MINISTÈRE
CHARGÉ
DES TRANSPORTS

Liberté
Égalité
Fraternité

dgac direction générale de l'Aviation civile

DSAC

HORIZON 2028

→ National Aviation Safety Plan
→ Risk Management Tools

CONTENTS

Part 1

NATIONAL AVIATION SAFETY PLAN

FOREWORD

In 2009, France established its very first State safety programme (SSP), and adopted its first National Aviation Safety Plan. Since then, this pioneering initiative has become an international and, in particular, a European standard. In accordance with Article 8 of the Basic Regulation (EU) 2018/1139, States must establish a National Aviation Safety Plan. The previous period, from 2018 to 2023, saw major upheavals with the COVID-19 health crisis followed by the resumption of activity, which brought new risks. This period was also marked by growing environmental challenges, the resurgence of armed conflict on Europe's doorstep, an increase in cyber-security threats, the emergence of new players particularly in new technologies and urban mobility, and a loss of skills due to staff turnover in certain aviation professions as a result of the health crisis. Following this time of crisis, and in response to those major and simultaneous changes, resilience has emerged as a general requirement in order to safeguard and consolidate the safety improvements made in previous years.

While safety standards in professional aviation are satisfactory compared with the strategic objectives defined by France, this is not true of general aviation, which has seen a deterioration in recent years.

Thanks to continuous improvement in the reporting of safety occurrences, to new data sources and tools, to the 'big data' analyses now available, to more efficient tools enabling experts to analyse safety indicators, and to successful aviation safety networks which underpin our knowledge of the activity and its risks, the French Civil Aviation Authority, DGAC, has been able to hone its understanding of safety risks and initiate priority actions.

To develop this plan, DGAC identified the main areas of risk and launched a consultation with the main aviation stakeholders to confirm the plan's priority focus areas. DGAC is therefore making a commitment to address these issues over the next five years. These topics are addressed through systemic actions and operational actions, with a section focusing specifically on ways of improving safety in general aviation.

1. CONTEXT, NEW STAKEHOLDERS AND AREAS, AND THREATS OR HAZARDS IDENTIFIED

1.1

AVIATION CONTEXT **IN FRANCE**

A number of factors set France apart from most European countries, namely:

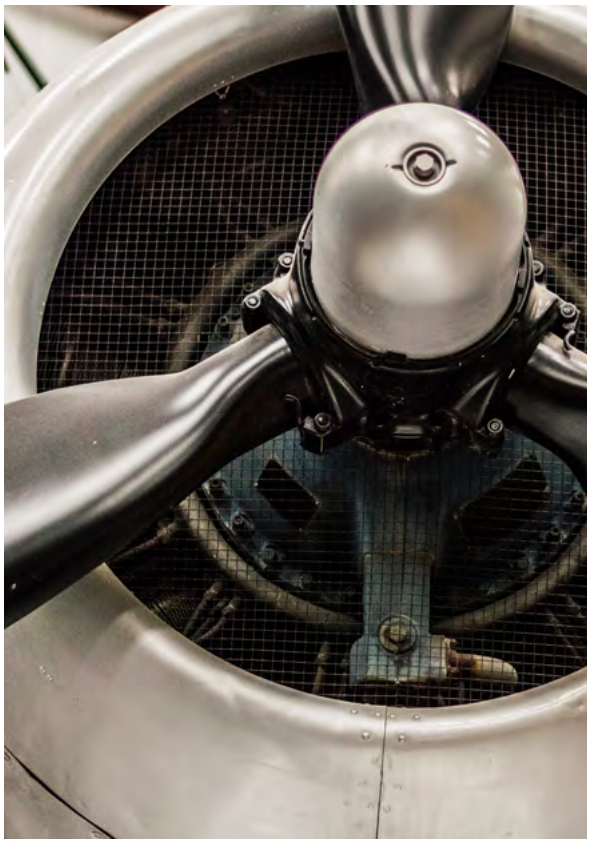
- → significant airport density;
- → a thriving general aviation sector, both in terms of certified aircraft and microlights;
- → very active innovation (prototype flights, new urban mobility projects (VTOL), use of unmanned aircraft systems (UAS), alternative energy sources, etc.).

This context of innovation and expansion, marked by a long-standing tradition of world-class aircraft manufacturing, requires a framework in which all these activities can develop while constantly improving the level of safety. However, this high level of activity comes with new threats that must be contained. This topic will be discussed in section 1.2.

With more than 12,000 aircraft holding a European or national certificate of airworthiness, 16,000 microlights, 20,000 UAS operators, 100 operators holding a commercial air operator certificate, nearly 500 aerodromes, 900 microlight airfields, 500 maintenance workshops or continuing airworthiness organisations, nearly 160 Approved Training Organisations (ATOs) and more than 750 Declared Training Organisations (DTOs), and a leading national civil aviation school, France boasts a very rich aviation landscape with which very few nations can rival.

Regarding air traffic, 145 million commercial passengers passed through French airports in 2022, including 116 million international passengers.

Mainland France has the largest airspace in Europe, with three million controlled flights, more than half of which are overflights, five en-route centres, 11 approach control units, 80 control towers and as many AFIS (Aerodrome Flight Information Service) providers. This airspace is also coordinated with the military authorities.



1.2

THREATS OR **HAZARDS IDENTIFIED**

The geography of mainland France is characterised by its location in a temperate region and its varied topography, resulting in a wide range of climates and meteorological phenomena which present various threats to aviation, including strong winds, sea haze, mountain air conditions, fog, thunderstorms and low-level icing conditions. France also has a number of overseas departments and territories which have their own specific climate and geographical features. In addition to natural obstacles due mainly to the country's high forest density and rugged landform, the risk of mid-air collisions is heightened by concentration points arising as a result of urban density where forced landing areas are scarce, the proximity of large airports, airspace complexity and the multitude of tourist attractions.

With regard to commercial air transport, the return to high traffic levels after the 2020-2021 COVID pandemic is the main challenge, due to the strain on skills and reduced resources in support functions, which are disrupting the value chain and threatening the management of many hazards, from flight preparation to its end. This particularly has impacts in terms of fatigue and flight time, and irritated or disruptive passengers, with an erosion of the safety culture on the ground.

The second threat consists of the direct and indirect consequences of conflicts around the world, namely cyber attacks, GPS jamming and spoofing, airspace restrictions, and large-scale military exercises.

Thirdly, DGAC will be attentive to the long-term consequences of strategic European satellite navigation choices on flight safety, the growing complexity of airspace and the related aeronautical information, and evolving business models in business aviation.

