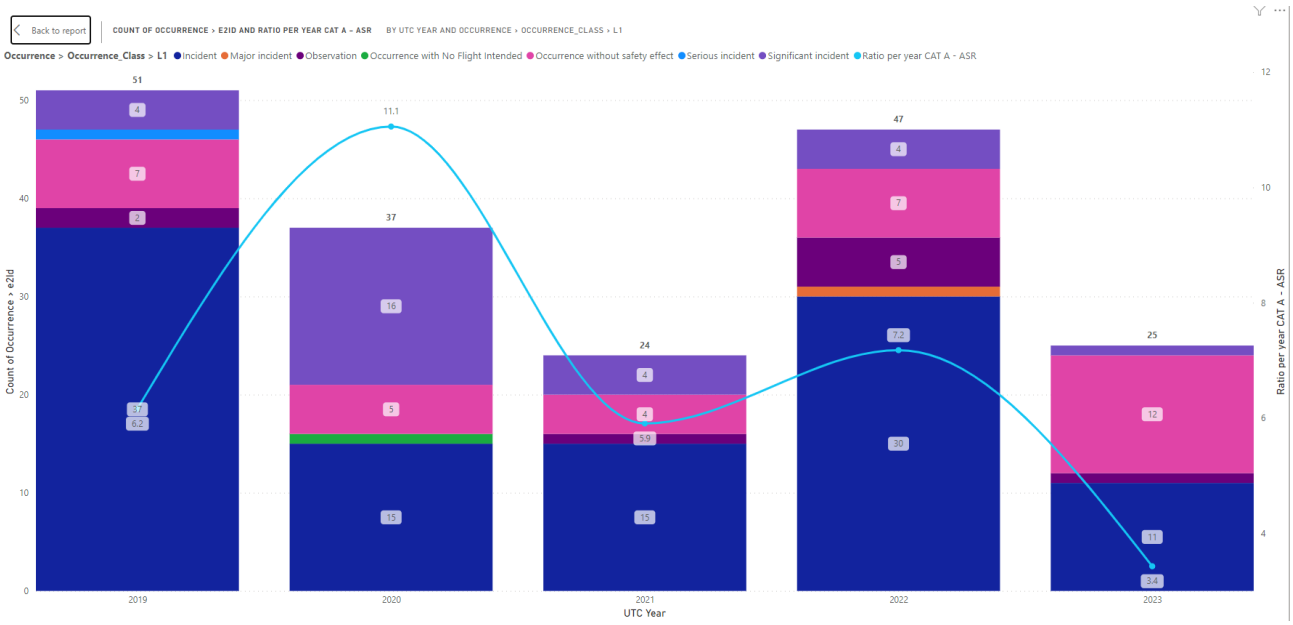

Figure 28: Distribution of rest time less than required related occurrences and event types

Figure 29 highlights the associated events of the rest time less than required related occurrences. The majority has been fatigue related coming from flight crew staffing and scheduling, duty time exceedance, and duty time extension.

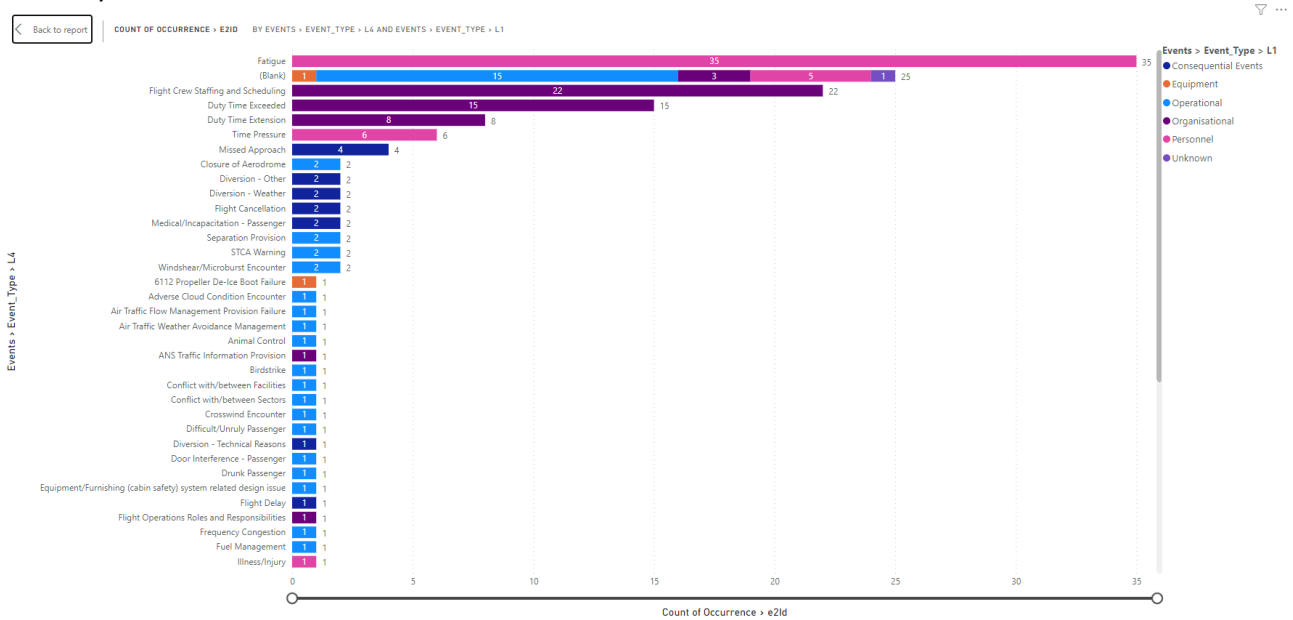

Figure 29: Distribution of rest time less than required related occurrences (list curtailed)

4.3.5 Tired

In this report a distinction between fatigue (accrued over period of time due to lack of sufficient or adequate rest) and tiredness (getting tired by the long day of duty, or a day with many ‘unexpected’ events) is made. In 92 occurrences tired has been mentioned in the headline. In 2022 the levels of 2019 were reached. However, 2023 has had a step to more than double of such occurrences when compared with 2019.

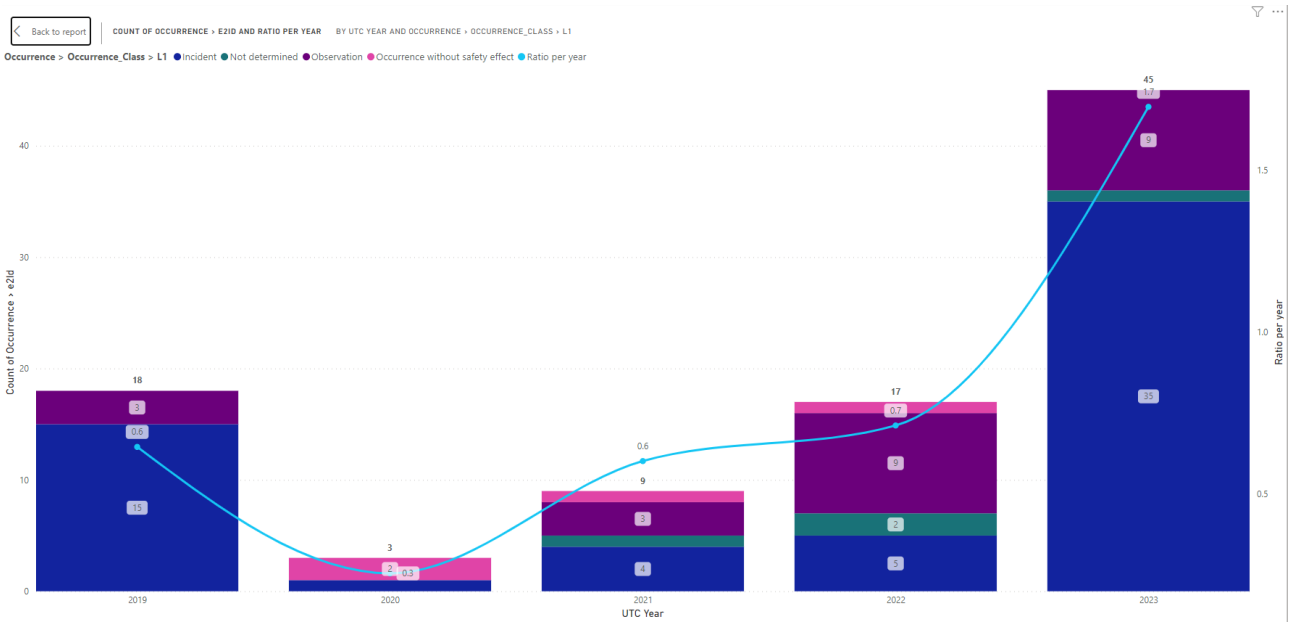

Figure 30: Distribution of tired keyword in headline occurrences

4.3.6 Acclimatisation

Acclimatisation involves occurrences involving crossings of multiple time zones. For the review period close to 70 occurrences were retrieved from the ECR that have been related with acclimatisation. According to Figure 31 majority of events occurred in 2019.