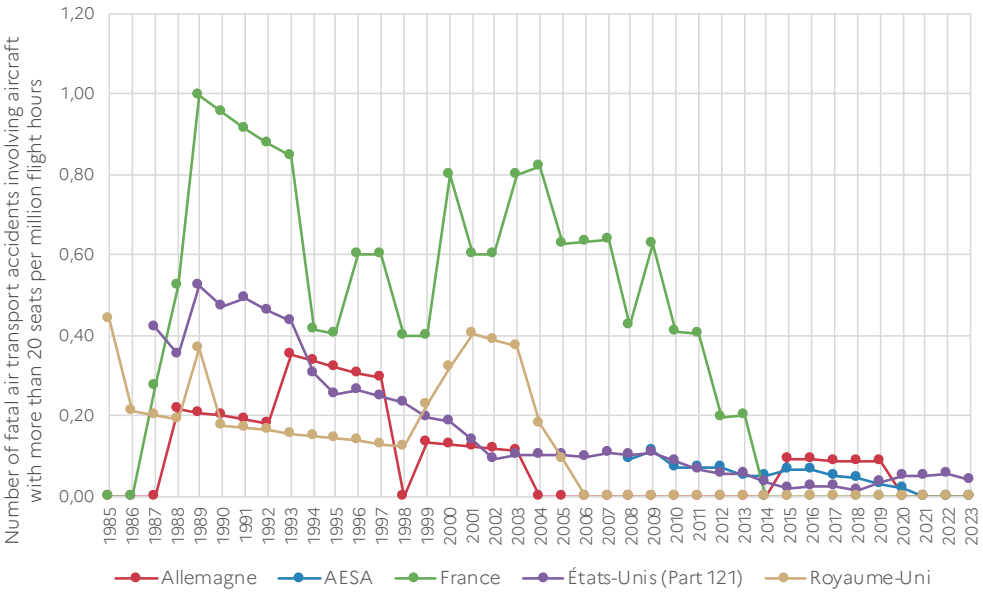
Finally, sustainable development and environmental issues are growing concerns and a number of initiatives are being led in response to the climate emergency underscored by the IPCC reports. Given the growing importance of environmental issues, DGAC will ensure that the changes made in response to them maintain the same standard of safety.

Similarly, the need to keep a closer watch on conflict-related and cyber-security threats will be addressed through specific awareness-raising campaigns for employees at the appropriate levels. Drawing on lessons learned from previous crises, DGAC will strive to cultivate the robustness and resilience of civil aviation.

1.3

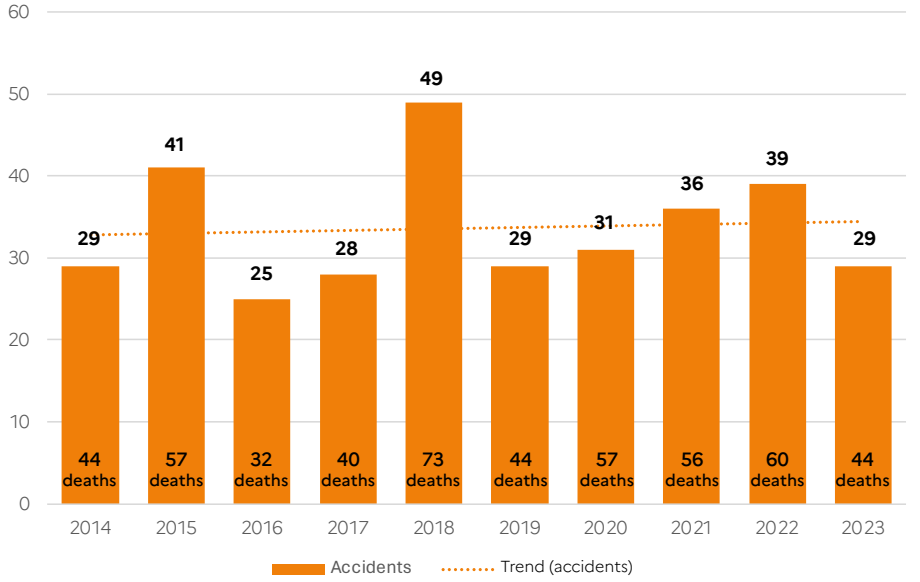
STRATEGIC GOALS AND **INDICATORS**

The goal set by the French SSP (named "PSE" for "Programme de Sécurité de l'Etat), which is the National Safety Programme as defined in Annex 19 to the Chicago Convention, is to keep France among the European countries where commercial aviation operators attain the highest standards of safety. The related indicator measuring the fatal accident rate of French operators of commercial transport aircraft with more than twenty passenger seats remained at zero over the period of the H2023 plan (Figure 1).



→ *Figure 1: fatal accidents of French operators of commercial transport aircraft with more than twenty passenger seats, in relation to the number of commercial transport flight hours*

The indicator for general aviation and aerial work includes the number of fatal accidents involving aircraft registered or identified in France[1]. The SSP aims to significantly reduce the number of fatal accidents. This goal was not achieved during the previous Horizon plan period, and the SSP must draw the conclusions when determining the safety actions to be taken as part of this plan.



→ *Figure 2: fatal accidents involving aircraft registered in France in general aviation and aerial work*

[1]This indicator does not include first flight and discovery flight accidents
These indicators are based on DGAC's commitment to implement the SSP in force at the time of preparing the document. The decision of 20 October 2023 defines the amended goals and indicatorshttps://www.ecologie.gouv.fr/sites/default/files/pse_lettre_engagement.pdf

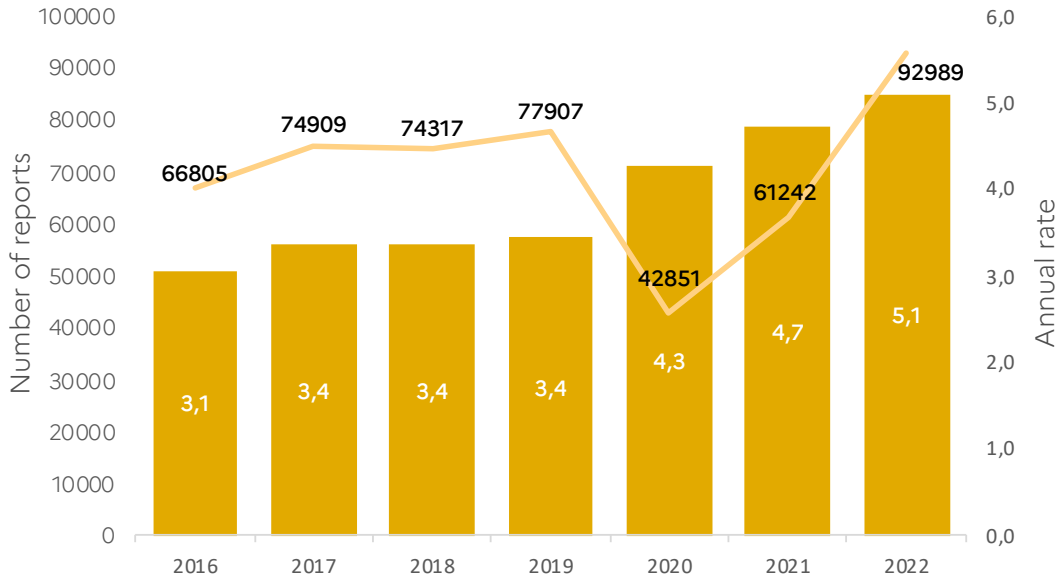
1.4

SAFETY OCCURRENCE REPORTING

Safety occurrence reporting is one of the keys to effective SSP implementation. An overall analysis and use of reports at SSP level has been one of the main sources used to identify the safety issues in preparation of this plan.