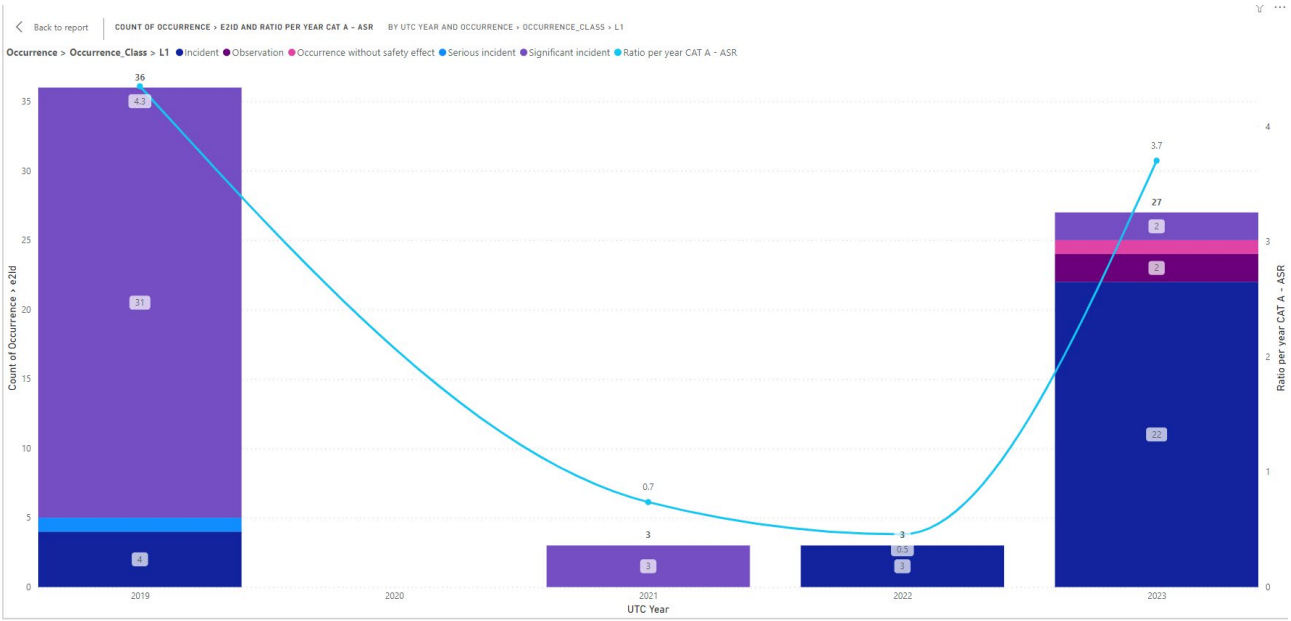

Figure 31: Distribution of acclimatisation related occurrences

In terms of events, as per Figure 32, majority are fatigue flight crew staffing and scheduling and circadian disruption related.

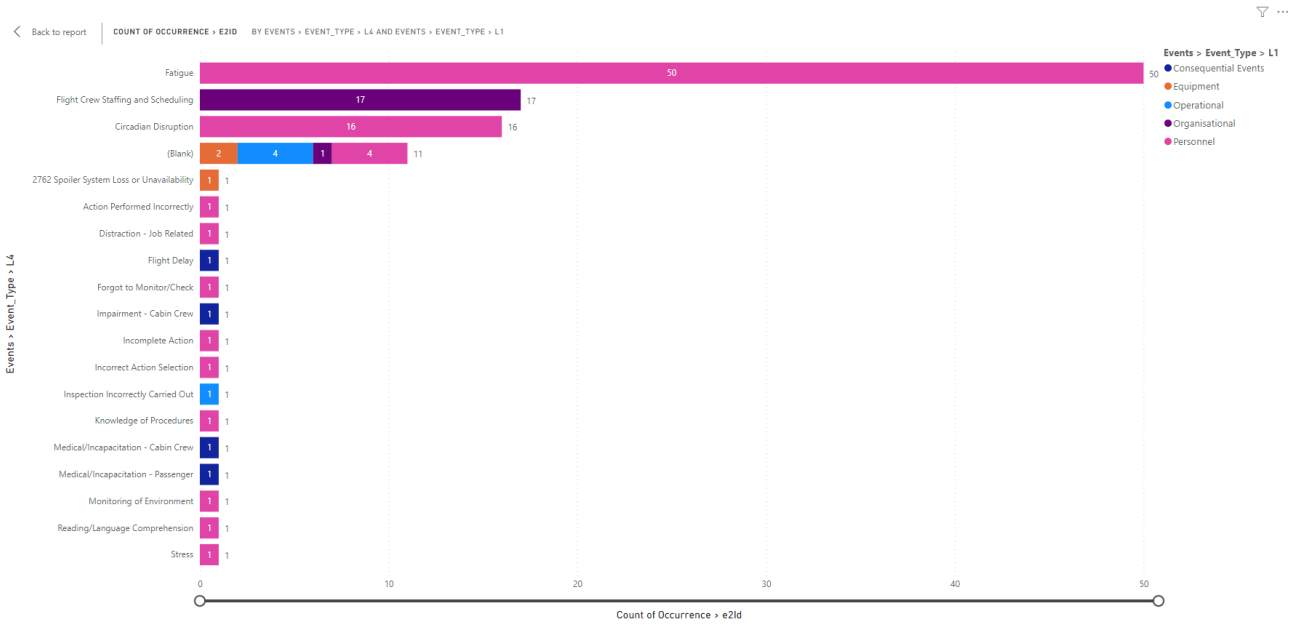

Figure 32: Distribution of acclimatisation related occurrences

It is worth noting that majority of these occurrences occurred in Japan and US in outstations, as well in Spain and Denmark.

4.3.7 Multiple sector

The dataset was also filtered by multiple sector keywords in the narrative. There have been a low number of 32 occurrences meeting this criterion. Figure 33 shows that this phenomenon has been more prominent in 2019, prior the COVID-19 pandemic. Multiple sector situations can mostly lead to being tired than fatigued (provided that all the sectors flown do not exceed FTL).

In the latest years this type of occurrences have occurred 6 to 5 times in 2022 and 2023 respectively.

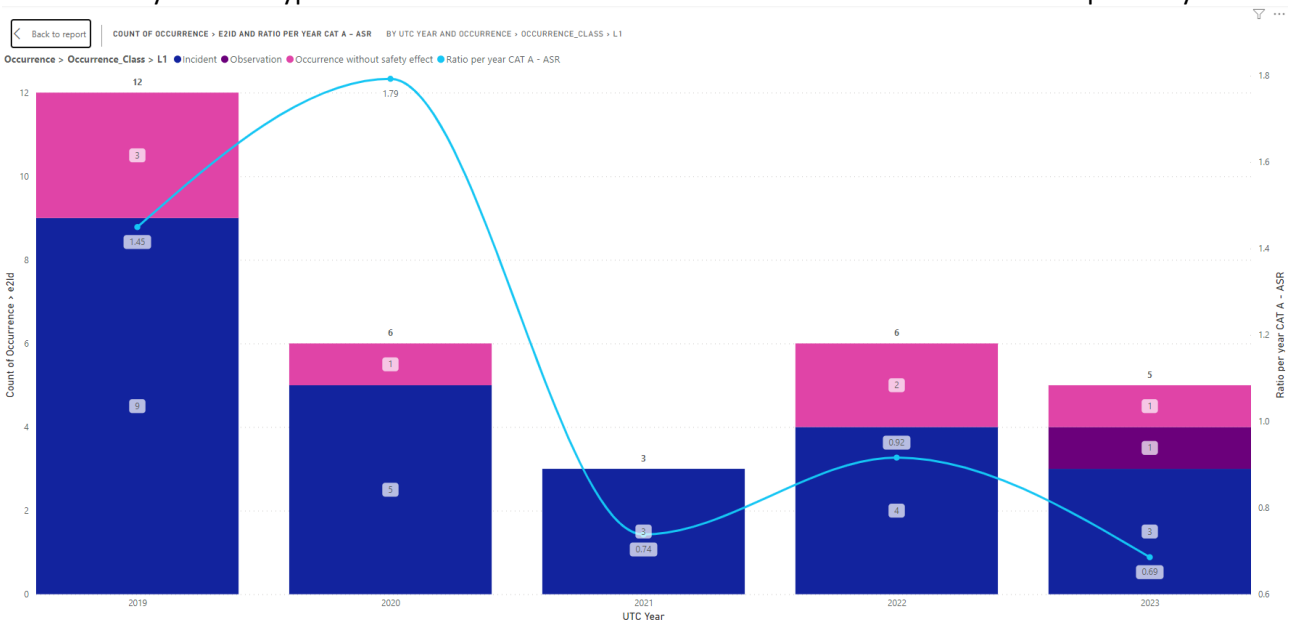

Figure 33: Distribution of multiple sectors keywords in narrative related occurrences

The associated event types for these occurrences were mainly fatigue related, caused by several technical failures, and consequentially resulting in diversions, aircraft return etc.

4.3.8 Awake

The dataset for the review period returned more than 1000 occurrences where awake keyword was found in the narrative. For both in terms of absolute numbers and rate the 2022 and 2023 are below 2019 levels.