Despite the COVID crisis, the number of safety occurrence reports increased from 74,000 in 2018 to almost 93,000 in 2022. The reporting rate, which includes all stakeholders (Figure 3), thus rose significantly in 2020 and has remained high ever since. This increase is seen as a sign that the reporting system is working well and that French operators have a good safety culture. However, DGAC will remain focused on improving the quality of reports, particularly in terms of the analyses and risk level classification carried out by operators, as well as the traceability of the actions they take.

In terms of safety culture, and more specifically safety occurrence reporting, DGAC has set a new strategic objective for the improvement of operator reporting rates.



→ *Figure 3: number of occurrences and reporting rate (per 100 flights) = ECCAIRS Annual Reporting Rate (per 100 flights) = Number of reports / Number of Commercial Movements at French airports*

2. SAFETY TOPICS

In the rest of this document, and depending on the context, the term ***oversight authority*** is used to designate DSAC in its role as oversight authority, or OSAC as the organisation responsible for the oversight of CAMO and Part 145 organisations on behalf of DSAC. The term DGAC is used when the information provided includes the role of ***regulator*** or ***authority responsible for the SSP***.

2.1

SYSTEMIC SAFETY

The cross-cutting safety issues identified for this plan are organised around five themes:

→ continued improvement of **operator safety management systems** and more effective Risk-Based Oversight (**RBO**);

→ greater inclusion of **Human and Organisational Factors (HOF)**, centred in particular on developing the **skills** of the various players, including the authority's staff, and the **safety culture** across all areas of aviation;

→ **maturing the State Safety Programme (SSP)** and improving the integration of **oversight into the programme**;

→ improving assessment of **safety performance** and **collaboration between aviation stakeholders** which is a key component of the SSP: exchange of safety data between operators; safety decisions based on safety data and information analysis; and in-depth study of the safety impacts of security, environmental and cyber-security issues, etc.;

→ **safety promotion**, a keystone of risk management, by continuing existing publications and focusing more on the scope of initiatives taken to promote safety among operators and individual players.

2.1.1 Operator safety management systems

Although it is widely accepted that safety management systems are the cornerstone of safety enhancement, the fundamental role of compliance should not be overlooked.

With the expansion of safety management systems (SMS) particularly to new types of operators and organisations[2], these players have demonstrated their ability to respond to major unexpected events and improve their resilience. However, there is room for improvement and scope for operators to gain in efficiency and maturity in the implementation of their SMS.

SMS Oversight:

In addition to determining whether an operator's SMS is compliant, the oversight authority must also be able to determine whether it is effective. Improving the ability of operators to manage their risks requires appropriate oversight. Regarding the implementation of RBO, **the oversight authority will use the lessons learnt from applying these principles in order to develop its own methods**, in particular by focusing oversight on the areas and operational activities with the highest risks, while optimising the allocation of its resources. Regarding the assessment of operator SMS performance, the oversight authority will be able to draw on the EASA SMS assessment tool, which now includes CAMO and Part 145. With regard to the maturity of SMSs, the oversight authority will focus more on how operators analyse the root causes of the authority's findings and on improving their ability to analyse safety occurrences.

[2] For example, since 7 March 2023, EASA has required PART 21J design organisations and PART 21G production organisations to implement an SMS

The oversight authority staff's understanding of how SMSs work is a key factor of the success of this support. Efforts to improve the skills of the oversight authority's staff in this area will be pursued, by reinforcing their operational knowledge of the professions overseen and training inspectors in new areas to which SMS requirements apply. The oversight authority will continue to contribute to international work in this area within organisations such as the SM ICG[3] and ICAO.

The oversight authority will build a network of experts to harmonise and develop the authority's SMS working methods.

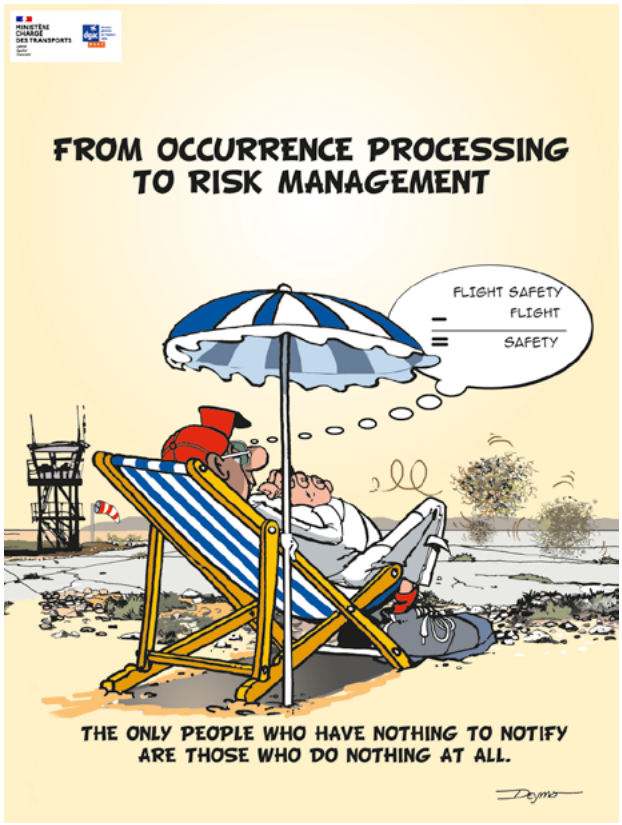
SMS Promotion:
The oversight authority will carry out several actions to promote SMSs:

- → regular promotion during the oversight authority's communication campaigns, in particular at operator seminars or when co-organising safety management events with operators;
- → updating or developing guidance on SMS application;
- → appropriate communication of promotion materials developed by international organisations (EASA, SM ICG, etc.).

At the same time, the oversight authority will continue to support operators who are not subject to SMS obligations in organising safety management events and sharing best practices.

On the regulatory aspects, the oversight authority will follow the work done at the international level by ICAO and EASA on the assessment of SMS maturity.

Compliance with standard operating procedures (SOPs) remains a major concern for DGAC: appropriate procedures can only be adopted and correctly applied if regulatory requirements are understood and accepted. Following on from the Horizon 2023 plan, **DGAC will take any necessary action to limit the regulatory or administrative pressure on operators for the sake of safety by providing optimum support on regulatory developments**, whether national or European, by simplifying administrative processes whenever possible, and helping to identify difficulties in applying regulations. In parallel, **the oversight authority will support operators who take specific measures to detect failures by their front-line staff to apply standard operating procedures.**



[3] *Safety Management International Collaboration Group*, an initiative aimed at promoting safety management principles and requirements and facilitating their application across the international aviation community

2.1.2
Human and Organisational factors (HOF), skills and safety culture

In line with the Horizon 2023 plan, the oversight authority is pursuing its commitment to integrate human and organisational factors (HOF) at every level of the SSP. **The oversight authority will take action to integrate HOFs into its safety policy and all the components of the SSP in order to continue developing a positive safety culture.**

2.1.2.1 Organisational aspects and safety culture:

The oversight authority will create a task force responsible for managing HOFs. Drawing on national and international guidance, this task force will promote the inclusion of HOFs in the oversight authority's culture, particularly in the areas of oversight, management of change and the use of safety occurrences.

To integrate HOFs into the SSP, employees involved in the programme will be trained and safety will be promoted through presentations and publications targeting all players in the aviation sector. This task force will therefore reinforce reporting by taking action to underline the importance of a just culture.

Finally, the oversight authority will strive to further its understanding of the organisational structure of operators, particularly where activities are carried out for different subsidiaries of the same group.

2.1.2.2 Skills and training

With the aim of encouraging front-line staff to take greater account of safety risks, **the oversight authority will promote threat and error management methods such as TEM[4] as part of basic pilot training.**

In addition, **the oversight authority will support the widespread application of teaching methods based on skills or on evidence of skills, and contribute to international work aimed at developing these methods.**

With regard to the skills of its own employees, the oversight authority will continue to train staff in the principles of HOFs, particularly its inspectors. In the specific area of crew fatigue risk management, the oversight authority will continue to train its employees who are responsible for approving and monitoring the flight time specifications of operators.

2.1.2.3 Well-being and human performance of aviation staff

Since the crash of the AIRBUS A320 operated by Germanwings in 2015, suicide risk prevention has been identified as a safety concern. Furthermore, workplace wellness has become a societal topic of motivation and public health, particularly since the COVID-19 pandemic. The oversight authority will therefore continue to support collaborative think tanks that aim to develop risk prevention and mitigation tools tailored to aviation professionals.

[4] Threat and Error Management

2.1.3
SSP Maturity

The oversight authority will continue to focus its oversight on assessing the performance of operator SMSs, while adapting its methods to existing and new areas of responsibility such as cyber security, UASs, USSPs, and ground handling.

DGAC will also continue its initiatives aimed at maturing the State safety programme. Action will particularly be taken in the following areas:

→ introduction of continuous assessment of safety issues in the different areas of activity and a better understanding of priority safety issues, in particular by drawing on the implementation of the European Risk Classification System (ERCS);

→ determination of safety goals covering all areas of aviation activity in coordination with stakeholders;

→ improved safety performance measurement and the connection with safety actions taken as part of the SSP;

→ establishment of a framework for greater sharing of safety information between operators;

→ improvement, within the authority, of the connections between operator oversight and risk management conducted by the SSP.

The skills of oversight inspectors and safety analysts will be adapted to support these changes.

2.1.4
Safety performance metrics and collaboration between operators

The ability to measure the safety performance of SSP players must be improved in order to effectively monitor changes in the safety levels of organisations over time. These improvements will apply to:

→ the quality of safety data (safety occurrences, flight data monitoring (FDM), their volume and source);

→ the ability to analyse these data in order to identify priority actions to be taken at SSP level.

Regarding the content of safety data, and in order to take full advantage of ECCAIRS 2 (E2) introduced in July 2023, **the oversight authority will particularly create reporting systems for UAS operators (CRESUS form).**

On the topic of improving data analysis, **the oversight authority will continue to support aircraft operators through a Flight Data Monitoring (FDM) task force**. The oversight authority will also analyse reported occurrences through the prism of the European Risk Classification System (ERCS) which came into force early in 2023, to more accurately monitor the actual risk of occurrences reported. **As these ERCS scores will be obtained by conversion, the oversight authority will take action with operators to improve the quality of the risk classification scores used as input for the conversion.**

As a founding member of the Data4Safety programme (D4S)[5], the oversight authority will continue to invest in this programme which demonstrated, during the development phase, that it can merge several types of data (occurrence reports, FDM, meteorological data, etc.) in order to extract relevant safety performance indicators for the SSP, and to respond to emerging issues which require data sharing and close collaboration between experts. **The oversight authority will continue to encourage leading French operators to participate in the deployment of the D4S project.**

Sharing safety information between safety operators and across the board is crucial to ensuring that safety issues are fully addressed. To this end:

→ **The oversight authority will study ways of automatically sharing reports in E2 with third parties concerned by the occurrence (voluntary and targeted sharing)** in order to facilitate the exchange of basic information and focus more on the concerted improvement of safety barriers;

→ **The oversight authority will promote the development of interoperable and harmonised digital management of safety occurrences by UAS operators, U-space service providers, common information service providers and relevant ATM/ANS providers.**

For certain national topics, the oversight authority will include data from the safety performance assessment carried out by DSNA as part of the SSP safety performance monitoring, and will carry out safety studies using safety data from DSNA.

2.1.5
Promoting safety[6]

Promoting safety contributes to DGAC's policy of fostering a positive safety culture. The promotion of safety therefore draws on safety occurrence and analysis reports, reports from the authorities responsible for investigations, and safety promotion materials prepared by other international organisations (EASA, SM ICG), while ensuring that this information is shared with all aviation players.

For this purpose, DGAC will take action to:

→ encourage occurrence reporting by protecting the data collected;

→ facilitate the flow of safety information within the SSP;

→ continue developing the Réseau Sécurité Aérienne France (RSAF, French aviation safety network) and the Collaborative Aerodrome Safety Highlight initiative (*CASH*).

The "Objectif sécurité" label covering publications designed to share targeted safety information with each aviation player, will be continued and developed. The performance of this safety promotion channel will be assessed based on customer feedback and improved knowledge of the target audience. This initiative aims to promote the "Objectif sécurité" label more broadly via the most effective channels.