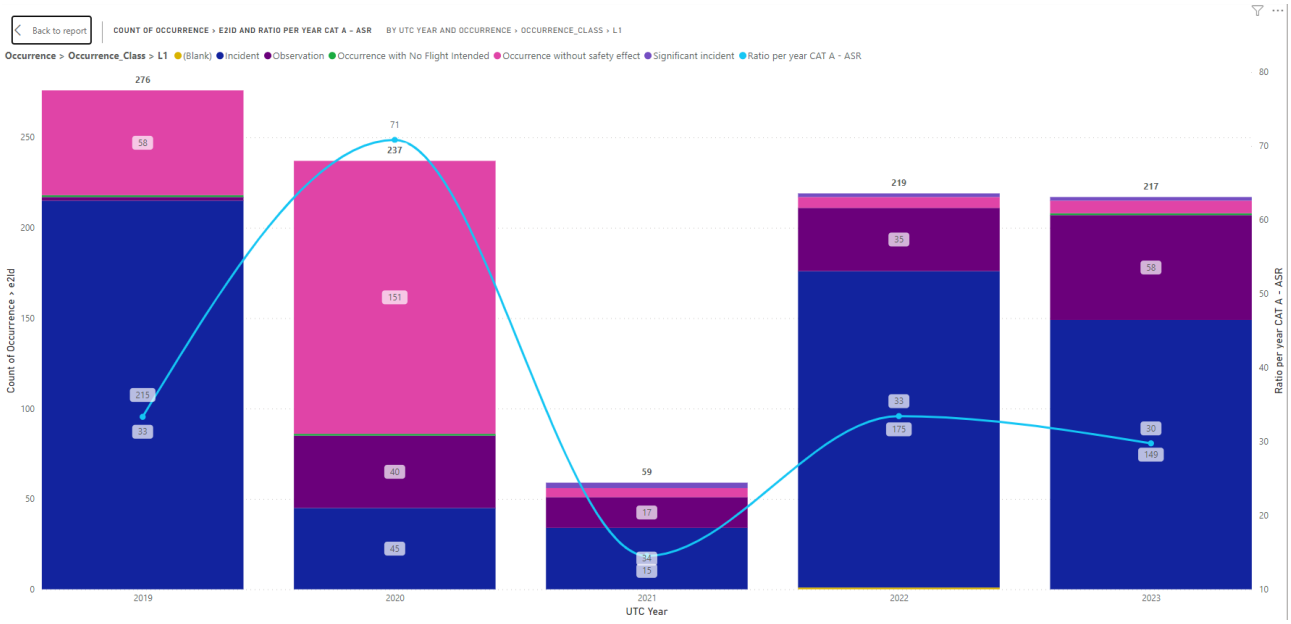

Figure 34: Distribution of awake keyword in narrative related occurrences

Majority of occurrences have been fatigue related. Then followed by organisational ones that are duty time extension and flight crew staffing and scheduling related.

4.3.9 Long night duty

The data set returns low number of 30 occurrences that are having the long night duty keywords in the headline. As it is shown in Figure 35, in terms of rate, it is elevated when compared with 2019 however well below the rate experienced in 2020.

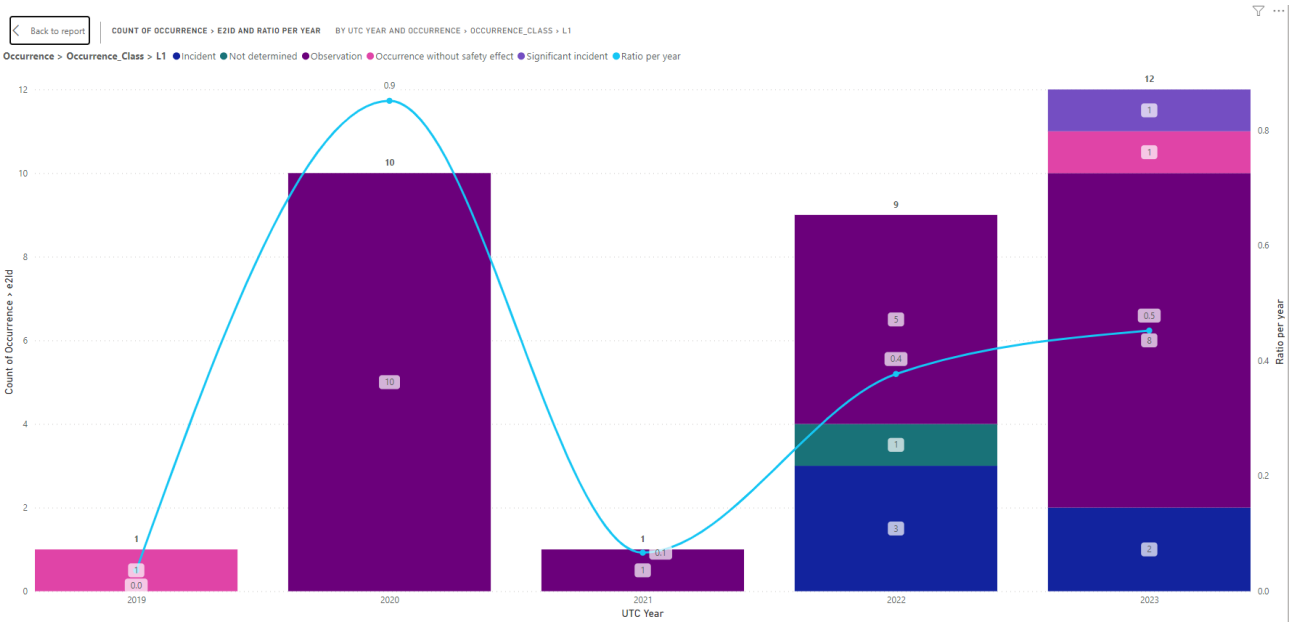

Figure 35: Distribution of awake keyword in narrative related occurrences

4.3.10 Controlled rest

For controlled rest keyword in the headline 25 occurrences were retrieved.

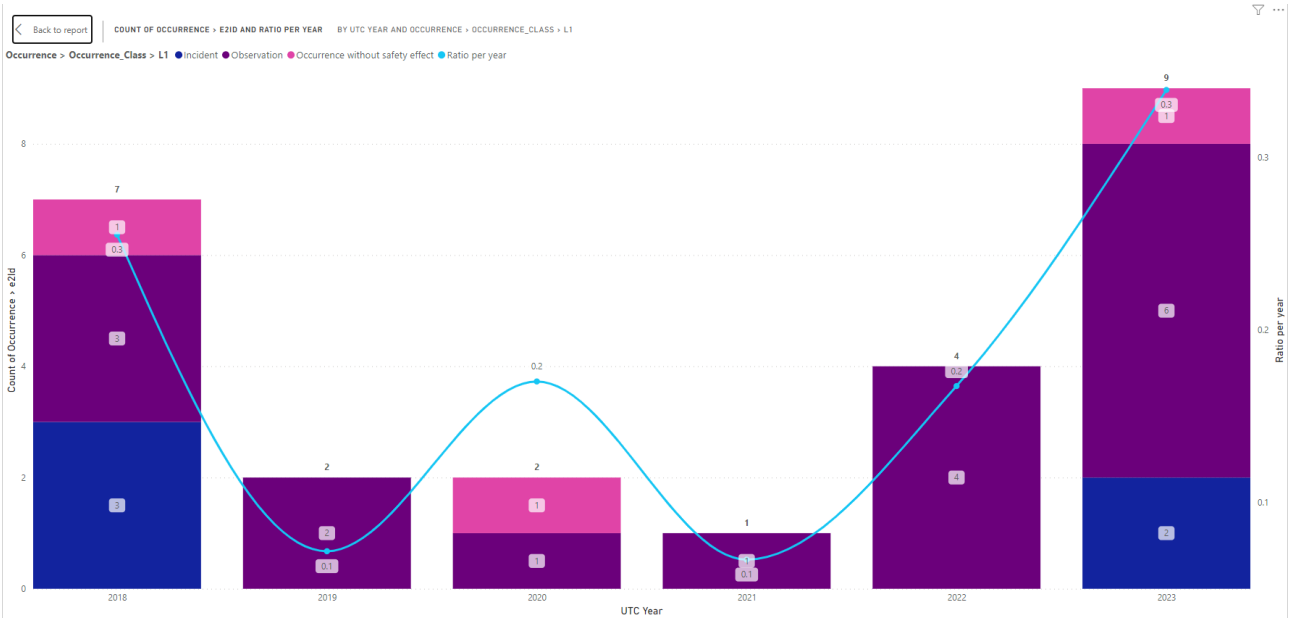

Figure 36: Distribution of controlled rest keyword in headline related occurrences

Here the majority of events were fatigue related. In one case there has been a prolonged loss of communication.
From the narrative:
CM1 feeling very tired and experiencing micro sleeps so implemented OMA 8.3.10.3.3 procedure for controlled rest for 30 mins. At end of controlled rest CM1 took a physiological break, stretched in the galley and used a hot towel to assist in combatting sleep emerita. CM1 returned to the flight deck, settled in and declared ready for duty and resumed PM duties. On handover, CM2 took the opportunity while SCCM was in the flight deck to also take a physiological break. CM1 was fully alert during this period, wearing headset but had not re-activated the VHF1 comm output. After approximately 4 mins, due to apparent quietness, CM1 requested radio check from Maastricht with no response, the VHF1 selector was found to be in the wrong position, normal communications were resumed following a second radio check with the switch in the correct position.