Annual symposia will continue to foster extensive cooperation between operators and the authority on priority safety topics.

[5] Data4Safety (D4S) is a voluntary partnership programme which aims to identify systemic risks at EU level and ways of mitigating them, in particular through a massive collection of aviation data and by organising the analytical capacity amongst all European aviation safety partners.

[6] The goals of promoting safety are defined in paragraph 8 of the SSP guidance.

2.1.6
Integrated risk management

Each area has developed its own safety, security and environmental risk management practices, focusing on vulnerabilities and threats. An effective risk management decision taken in one area can have a negative impact on another, forcing staff to transfer risks if they are not analysed holistically, at both organisational and human levels.

Safety / security overlap:

With a view to strengthening current practices for integrated safety and security risk management, **the oversight authority will integrate the lessons learned from the EASA Impact of Security Measures on Safety study**. This study will provide a better understanding of the nature and extent of the interdependencies between safety and security in order to assess the potential (positive or negative) impact of security measures on the safety performance of aviation systems, personnel and operations.

In addition, **the oversight authority will pursue its efforts to coordinate the management of safety and security occurrences**. In this regard, the oversight authority will aim to create a database for security incidents that is compatible with the database of safety occurrences, and to develop a coordinated methodology for monitoring safety and security occurrences.

Finally, disruptive passengers represent a specific priority issue. In this area, **DGAC will take measures to implement the provisions of the French Ordinance of 1 June 2022 on disruptive passengers. Regulations will be adopted to enable air carriers to submit a report via an electronic process which will include reporting the incident and applying and monitoring the effectiveness of sanctions.**

DGAC will also identify and encourage the implementation of local preventive and collaborative measures to identify passengers likely to present a risk of disrupting a flight prior to boarding.

Safety / environment overlap:

Environmental measures are on the increase and this trend is set to continue. Examples include the N-1 taxiing procedures introduced to reduce the environmental footprint of aircraft taxiing at certain airports, PBN to ILS

approaches that foster continuous descents, and the flying restriction periods that are now being applied at certain airports. **The oversight authority will continue to play an active role in supporting the implementation of environmental measures in compliance with applicable safety and security requirements.**

Cyber-security:

Cyber-security is a fast-changing area, with growing threats and new regulatory requirements that will come into force during the period of this plan. In this context, the oversight authority will support operators in their efforts to achieve compliance while preparing to oversee this area. It will therefore develop a compliance framework that aggregates and streamlines the applicable cyber-security requirements. Finally, the oversight authority will foster the sector's resilience through crisis management drills.

2.2

OPERATIONAL FOCUS AREAS

Among the five major risk areas identified by ICAO[7], DGAC has identified specific actions in the following operational focus areas: runway overruns, mid-air collisions, runway collisions and controlled flight into terrain (CFIT). In addition to these priority risk areas, DGAC will be taking specific action in the following areas as part of this plan:

- → preventing risks related to ground operations;
- → aeronautical documentation and information;
- → influence of security measures on safety;
- → monitoring the implementation and risks associated with certain new technologies;
- → meteorological factors.

"Loss of control in-flight" was covered by several large-scale actions during the previous plan, and there is no need to add any new ones, other than continuing to monitor the effectiveness of the measures in place.

2.2.1 Prevention of runway overruns

DGAC will pursue actions to prevent the risk of runway overruns, **taking account of the lessons learned from the symposium on runway excursions held in December 2023** which proposed actions in the following areas:

- → monitoring operational implementation of the GRF;
- →monitoring and analysing the commercial practices of airlines likely to influence landing performance;
- →maintaining awareness of the risk of a runway overrun and the capacity to go-around throughout the approach and landing flight path;
- → the contribution of new technologies to aircraft performance management;
- → the contribution of new technologies to the management of ground aspects (end of runway arresting systems, quality of surfacing, etc.).

DGAC will also initiate consultations with the operators concerned in order to propose methods and tools designed to improve **energy management on approach**.

[7] The five major risks identified by ICAO are: runway excursion, loss of control in-flight, mid-air collisions, runway incursion and controlled flight into terrain (CFIT)

2.2.2
Prevention of mid-air collisions

DGAC will continue to implement safety actions aimed at assessing and managing the risk of collision between a commercial transport aircraft and a light aircraft in the vicinity of uncontrolled aerodromes. DGAC will pay particular attention to aerodromes at which an Aerodrome Flight Information System (AFIS) has been or is being set up following the abolition of the air traffic control service, or where a schedule-based alternation between air traffic control and AFIS has been introduced. **DGAC will encourage the introduction of radio and/or transponder mandatory zones (RMZ, TMZ) depending on the risk involved.**

Intrusion into controlled airspace by light aircraft, which is a precursor for the risk of collision with a controlled aircraft, has increased since the end of the COVID period. To limit the number of intrusions, **DGAC will take measures including improving flight preparation by pilots of light aircraft, improving aviation information and raising instructor awareness.** In the context of DSNA's reorganisation of the flight information service, the oversight authority will ensure that the flight information service continues to be provided in the requisite airspaces.

For the risk of mid-air collision during cruise flight, DGAC will identify defective safety barriers, both aboard aircraft and in air traffic control, on the topic of malfunctioning transponders, in consultation with operators.

Each year, DGAC will also assess the impact of UAS and U-space operations on aviation safety to ensure that the development of these new activities is not detrimental to the level of safety.

2.2.3 Prevention of controlled flight into terrain (CFIT)

DGAC will take targeted action to reduce the risk of CFIT in two specific areas:

→ In response to the increase in GNSS jamming and spoofing, **DGAC will set up a task force with the main departments**, with the aim of sharing best practice and identifying vulnerabilities in the current system so that each entity can take appropriate action to reduce the risk of GNSS jamming or spoofing.

→ **DGAC will monitor the implementation of actions resulting from work done following events that highlighted the vulnerability of certain approaches (in particular RNP APV BARO VNAV) to QNH selection on board aircraft.** These actions particularly apply to:

- air traffic control QNH transmission procedures;
- promoting safety based on mutual knowledge of recovery barriers (MSAW, TAWS);
- sharing safety lessons with EASA on the long-term strategy for satellite-only navigation by 2030;
- monitoring actions taken by each operator to detect incorrect QNH selection using flight data monitoring (FDM) or Mode S downlink data;
- monitoring manufacturer error-detection solutions.

2.2.4 Prevention of risks related to ground operations

In the area of ground-handling services, the oversight authority **will continue to play an active role in the EASA-led regulatory working groups** with a view to preparing a delegated regulation specifically addressing the aviation safety of ground handling activities, which is due to be implemented in 2027 after a three-year transition period.