CM2 returned shortly afterwards, during the re-brief, an ACARS message printed asking us to contact Maastricht. His had already been accomplished and frequency changed to Copenhagen control.

It may be prudent to supplement the OMA with a checklist of ergonomic and anthropometric items that will be in non-standard positions during controlled rest, for example seating position for approach, comms setup, and display settings. A formal brief on position, changes, local traffic and changes in Meteorology at destination and alternate may also assist in resumption of situational awareness.

4.4 Conclusions after the occurrence narrative review.

First of all there is an apparent issue with the way occurrence reports are being handled by the states, as the practices of whether to include these occurrences in the ECR or not varies from one Member State to

another. Data is not always clear and make it challenging to understand the underlying factors or causes for the fatigue from information available in the European Central Repository.

This implies that from this data analysis it is not possible to determine if existing scheduling practices, FRM processes or and FTL requirements are fit for purpose and are averting the situation that aircrews are taking up duties while being fatigued, additional information is needed, such as information from the authority oversight activities.

Furthermore, it is evident that from the content of submitted fatigue reports is not possible to clearly deduce the contributing factors.

Also, reporting culture and openness for aircrews to report 'fatigued' needs to be assessed in a wider context within an operator – is this tolerated or there are possible direct or indirect repercussions.

4.5 Proposed actions

The following mitigating actions or recommendations are proposed as an outcome of this assessment.

4.5.1 To explore other data sources for aircrew fatigue assessment [STD, MST]

4.5.2 To provide guidance for operators and Member State authorities on fatigue related occurrence processing and ERCS application [MST, SPT.0057]

There is a lack of more homogenous approach for integration of the fatigue related occurrences in the European Central Repository by all competent authorities. Some Member States integrate all occurrences, some integrate parts, some do not integrate at all. Also the information available in the occurrence records is lacking the required level of detail to understand the outcomes of the investigation and analysis of those occurrences that do not allow to validate if present FTL and FRM provisions are sufficient to address this contributing safety issue. Follow up information is also not always available in the records.

The ECR records are also subject to the level of data quality that is ensured by the MS authorities, namely the event types coded, and narratives updated, lack of European Risk Classification Scheme being applied. All this, limits the possibilities to derive final conclusions on this topic and require additional sources of information to be reviewed, such as outcomes of the oversight activities in the area for FTL and FRM, with an especial focus on scheduled rosters versus the executed ones, in order to spot systemic issues at the rostering level, such as multiple sectors with little or no margin for delays, long night duties, consideration of trainings and other preceding duties, etc.

The use of EASA FTL/FRM INSPECTOR'S CHECKLIST, SUPPORTING MATERIAL FOR NAAs INSPECTORS, 2024 could be of use to collect such an information.

The guidelines should also include the review if 'commander's discretion' is being properly applied – so that it is not already foreseen in the roster planning and scheduling but is really used for unforeseen circumstances.

See also: ORO.FTL | EASA

4.5.3 Remind and maintain the focus on fatigue, its prevention, and consequences [SPT.0116, SPT.0117 and SPT.0118]

To remind the aviation community about the fatigue risk, necessity to comply with the FTL rules, not to schedule to the maximum, promote open reporting of fatigue, ensure that aircrews are involved in operations only when they are fit for duty (not fatigued).

Difference between being fatigued and being tired after a long day, needs to be educated to the aviation community.

4.5.4 To update the ECCAIRS taxonomy [NoA action]

The analysis and monitoring by existing ECAIRS taxonomy regarding fatigue is limited and does not optimally facilitate this task. Therefore, in this chapter the existing ECCAIRS taxonomy for event types is listed and new/modifications are proposed to better capture the fatigue related occurrences and enable a more structured monitoring, analysis of these in the future. This will facilitate a better monitoring of fatigue related occurrences and analyse them in the future. This is an initial proposed list that needs a review in a wider FRM/FTL experts group. The present value 'Fatigue - Events involving an individual or a crew/team collectively being affected by fatigue' needs to be improved towards:

Personnel → Physiological Events → Personnel Alertness and Fatigue Events:

Existing in the taxonomy:

- Fatigue [proposal to deactivate]

New (proposed):

- Fatigue – flight crew member
- Fatigue – cabin crew member
- Fatigue – air traffic control officer (ATCO)
- Fatigue – technician or mechanic
- Fatigue – ground handling employee
- Fatigue – other aviation personnel
- Fatigue affecting performance – flight crew member
- Fatigue affecting performance – cabin crew member
- Fatigue affecting performance – air traffic control officer (ATCO)
- Fatigue affecting performance – technician or mechanic
- Fatigue affecting performance – ground handling employee
- Fatigue affecting performance – other aviation personnel
- Tired – flight crew member
- Tired – cabin crew member
- Tired – air traffic control officer (ATCO)
- Tired – technician or mechanic
- Tired – ground handling employee
- Tired – other aviation personnel
- Tired, performance affected – flight crew member
- Tired, performance affected – cabin crew member
- Tired, performance affected – air traffic control officer (ATCO)
- Tired, performance affected – technician or mechanic
- Tired, performance affected – ground handling employee
- Tired, performance affected – other aviation personnel
- Tired due to multiple sectors flown
- Fell asleep, micro nap, microsleep (related)

Organisational → Regulatory → Personnel Regulatory Events:

Existing in the taxonomy:

- Duty Time Exceeded
- Duty Time Extension
- Rest Time Less than Required

New (proposed):

- Stand by duty related aspects: Stand by duty not counted in the FTL, retrospective change of stand by duty, stand by duty swapped to split duty, last minute change from late to early stand by duty, conflicting stand by duty, etc.
- Commander's discretion – pressure to apply: Pressure to apply Commander's discretion, or Commander's discretion already included in the roster planning.
- Commander's discretion – proper application
- Controlled rest applied or used – Controlled rest procedure is a countermeasure to manage unexpected fatigue, and it is organised by the commander, if workload permits.
- Controlled rest misused – improper application of controlled rest. Controlled rest procedure is a countermeasure to manage unexpected fatigue, and it is organised by the commander, if workload permits.
- Disturbance outside stand by duty times: Operational control contacting the crewmembers outside the rostered stand by duty times.

Organisational → Organisational Management → Flight Operational Management:

Existing in the taxonomy:

- Flight Crew Staffing and Scheduling (An event related to the planning and scheduling of flight crew (includes cabin crew))

Amend (proposed):

- ~~Flight~~ Aircrew ~~Staffing and~~ Scheduling and Rostering (An event related to the planning, scheduling, and rostering of flight crew (includes cabin crew))

New (proposed):

- Aircrew rostering – multiple sectors scheduled: Multiple sectors scheduled with no or limited margin for delays or unforeseen circumstances.
- Aircrew rostering – long night duty scheduled: Long night duty scheduled that may contribute to the fatigue or tiredness.

5 Conclusions

There have been no aircrew fatigue related occurrence confirmed to be a serious incident or accident (2019-2023) according to the ICAO Annex 13 and R996/2010 in the dataset for CAT fixed wing operations.

When focusing on the aircrew related fatigue occurrences involving operations with CAT fixed wing aeroplanes, overall a significant increase for both absolute numbers and rates are noticed for 2022 and 2023.

There is insignificant number of fatigue related occurrences for CAT Rotorcraft operations, thus making impossible to analyse and derive conclusions.

Considering that the number of safe flights taking off, and a rate of 21 confirmed fatigue related occurrences for aircrew per one million flights in 2023, the situation in general could be perceived to be under control. But this may be a misleading conclusion as it is subject to reporting culture and data quality of the records in the ECR. To conclude, the rostering and its execution (planned vs executed) review at the operator level is needed, as part of the oversight activity by competent authorities.

All in all there has been a significant number of occurrences, reported over the review period from 2019-2023 and coded with 'fatigue' event type, with an increasing trend for the rate, occurrences per million flights for aviation personnel covering all domains.

In terms of risk classification aggregated scores for 100 occurrences with ERCS scored, mainly for 2023 occurrences[12], the highest risk key risk areas are collision on runway (runway incursion by a vehicle – one occurrence high risk), aircraft upset and airborne collision. This shows that fatigue have negative effects upon actors' abilities and vigilance and normally exacerbates the situation or contributes to errors and lapses.

Unstable approaches have been one of the most common event type, however in terms of ERCS aggregated score, runway incursion by a vehicle, separation minima infringement and configuration warning related are the highest risk ones.

Flight delay has been the most common outcome event in terms of number of occurrences, however as per ERCS score, go arounds have been with the highest risk. It is important to note that go-around even risky in its execution is a safety net that allows to repeat an approach for a safe landing.

There are four states of operator, where the more than half of occurrences are stemming from. What about others? There could be different reasons for that, good reporting culture being one of them.

The occurrence narrative review for 2023 occurrences with operational events, shows that there have been 21 occurrences per one Million flights, where fatigue played a role to the safety of operations, that in comparison to the GNSS outages and alterations that were around 1700 occurrences per one Million flight in the same period. The full-scale analysis of the European Risk Classification is not possible yet, as only 20% of these occurrences have the ERCS score.

For the focus areas, the following can be concluded:

- Commander's discretion reports have significantly increased for 2022 and 2023 in both absolute numbers and rate. Associated events per numbers and aggregated ERCS score are duty time exceedance and extension.
- Vast majority of Duty time extension related occurrences have been experienced in 2020 during the pandemic.
- Even as the number of occurrences is low, there is a steady increase in occurrences where the term 'tired' is mentioned in the headline.
- Long night duty related occurrences, even with low number, have increased when compared with 2019, especially for 2020, 2022 and 2023.