Pending the entry into force of this delegated regulation, the oversight authority **will prepare, define and implement a system for monitoring service providers that meets the requirements of the regulation.** This system will be based on RBO concepts and will take recognised industry standards into account. Through its actions, the oversight authority will also assess the safety culture of service providers, as well as the training and skills of their staff, their safety management methods, compliance with their operational procedures, and occurrence reporting.

The oversight authority will organise its action in a complex environment in which safety is contingent upon the effectiveness of multiple interfaces between ground handling service providers, airlines and airport operators.

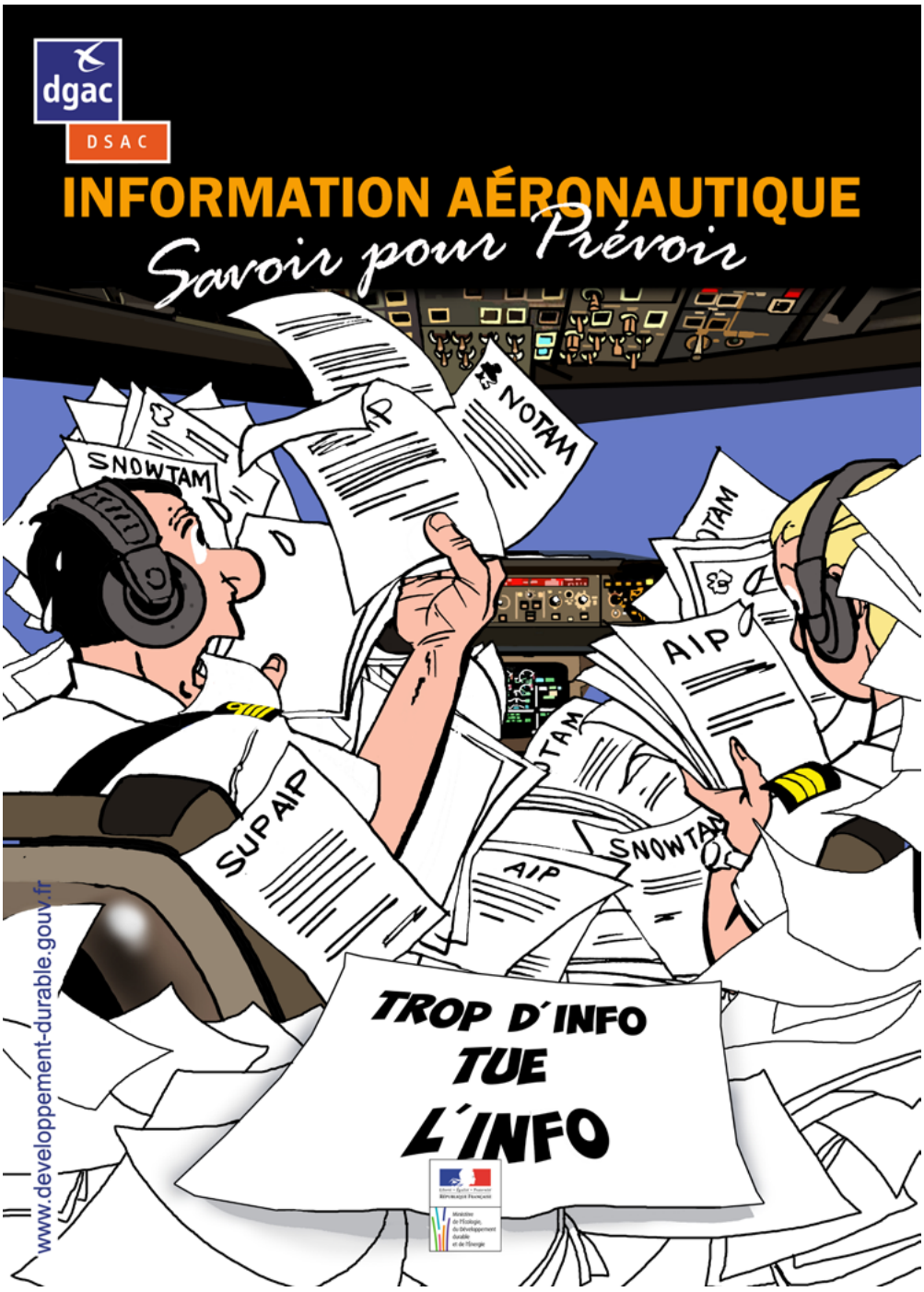
Developing and disseminating a safety culture is a crucial prerequisite to improving the safety of ground handling operations. This safety culture suffered greatly following the COVID period when ground handling service providers had to recruit extensively to cope with the rapid increase in air traffic. **In this context, the oversight authority will play a key role in helping service providers to rebuild this safety culture, through targeted actions to promote safety and meetings between organisations.**

2.2.5
Aeronautical documentation and information

The growing amount of aeronautical information, notably as a result of the complexity of airspace, as well as the format and often non-user-friendly presentation of data, are all factors that can contribute to safety occurrences. Already identified in 2013, this issue led DSAC to hold its annual symposium on the topic and to take a first set of measures.

The many players involved in producing aeronautical information and presenting it to users makes this issue particularly complex. **As a first step, DGAC will review the difficulties and propose leads for improvement; it will therefore create a working group with the main aviation stakeholders, from aeronautical information service providers to commercial integrators and end users.** This working group will also study aspects relating to the increase in documents, beyond the strict framework of aeronautical information.

Alongside this initiative, DGAC will take steps to provide users with dynamic electronic charts, i.e. charts that are updated with the temporary information currently disseminated by NOTAM or SUP AIP.



2.2.6
Monitoring the implementation and risks associated with certain new technologies

EASA-certified VTOL aircraft will emerge during the period of this plan, and multiple commercial projects could be proposed in France. The first project due to take place in 2024 will be a world first. **It will therefore be vital for DGAC to oversee the development of VTOL operations to ensure that they are carried out in adequate safety conditions. Particular attention will be paid to the development of new routes, especially in urban environments.**

The introduction of UAS regulations and the creation of U-Spaces will ensure that these mobile devices are properly integrated into shared airspace. **DGAC will continue to support professional users** and will seek to improve the reporting of occurrences, which will inevitably increase in number. **DGAC will also explore alternatives to temporary restricted areas (TRA)**, which will no doubt increase in future, in order to prevent mid-air collisions involving UASs and avoid rendering airspace overly complex.

Several commercial airship transport projects are under way in Europe including a very ambitious project in France to transport heavy loads using large airships. **To support this project, DGAC will contribute to the preparation of European regulations and to their gradual implementation. It will ensure that it has the necessary skills to provide the appropriate oversight.**

Finally, DGAC will explore ways of adapting Artificial Intelligence (AI) tools to make the SSP more efficient in identifying leads for improving safety using the textual data of safety occurrence reports, while ensuring that reports remain confidential and that reporting entities are protected.