All in all, it can be concluded that fatigue is a factor that does contribute negatively on aviation safety. It cannot be taken in isolation, as fatigue facilitates errors introduced by aircrews.

However, the quality level of information in occurrence records in the European Central repository is rather poor, follow-up information missing, and underlying factors for the causes of the fatigue are challenging or even impossible to be derived. This implies that for a complete assessment, additional information is needed, such as information from the oversight activities on FTL/FRM. Refer to the action in 4.4.1.

[12] The requirement to apply the ERCS classification on all occurrences in the ECR is applicable since Jan 1, 2023.

It is also recommended to remind and maintain focus on fatigue, its prevention, and consequences, see chapter 4.4.2.

To facilitate the better analysis of fatigue related occurrences, ECCAIRS taxonomy needs to be updated with relevant values that are proposed in chapter 4.4.3.

The activity of assessment should be repeated once all occurrences since 2023 onwards are ERCS scored by authorities as per regulation, as well as using fused data in the D4S.

Best Intervention Strategy
"Aircrew Fatigue"

Attachment A: Acronyms and Definitions (Optional – if required)

ECR – European Central repository of occurrences

APPENDIX B – SAFETY ISSUE ANALYSIS "SI-3005 Fatigue in non-aircrew personnel"

1. Executive Summary

Note on bundling the Safety Issues related to fatigue:
SI-3005 addresses fatigue across all aviation personnel other than flight and cabin crew. By contrast, SI-0039 focuses exclusively on flight and cabin crew within the FTL/FRM regulatory framework. The two SIs are complementary and intentionally form a total system approach: SI-0039 concentrates on aircrew specific rules and oversight, while SI-3005 targets cross domain culture, technology, scientific evidence and implementation support for non-crew roles. Activities should be coordinated to avoid duplication.

Summary of the Safety Issue Assessment		
1	**Problem**	Problem 1: Apart flight and cabin crew having currently dedicated rules, and to a lower extent ATCOs, there is no policy to support the other aviation domains to address the fatigue safety risks. Problem 2: This can be reflected by the fact that >58 000 ECCAIRS occurrences linked to fatigue were reported between 2019 and 2025, where about 52 000 do not have sufficient information on fatigue. There is a problem of data reliability to face if we want to manage the safety risks appropriately. Indeed, Regulation (EU) No 376/2014 requires reporting of any occurrence that may represent a significant risk. Problem 3: For non-aircrew personnel, this number of occurrences might be the sign of a problem for which its criticality cannot be yet addressed adequately.
2	Stakeholders	Non-aircrew personnel, for instance: Aerodrome operators; ATM/ANS providers; ATSEP; CAW entities Part-145, Part-CAMO and Part-CAO; ATO/DTO; FSTD operators; ground handling organisations; Apron management service providers ; flight operations officers/dispatch.
3	ESC Decision	It was decided that problem 2 (lack of data reliability for non-aircrew safety event) is the most prominent issue to tacle in priority. It was concluded to work on taxonomy refinements (linked to BIS15 "Aircrew Fatigue" action 6) and clearer guidance for those coding fatigue occurrences for non-aircrew personnel. It is proposed to use the current Member States Tasks for these purposes: o MST.0002 Promotion of SMS o MST.0043 Improvement of data quality in occurrence reporting

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2 Safety Issue Assessment

2.1 Introduction and purpose

The EASA Safety Risk Management process aims to manage aviation safety risks in an integrated manner, with the objectives of:

1. Prioritising safety actions which are most efficient in reducing risk levels
2. Ensuring adequate internal and external coordination on both key aspects of the Safety Risk Management, which are:
   - The identification and assessment of safety issues,
   - Identifying existing mitigating actions, and
   - The programming of safety or mitigating actions
3. Providing transparency on why the Agency takes certain actions

In order to achieve these objectives, the Agency has established structured links between safety intelligence processes (safety analysis and performance) and safety action related processes (integrated programming, rulemaking, certification, organisations oversight, standardisation, safety promotion, corrective action in reaction to a safety problem/operational directives). These links should foresee the need for an assessment of both the risks levels associated to certain safety issues, and an assessment of the efficiency of intended safety actions, in order to enable prioritization. The scope is here limited to global or systemic safety issues that may affect European aviation products, services, or European passengers.
A safety risk portfolio is the domain specific, common repository for recording and documenting the outputs of the above mentioned tasks. Within the Human Factors Safety Risk Portfolio, the safety issue 'fatigue and quality of sleep' has been raised.
This paper documents the safety issue assessment carried out by the Assessment Team. It provides data and expert judgement, in addition to making specific recommendations regarding how best to manage this safety issue. This supports the governing bodies of the SRM process in their evaluation of the need for safety actions.

2.2 Definition of the Safety Issue

Fatigue is defined by ICAO as 'a physiological state of reduced mental or physical performance capability resulting from sleep loss, extended wakefulness, circadian phase, and/ or workload (mental and/ or physical activity) that can impair a person's alertness and ability to perform safety related operational duties.' [13]
Sleep quality is defined by ICAO as the 'capacity of sleep to restore waking function. Good quality sleep has minimal disruption to the non-REM[14]/REM cycle. Fragmentation of the non-REM/REM cycle by waking up, or by brief arousals that move the brain to a lighter stage of sleep without actually waking up, decreases the resporative value of sleep.'
Fatigue is repeatedly identified as one of the most serious challenges within the industry. The signs of fatigue are subtle and will lower human performance. The aviation industry relies on competent, trained, rested people that are physically and mentally fit to perform their duties to ensure safety and efficiency. The nature and amount of work, the physical and emotional environment, opportunities to rest and the quantity and quality of sleep all affect fatigue levels. The management of fatigue levels requires that:

[13] ICAO DOC 9966 Manual for the Oversight of Fatigue Management Approaches
[14] Rapid eye movement

- Organisations provide the conditions, facilities and guidance to support their employees to be fit for duty; and
- Individuals take responsibility for using their rest periods and other activities to be fit for duty and report to their organisation if they feel that they are, or will become, unfit for duty.
- This is enabled by the organisation having a positive safety culture

Amongst the conditions provided by organisations is the ability for employees to predict or plan ahead in terms of working time and free time, enabling individuals to plan their private life and manage their rest effectively.
Although technologies are increasingly becoming available to assess fitness for duty, organisations and individuals need to use these with caution. Such measures must be validated, both scientifically and for the operational context in which they are being applied. Examples include performance vigilance tests, online cognitive testing, personal wrist worn activity monitors, mobile apps, physical assessments (wobble boards), task-load assessment, computer fatigue modelling software, as well as numerous other methods. It is often said that individuals are poor judges of their own physical and mental state, but if an individual is reporting unfit these tools should not be used to claim otherwise.
Despite extensive regulations and guidance on fatigue, it remains one of the most commonly raised issues when discussing human performance. In addition, quality of sleep, wellbeing is less well regulated than the duration of a rest period, or duty time limits. Therefore, its contribution to fatigue and the means of ensuring quality of sleep should be considered. Social connectivity, family time and predictable work schedules are all important contributors to fatigue.
Many, many reports have been written regarding fatigue and the status of fatigue regulations. However, while the science of fatigue is well-established and regulations are in place nationally and internationally, it is still being raised as a safety issue, not only by the HF CAG, but by the domain CAGs, not only within EASA but also within the industry as a whole. Why does fatigue remain an issue in domains where specific fatigue regulations are limited or absent? What are the obstacles to minimising fatigue as an issue for aviation professionals?
Regulations are developed in collaboration with those they affect and those who will have to implement them. Organisations operate within practical, financial and safety constraints. These constraints and inputs to regulations create inevitable trade-offs with the scientific basis on which the regulations should be based. Equally, if the scope of fatigue regulations is expanded without an exploration of the effectiveness of the regulatory approach, then the same issues are replicated elsewhere. More broadly, continuing cost pressures, staffing constraints and operational volatility can create incentives - organisational and individual - that unintentionally normalise extended duty patterns or insufficient recovery. Trade-offs also exist in personal management of fatigue, and the absence of a means of monitoring this means that this can often be the area where blame for fatigue is placed. However, personal privacy, trust, safety culture and national culture are all difficult to overcome.
Methods of objectively measuring fatigue and the ability to predict the impact of fatigue on human performance are improving, which may help to make fatigue management more effective. They may also help to demonstrate to people when they are fatigued, since individual perception is subjective, thus providing greater acceptance of what the science is telling us.
What is now needed are some pan-professional recommendations, which can be embedded in safety management, on how to manage fatigue.

2.3 Who is affected?

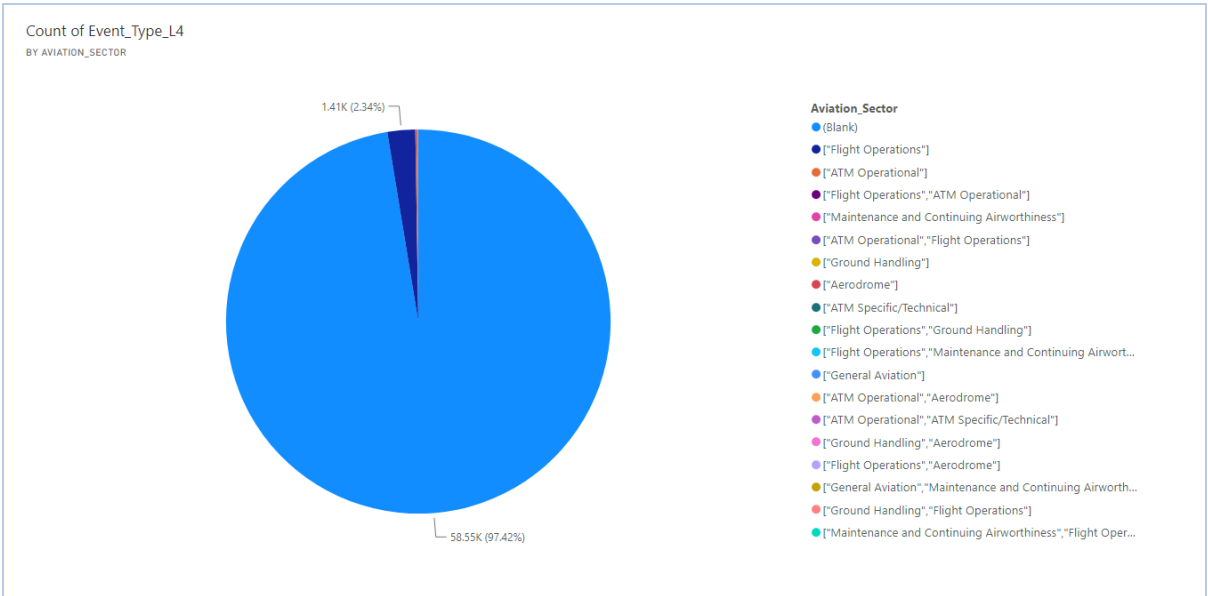
Within EASA remit, the scope covers aerodrome operators under Regulation (EU) 139/2014 with explicit SMS obligations; ATM/ANS providers subject to Regulation (EU) 2017/373, which sets management system (SMS) requirements and ATSEP competence provisions; and CAW entities Part-145, Part-CAMO and Part-

CAO where management system duties are embedded in the framework. It also includes training organisations (ATO/DTO) and FSTD operators, which operate under management/quality systems with safety elements (with FSTD governed by CS-FSTD), as well as ground handling organisations brought under the new EU rules (2025/20 and 2025/23) with competent authority oversight and the related Air Ops amendment (2025/24) aligning operator responsibilities.

In addition, some functions are addressed through certified entities SMS and interfaces rather than direct certification: apron management service providers are covered via the aerodrome framework (procedures and SMS under Regulation (EU) 139/2014) and flight operations officers/dispatch are addressed through the air operator SMS (Part-ORO), including their interaction with ground handling as clarified by the 2025 Air Ops amendment.

2.3.1 Global analysis

ECCAIRS contains 58 205 occurrences from 2019 to 2025 where fatigue is coded.
At the outset of the analysis, it was established that the representation of fatigue across operational domains could not be reliably assessed for datasets exceeding 52 000 records. Additional verification was performed to determine whether the Aviation Sector field could help clarify the operational context of the fatigue coded occurrences but the result came back with approximately 97 % of entries blank.
The lack of detail highlights the limited availability of contextual information in occurrence data and reinforces the need to interpret fatigue through the event type coding structure rather than by sector.



Data as of 28/10/25
Filtered by Event_Type_L1 (is Personnel), Event_Type_L4 (is Fatigue), Year (is less than or equal to 2025), Year (is greater than or equal to 2019)

Given these limitations, the subsequent analysis further focuses via the event types (L1-4) on identifying how fatigue is represented across different operational domains.

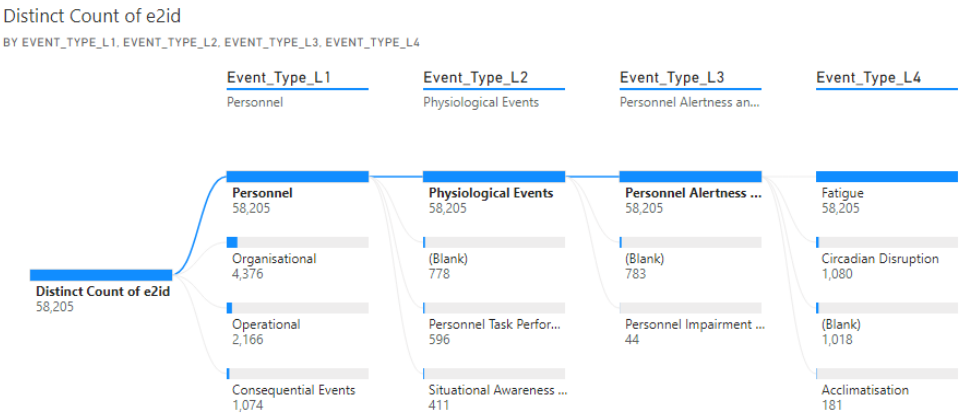
2.3.2 In-depth analysis

Analysis of ECR data for 2019–2025, filtered for all occurrences where fatigue was coded anywhere in the event chain, provides three key insights:

Fatigue is almost exclusively recorded as a "Personnel" event only

Among 58 205 fatigue coded occurrences 'Personnel' was the only consistently coded event type. An additional event type was present in 7-12% of the records, allowing partial inference of originator domain in those cases. For the remaining >52 000 records, no structured field permits originator attribution; proportions of flight vs non-flight reporters could possibly (if an indication is present) be derived by manual review or post-hoc recoding, which was not performed.

- This pattern reflects that most of the time reporters and analysts are capturing the observable fatigue symptom without linking it to its operational or organisational contributors.
- Capturing the observable fatigue symptom mostly without linking it to its operational or organisational contributors suggests that many fatigue entries originate from direct self initiated reports or front line observations, which are less likely to include contextual coding[15].



Data as of 27/10/25
Filtered by Year (is less than or equal to 2025), Year (is greater than or equal to 2019), _Fatigue (is not (Blank) or 0)

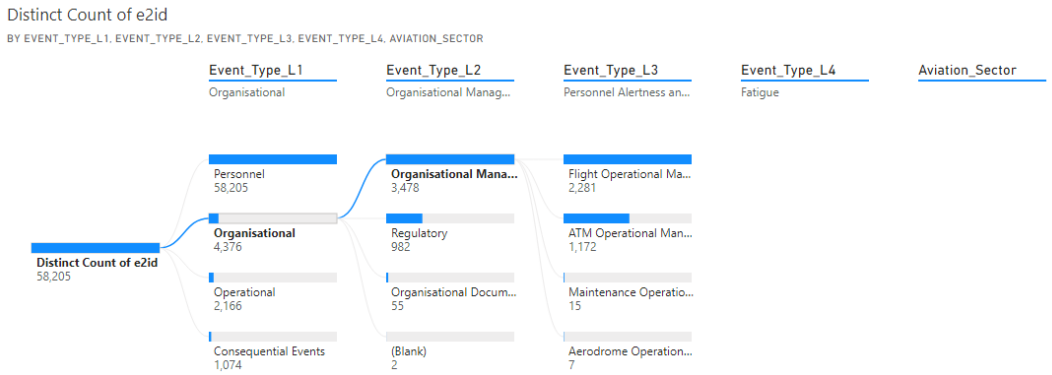
Systemic and organisational signals are nevertheless visible across domains

4 376 occurrences in addition to Personnel, also include Organisational coding, mainly under Organisational Management (3 478) and Regulatory (982).
Within Organisational Management, fatigue is associated with:

- Flight ops management (2 281)
- ATM ops management (1 172)
- Maintenance ops management (15)
- Aerodrome ops management (7)
- Production ops management (2)
- Design ops management (1)

[15] In safety analysis, "under-coding of contextual factors" is a known phenomenon. Literature on HF taxonomies (e.g. HFACS, Reason's model) notes that analysts tend to document proximal human actions over latent organisational conditions unless guidance or training explicitly requires multi-level coding.

Implication - data suggest that fatigue is recognised as part of broader organisational and oversight responsibilities across multiple domains, though analysts or reporters do not always apply the appropriate event types or cross links when entering fatigue related data. As a result, the data under represent how often fatigue is connected to organisational or operational causes, even though such links may exist in practice.