2.2.7
Meteorological factors

Climate change brings new risks for aviation and these risks are set to become more intense. **DGAC will actively participate in the European Network on Impact of Climate Change on Aviation (EN-ICCA)** set up by EASA with the aim of collectively analysing the need for better anticipation and management of meteorological events.

Meteorological information, and ensuring that it is taken into account and fully understood by aviation players, is an important part of effective flight preparation. Employee training and awareness of methods for anticipating and operationally managing hazards (such as Threat and Error Management, TEM) will improve the management of situations encountered in flight (mass diversion, for example). Discussions will be held with Météo France with the aim of developing forecasting and observation tools adapted to the needs of as many users as possible.

2.3

GENERAL AVIATION

Owing to the differences between professional aviation and essentially non-professional general aviation, and the different approach taken by the authority as regards available prevention tools, this section of the Horizon 2028 plan is specific to general aviation.

An analysis of general aviation accidents has shown that the goal of improving safety levels was not achieved during the previous plan. The actions defined in the previous plan are still relevant and should therefore be reinforced and supplemented with new systemic and operational measures. The involvement of federations is still a major asset for the effectiveness of these actions, both during the consultation phase with a view to defining goals and in relaying the authority's messages to promote safety.

Several systemic issues can be identified for general aviation safety, with operational focus areas complementing the cross-cutting actions taken in response to these issues.

2.3.1
Systemic focus areas

a • Promoting safety
Promoting safety is essential to raise awareness of risks and to encourage users to adopt good practices that will reduce the risks or their consequences. The oversight authority will therefore continue its efforts to promote safety, while developing the penetration of its messages, through regular audience measurement and the development of communication media and channels, in particular with the support of aviation federations.

b • Safety occurrence handling This means of promoting safety is fuelled by feedback. Increasing the volume and maturity of occurrence reporting therefore remains a priority goal for the authority. Initiatives will be taken to facilitate reporting, improve the quality and analysis of the data collected, improve understanding of the benefits of reporting, and continue to promote the just culture for reporting safety occurrences in confidence.

The authority recognises the full potential of feedback and safety occurrence analysis, so it will provide practical help with risk analysis and classification for general aviation users.

c • Sharing safety information
The aerodrome operator must be able to fully play its role in managing safety on a local level. To this end, the authority will encourage the organisation of events for exchanges on safety issues between general aviation users and other aerodrome users.

d • Training and skills
Instructors play a vital role in the skills of the pilots they train. The authority will therefore take steps to ensure that instructors adopt and effectively communicate safety messages to their trainee pilots.

The Threat and Error Management (TEM) method has proved its worth in anticipating risks and reducing their consequences. The authority will ensure that TEM methods are taught in initial training, in order to instil a mindset and provide safety-enhancing methodological tools.

Compliance with standard operating procedures (SOPs) continues to underpin daily practice. The authority will ensure that general aviation users are more familiar with the concepts of actions, actions by-heart and check-lists, and that their organisations' tools are as standardised as possible. A better understanding of their objectives will facilitate the correct use of them.

e • Managing safety
Safety management is based on a coherent set of tools. Even without a nomenclature-based management system, organisations should be more familiar with certain principles. The authority will provide these organisations with learning tools to help them assess the issues at stake in several key areas, including:

- → *general aviation and safety issues*
- → *from occurrences to risk mitigation measures.*
- → *lessons learned from recent/regular accidents and safety occurrences*
- → *accident and safety occurrence classification*
- → *pilot skills*
- → *safety management terms and concepts*
- → *occurrence reporting*
- → *channels for promoting safety*
- → *proposed directions for improving safety*

f • Extension of actions defined in the previous Horizon 2023 plan
Although all the actions defined in the previous plan have been completed, the issues they addressed are still entirely relevant and it is important to find ways of making them more effective. DGAC will therefore pursue its efforts to help users adopt the new safety regulations, monitor technological innovations that can improve safety, support initiatives taken by federations and oversee activities open to the public.

2.3.2 Operational Focus Areas

To complement these systemic actions, some actions in operational focus areas are described below.

a • Preventing runway excursions
Although commercial aviation was the target of the 2023 symposium, the authority will endeavour to transpose relevant actions to general aviation, in line with the wishes of the majority of participants. The safety lessons learned will give rise to amendments in the solo flight guide published by DSAC.

b • Preventing loss of control in-flight

The recent occurrence of fatal accidents involving aircraft carrying more passengers than usual shows that pilots can be taken by surprise by the flight characteristics of their aircraft during discovery flights or long journeys. The authority will take steps to communicate safety messages in preparation for and during flights, so that pilots are better prepared for this context and its specific threats.

This kind of flight is one of the circumstances that can encourage take-off in the back side of the power curve and it needs to be better understood within the general aviation sector. In cooperation with federations, the authority will take measures to promote safety around this precursor for loss of control.

• Preventing mid-air collisions

Mid-air collisions are ultimate events which, although rare, generally leave occupants with little chance of survival. The prevention tools are not the same for collisions between VFR aircraft in uncontrolled airspace and collisions with controlled aircraft.

AT AERODROMES

The airfield circuit is the first environment where mid-air collisions can occur. In addition to promoting good "cohabitation" practices, the authority will propose educational actions on aerodrome circuit entry, to improve awareness of other aircraft and entry without interfering with other users.

AROUND AERODROMES

Some relatively dense volumes of traffic (often around aerodromes hosting multiple activities) may warrant restricting access to aircraft equipped with transponders and/or radios. To achieve uniform risk reduction across the country, DGAC will define national criteria for establishing RMZs or TMZs, in conjunction with user representatives on regional consultation bodies.

In this respect, the authority will take action to mitigate the risk of inappropriate use of radio, which is a key tool for mutual information to improve situational awareness. More generally, precise knowledge of aircraft avionics must still be improved.

AIRSPACE COMPLEXITY

The complexity of airspace can lead pilots to forget the rules applicable in a given portion. It can also increase the pilot's workload and affect their ability to cope with unexpected circumstances. Additionally, it can create concentrations of traffic in sometimes small areas where access is less restricted but volumes are limited by the environment (urbanisation, topography, presence of a secondary airport, etc.). In certain specific cases of low-altitude specialised (SPOs) or UAS operations, mutual knowledge of the activities of all users is vital to improve situational awareness. The authority will therefore find ways to improve the sharing and integration of information by all stakeholders.

Consequently, the authority will ensure that the action undertaken to improve aeronautical information described in 2.2.5. of this plan leads to effective improvements for general aviation users, in particular dynamic mapping tools. Similarly, when necessary changes are made to the airspace, the authority will pay particular attention to avoid making it more complex.