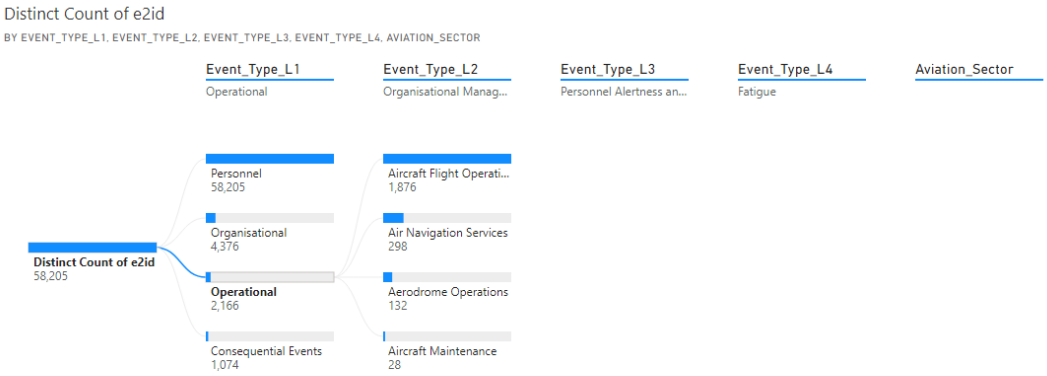
Data as of 27/10/25
Filtered by Year (is less than or equal to 2025), Year (is greater than or equal to 2019), _Fatigue (is not (Blank) or 0)

Operational level coding reinforces this cross-domain presence

2 166 occurrences, in addition to Personnel and Organisational, also include Operational coding and further connect fatigue to:

- Aircraft Flight Operations (1 876)
- Air Navigation Services (298)
- Aerodrome Operations (132)
- Aircraft Maintenance (28)
- Aircraft Design (25)
- Aircraft Production (1)

Implication – besides flight operations, fatigue related risk appears in ANS, aerodrome and maintenance, design and production operational processes.



Data as of 27/10/25
Filtered by Year (is less than or equal to 2025), Year (is greater than or equal to 2019), _Fatigue (is not (Blank) or 0)

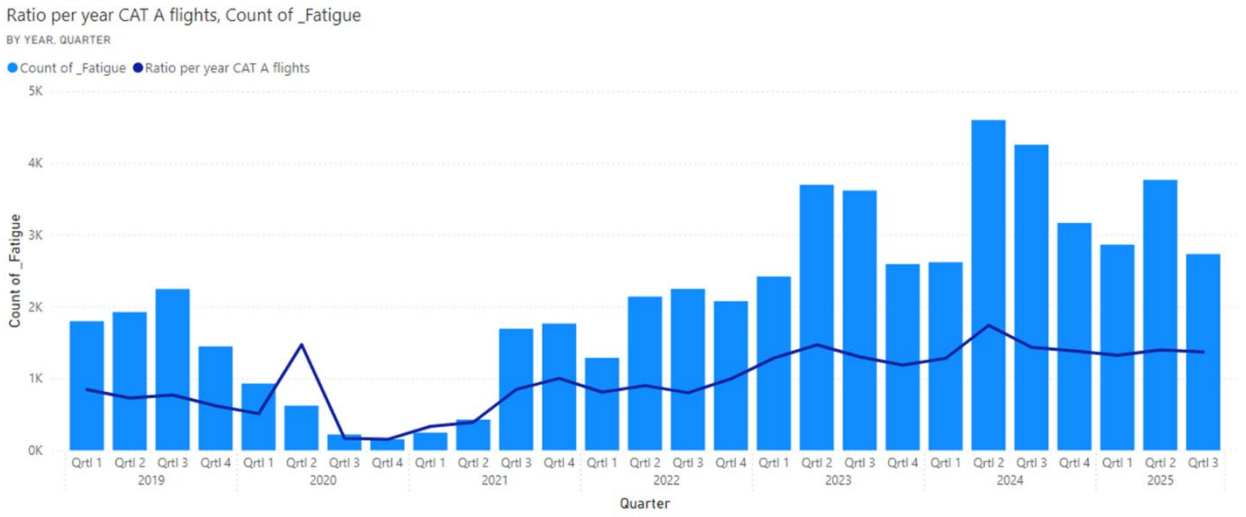
Summary:
Analysis of 58 205 fatigue-coded occurrences (2019–2025) shows that all contain a Personnel → Physiological → Fatigue entry, with about 88 % recorded only at this level and roughly 12 % cross-coded with Organisational, Operational or Consequential event types. This reflects a recognised reporting pattern in ECCAIRS 2, where front line or self initiated reported events do not include the appropriate event types or cross links when entering fatigue related data. As a result, the data underrepresent how often fatigue is connected to organisational or operational causes, even though such links may exist in practice. The pattern where majority of the records are coded only under Personnel, does not mean that fatigue occurs only at the individual level but it reflects the tendency to document the immediate human symptom without linking it to the broader organisational or operational context. The limited contextual data nonetheless reveal fatigue signals under Organisational and Operational categories across domains including ATM, aerodrome and maintenance.

Overall, the evidence indicates that fatigue is documented mainly at the individual level and occurs across multiple domains.

2.4 Assessment methodology

The team spent several meetings identifying the main barriers to preventing fatigue in the operational environment, focusing on organisational culture and the potential for implementing new technology. In addition, in the Task Team safety issue assessment of fatigue in the context of the COVID-19 pandemic, a bow-tie model was developed. Many of the issues identified via the bowtie analysis (Annex 1) are still valid in the current operational context.

The principle data source for this issue was the European Central Repository. For >52 000 fatigue coded occurrences the operational domain cannot be reliably determined without manual narrative review or post-hoc recoding and even then may remain unknown if the reports do not state the role of the originator. The graph below therefore presents fatigue reports in aggregate across domains.



SI-3005
Data as of 29/9/25

Studies, reports and articles reviewed for this safety issue assessment are listed below:

- EASA report '[Effectiveness of Flight Time Limitation]', published 28th February 2019
- Research project into the effectiveness of Flight Time Limitation (FTL), delivered on 1 April 2025. Details of this project can be found [here].
- 'Scheduled napping as a countermeasure to sleepiness in air traffic Controllers', Signal, T.L., Gander, P.H., Anderson, H. and Brash, S. (2009), Journal of Sleep Research, 18:11-19.
- 'Effects of pre-sleep simulated on-call instructions on subsequent sleep', Wuyts, J., De Valck, E., Vandekerchove, M., Pattyn, N., Exadaktylos, V. Haex, B., Verbraecken, J. and Cluydts, R. (2012), Biological Psychology, 91:383-388.
- 'Activity trackers: Can they really help you get fit?' https://www.health.harvard.edu/blog/activity-trackers-help-you-get-fit-2017102312594
- 'Fitness for duty: A 3 minute version of the Psychomotor Vigilance Test predicts fatigue related declines in luggage screening performance' M. Basner, J. Rubinstein (2011) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3190077/
- '3-minute smartphone-based and tablet-based psychomotor vigilance tests for the assessment of reduced alertness due to sleep deprivation' D. Grant, K. Honn, M. Layton, S. Riedy, H. Van (2016) Dongen https://link.springer.com/article/10.3758/s13428-016-0763-8

2.5 Risk assessment of the scenarios

The scenario posited for the safety issue assessment is that fatigue management is difficult to implement to a high standard. The reasons for this were identified via discussion in the group and via a review of occurrence reports, evidence was supplied for these reasons and solutions were proposed. In this sense, if the safety issue assessment were presented as a bow-tie model, the hazard would be poor fatigue management implementation, with the threats being the reasons identified and the proposed solutions as barriers.

It should be noted that the fatigue task team established as a result of the COVID-19 safety risk portfolio developed a bow-tie model for fatigue in the context of operating in the pandemic. This bow-tie model and its accompanying recommendations remain valid 18 months later. The report prepared by the task team has been published on the EASA website and is available here. The bow-tie model is available in annex 1 to this SIA.

List of problems

Rules/ regulations can be interpreted differently by different actors

Where fatigue related provisions are newer or less explicit, organisations can lawfully arrive at very different practices (e.g. compressing permissible duties into short periods versus distributing them more evenly to protect recovery), especially in highly seasonal roles. This variability is compounded by uneven occurrence reporting practice in ECCAIRS as fatigue contributors are often recorded under operational event types or left in narratives, so signals are missed when queries rely on narrow fields. To resolve this issue, existing regulations and responsibilities need to be better explained. Additional guidance on the intent and means to comply with what is required should be developed.

Fatigue Management is a medium to long term investment

Fatigue management requires data, monitoring and adjustment. The benefits are therefore not always immediate relative to the cost of the initial investment, which may include the cost of data collection and analysis, reduced working hours or constraints to rostering/ scheduling of staff and recruiting staff for fatigue management. Only after this investment will the gains of FRMS and increased business flexibility be realised.

To resolve this issue, we should clarify the intent of applicable requirements and how they should be applied in non-crew contexts and issue concise compliance guidance with examples. Support organisations with reporting aids so fatigue factors are captured consistently under Regulation (EU) 376/2014 and the organisation management system to improve both oversight and comparability without creating new rules.

All actors in the system are involved (or need to be involved) in fatigue management

The notion of shared responsibility is central to fatigue management. Fatigue in the work place cannot be isolated from personal fatigue and personal responsibility, personal life has to go hand in hand with organisational decisions, rostering and human resources.

Everyone need to understand the intrinsic dependabilities of professional decisions, organisation of work and personal decision personal choices.

Lack of understanding of the technologies that are becoming available to objectively monitor fatigue

Technologies that objectively monitor fatigue are starting to become available. In order for these to provide a positive effect on fatigue management, they need to be properly understood by users. It can be difficult for organisations and individuals to appreciate the capabilities and limitations of such tools, leading to the risk of inadvertent misuse or simply not using the tools to their full capability.

2.6 Existing Actions

The EU rules and actions relating to fatigue that have been published in the EPAS are limited so far to flight and cabin crew. The rulemaking tasks concerning the development or update of flight and duty time limitation (FTL) rules for flight crew are not considered here, as the recommendations in this Safety Issue Assessment (SIA) do not relate to the Aircrew domain. Ongoing activity and new proposed actions addressing flight crew fatigue are in BIS15 "Aircrew fatigue SI-0039".

Apart from the Regulation (EU) 2017/373 and the ATCO Fatigue Study which aims to assess the effects resulting from the implementation of the regulation (*https://www.easa.europa.eu/en/domains/air-traffic-management/atmans-workforce-air-traffic-controller-%28ATCO%29-fatigue*) there are no other ongoing EPAS actions or studies specifically addressing fatigue in other domains.

3 Baseline scenario-– What would happen if there is no additional action?

It is not possible to forecast changing levels of fatigue and the future risks posed by fatigue without speculation. However, looking at the issues identified, if no additional action were to be taken then the following situations may evolve:

1. With current ECCAIRS fatigue related reporting practice, the understanding of fatigue risk will remain incomplete and largely limited to individual level data. The current practices capture the presence of fatigue but very rarely its operational or organisational context. We know that fatigue is present in occurrence data (58 205 records since 2019) but we do not know where in the system it originates or how it interacts with organisational and operational factors (>52 000 records lacking context). This limits the ability to detect emerging fatigue trends across domains and to prioritise effective mitigation actions.

2. Where fatigue management expectations are not explicit for non-crew domains, differing interpretations can emerge. Under commercial pressure some organisations may adopt minimal practices, creating an uneven playing field. The EU principle of a level playing field should guide consistent expectations and oversight for non-crew fatigue management within SMS. Without targeted support on what effective fatigue risk management looks like for non-crew roles, organisations tend to meet only a minimum standard. Ongoing guidance that translates the latest science into practical, role-specific measures is needed so that FRM within SMS is applied optimally and consistently across non-crew personnel. In the absence of information regarding the joint responsibilities of the employer and employee in managing fatigue, there will continue to be a disconnected and thus sub-optimal approach to managing fatigue.

3. There is a growing market for objective sleep monitoring tools, such as apps and smart watches. With no interventions, there will be a lack of guidance on the proper use of these tools, their capabilities and limitations. It is very likely that the use of these tools will bring benefits to individuals, but misuse of these tools also bears the risk that personnel could be fatigued without realising.

In a fundamental sense, if no action is taken, nothing in the system will change. The nature of the fatigue issue is that it is affected by social changes as well as aviation system change. As such, risks may increase outside of the control of the aviation regulatory framework.

4 Intervention objectives

The overall objective of the interventions are to reduce the risks posed by fatigue for non-aircrew personnel, through reducing both its prevalence, severity and the severity of the potential consequences of fatigue. Specifically, the proposed actions seek to:

- Ensure that individuals have a reliable, objective means of monitoring their personal fatigue;
- Ensure that organisations have the right organisational culture and management accountabilities, so that:
    - fatigue risk management is a normal activity and is used to support safe, efficient and effective operations;
    - individuals are able to report fatigue without fearing negative consequences;
    - organisations know when and how to react to rising fatigue levels

- Ensure that scientific advances in predicting and objectively identifying fatigue are able to be incorporated into organisations' fatigue management programmes;
- Ensure that fatigue considerations are systematically embedded in existing requirements (e.g. occurrence reporting under Reg. (EU) 376/2014 and SMS obligations) by the authorities and organisations so application and oversight are thorough, consistent and evidence based.

5 Proposed actions

5.1 List of proposed actions

Action number	Action title	Issue	Objective	Type of action (RMT, SPT, RES, MST)	Scenario number to which it is linked (where applicable)
1	*Guidance on fatigue monitoring apps and smart technology*	*Apps and 'smart' technology exists to warn individuals that they may be fatigued, but they have strengths and limitations that the user must be aware of and understand.*	*Ensure that individuals can benefit from the technology that exists, while guarding against over-reliance or misuse.*	*SPT*	*4*
2	*Promote and educate positive organisational culture and behaviour to senior managers*	*Organisational cultures that are negative prevent reporting of human performance related issues, such as fatigue.*	*Ensure that senior managers establish positive organisational cultures that are robust even in times of crisis and ensure occurrence coding with appropriate information to assess fatigue events.*	*SPT*	*3, 2*
3	*Develop material to support implementation of fatigue requirements in the Member States*	*Consistent and good quality application of fatigue management in organisations can be supported by regulatory oversight.*	*Ensure that good practices surrounding fatigue, including those not explicitly referencing duty time limitations or fatigue management (e.g. occurrence reporting and*	*SPT*	*1*

			safety management) are applied and overseen in a thorough and consistent manner.		
4	*High quality, regular reviews of scientific advances in prediction and identification of fatigue.*	*Scientific advances in the prediction and identification of fatigue continue to be made, but it can be challenging for organisations to identify good quality and up to date material.*	*Ensure that scientific advances in predicting and objectively identifying fatigue are able to be incorporated into organisations' fatigue management programmes, by publishing regular and high quality reviews of the available science.*	*RES (on the basis that this is a more in-depth and science led activity than an SPT).*	*2*

5.2 Detailed definition of proposed actions

Guidance on fatigue monitoring apps and smart technology

There is a proliferation of fatigue monitoring apps and smart technology, but users need to be aware of the strengths and limitations of this technology in order to use it safety and effectively. Keeping on top of the latest developments and ensuring that aviation professionals are using technology of a suitably high standard is not an easy task for individuals. As a result, it is recommended that an inventory of currently available technology, its strengths and limitations is developed, maintained and promoted to aviation professionals. This action should be comprised of four steps:

1. Development of criteria with which to assess fatigue monitoring technology
2. Assessment of currently available technology
3. Safety promotion of the technology
4. Regular update of the assessment and the safety promotion material

Promote and educate positive organisational culture and behaviour to senior managers

By definition, organisational culture is slow to change. However, senior managers can lead changes to organisational culture and behaviours. Organisational culture training courses aimed at senior managers are already in development, therefore this safety promotion aims to promote the need for such senior management knowledge, skills and attitudes (competence) in the area of fatigue management. As such the SPT needs to outline that:

- fatigue risk management is a normal activity and is used to support safe, efficient and effective operations. Fatigue risk management systems are a medium to long term investment, requiring investment in both establishing and maintaining the FRMS, in equipment or software and personnel, in ensuring that the system is integrated in the overall safety management system and as such is updated in alignment with the SMS.

- Because the determination of whether an individual is fatigued is subjective and rests solely with that individual, fatigue reporting is always a voluntary act. This is in spite of the fact that occurrence reports relating to fatigue are mandatory under Regulation 376/2014[16]. Therefore, if an organisation is to manage fatigue adequately, it must also ensure that individuals are able to report fatigue without experiencing negative consequences.
- Levels of fatigue in an organisation can change for a variety of reasons and these are not only related to the aviation working environment, but also external circumstances. Effective fatigue monitoring not only needs to establish whether levels have changed and define acceptable limits, but also identify circumstances where they should have changed but haven't, and why. Accountabilities and decision-making processes should be clearly defined in advance, rather than waiting for the situation to arise and wondering what to do.

Develop safety promotion material to support implementation of fatigue requirements in the Member States

Consistent and good quality application of fatigue management in organisations can be supported by regulatory oversight. Since fatigue management interfaces with other regulatory requirements, such as Management Systems and occurrence reporting, the full scope and meaning of fatigue management needs to be properly outlined.

The safety promotion material should outline not only the scope and meaning of requirements relating to fatigue, but it should also show the relationships between different requirements. Information should also be included regarding fatigue management in different domains and how these might be applied in organisations that employ different types of aviation professional.

Finally, the means of overseeing the application of fatigue related requirements and of viewing all the different explicit and implicit requirements as a whole should be outlined and then described in detail. Consideration should be given to auditing techniques and the assessment of organisational culture, since fatigue management may be nicely documented but poorly applied.

High quality, regular reviews of scientific advances in prediction and identification of fatigue.

Scientific advances in the prediction and identification of fatigue continue to be made, but it can be challenging for organisations to identify good quality and up to date material. Expert knowledge and ample time are resources that are simply out of reach for many organisations.

In order to ensure that scientific advances in predicting and objectively identifying fatigue are able to be incorporated into organisations' fatigue management programmes, EASA should initiate a research study to first establish a high quality review of the available science. This review should include:

- The current established understanding of fatigue identification and prediction
- The most recent advances in the field, along with a critique of the studies so that their conclusions, uncertainties, strengths and weaknesses are clear to the reader.
- A summary of what the new and old information means in combination, including what can and can't be concluded. Guidance on how the information can be used.

This review should then be updated annually, such that it remains useful and relevant.

[16] See Commission Implementing Regulation (EU) 2015/1018

6 Conclusion

It was decided that lack of data reliability for non-aircrew safety event is the most prominent issue to tackle in priority, and then the scope of actions like safety promotion tasks may be assessed. It was concluded to work on taxonomy refinements (linked to BIS15 "Aircrew Fatigue" action 6) and clearer guidance for those coding fatigue occurrences for non-aircrew personnel. It is proposed to use the current Member States Tasks for these purposes:

- MST.0002 Promotion of SMS
- MST.0043 Improvement of data quality in occurrence reporting

Best Intervention Strategy
"Aircrew Fatigue"

SIA Appendix 1