INTRUSION INTO CONTROLLED AIRSPACE

Generally speaking, intrusion into controlled airspace is a highly adverse situation which the authority will take several actions to prevent. Firstly, this concept must be developed further in basic training. VFR forums will also be renewed to encourage meetings between controllers and pilots. All actions contributing to a better understanding of the issues, from flight preparation to radio use and procedures, will be developed.

Secondly, the authority will ensure that the core competencies of instructors include the skills required to avoid such intrusions and that examiner awareness of this risk is heightened.

SPECIAL CASE OF MOUNTAIN ENVIRONMENTS

Specific measures will be taken to address the situation of mountain flying. The collision that occurred in January 2019 in the vicinity of the Ruitor glacier in Italy prompted the authority to draw up a special action plan. This plan particularly includes measures relating to the frequencies used in flight, good practices that will be codified, such as the direction of traffic in valleys, provisions specific to the busiest areas, and updated altimetry procedures.


NO SMOKING
CHOKE
CARB. HEATER

Part 2

RISK MANAGEMENT TOOLS

INTRODUCTION

This document supplements the Horizon 2028 national aviation safety plan by presenting a number of risk management tools that can be used by many professionals in the aviation sector.

The first part of this document contains tables for classifying operational safety issues in the fields of commercial aircraft transport, helicopters, aerodrome operations, ground handling, air navigation service providers (ANSPs) and continuing airworthiness. These tables, which provide an overview of safety issues, are classified by operational area, and one contains systemic safety issues that can be relevant to all areas. The subjects included in the study were selected through a series of actions:

- → expert opinion, particularly in the context of the French aviation safety network (RSAF);
- → consultations with stakeholders (safety committee and surveys sent to operators);
- → the SSP bodies;
- → use of data from oversight / occurrence reviews;
- → an analysis of SSP indicators for the 2018-2023 period;
- → a study of EPAS vol III.

These tables are not intended to replace, but to supplement, those used by operators.

The second part of this document presents analysis methods such as the *Hazard List*, the Bowtie method and the more operational Threat and Error Management (TEM) tool.

These tools and methods can be used to:

- → feed the process of identifying safety topics by identifying hazards and undesirable events (safety issues overview);
- → model safety issues (Hazard List + Bowtie);
- → identify defective or missing safety barriers (Bowtie);
- → assess the risk associated with a single safety occurrence (risk classification guide);
- → define risk mitigation actions taken within the framework of an operator's SMS or the SSP at State level;
- → finally, the TEM method can be used by both crew members and by certain operators as part of their training.

1

SAFETY ISSUES **OVERVIEW**

As a reminder, in the context of the State safety programme:

- ➔ a safety issue is the manifestation of one or more hazards in a specific context;
- ➔ an undesirable event (UE) is an occurrence corresponding to the loss of control of an operational process. One or more UEs may be linked to an operational safety issue or to a topic involving cross-cutting risks;
- ➔ an ultimate event (in the chain of causation) is, in most cases, an accident within the meaning of ICAO Annex 13.

An undesirable event is likely to lead to the associated ultimate event(s).

1.1 Keys and abbreviations

The safety issue significantly increases the likelihood of occurrence of the ultimate event
LOC-I: Loss Of Control In-Flight
FOD: Foreign Object Debris (FOD)
HOF: Human and Organisational Factors
CFIT: Controlled Flight Into Terrain

1.2
Aircraft flight operations

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
AC 1	Unstabilised or non-compliant approach	●	●			●		●	
AC 2	Unusual flight attitude (pitch, bank angle, angle of attack)		●				●		
AC 3	Occurrence related to aerodrome conditions (runway surface condition and contamination)		●			●	●	●	
AC 4	Encounter of dangerous weather phenomena (thunderstorm, turbulence, icing)		●	●			●	●	●
AC 5	Misuse of aircraft systems (weight and balance, speed, flight paths, aircraft configuration, parameter insertion, etc.)	●	●	●	●	●	●	●	
AC 6	Occurrences pertaining to work/maintenance operations on or near a runway (landing / take-off on a 'shortened' or closed runway, hindrance to emergency operations, etc.)		●		●	●		●	
AC 7	Poor coordination / execution of ground operations (de-icing, loading, stowing, line maintenance, etc.)	●	●		●		●	●	●
AC 8	Runway incursion / near-incursion		●		●	●		●	
AC 9	Loss of separation / aircraft proximity hazard in flight (including with UASs or EVTOL) / airspace incursion		●	●	●		●		

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
AC 10	Bird and other wildlife hazard		●		●	●	●	●	
AC 11	Ground/aircraft interface failure (misunderstanding, transmission of inappropriate information)	●	●	●	●	●	●	●	
AC 12	Aircraft maintenance event	●	●		●	●	●	●	●
AC 13	Aircraft system failure resulting in flight management disturbance	●	●	●		●	●	●	●
AC 14	Smoke / smell	●	●	●	●	●	●	●	●
AC 15	Aircraft damage due to FOD		●	●	●	●	●	●	●
AC 16	Disruptive or unruly passengers	●				●	●	●	
AC 17	Glare from a laser device	●	●	●	●	●	●	●	
AC 18	Jet blast and wake turbulence		●				●	●	

1.3
Helicopter operation

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
HEL 1	Navigation and approaches (alarms and significant deviations)	●	●			●		●	
HEL 2	Unusual attitudes (pitch, bank, manoeuvres close to the ground)		●				●	●	
HEL 3	Lack of flight preparation given the characteristics of the operating site		●			●	●	●	
HEL 4	Encountering dangerous weather phenomena en route (loss of visibility in VFR, thunderstorm, turbulence, icing, and in particular anticipating them during flight preparation) or loss of visibility in low-height flights.	●	●	●			●	●	●
HEL 5	Misuse of systems (relating to mass, speed, configuration or planned flight path)	●	●	●	●	●	●	●	
HEL 6	Occurrence pertaining to infrastructure work/maintenance on or near the operating site		●		●	●		●	●
HEL 7	Poor coordination/execution of ground operations (de-icing, loading, stowing, fastening, etc.)	●	●		●		●	●	
HEL 8	Incursion onto operating site		●		●	●		●	
HEL 9	Loss of separation in flight / airspace incursion / dangerous approach / airspace management (UAS or EVTOL)		●	●			●		

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
HEL 10	Bird hazard		●		●	●	●	●	
HEL 11	Failure of air-ground interfaces (misunderstanding, transmission of inappropriate information) through communication means (frequency management, etc.)	●	●	●	●	●	●	●	
HEL 12	Continuing airworthiness occurrence	●	●		●	●	●	●	
HEL 13	On-board system failure	●	●	●	●	●	●	●	●
HEL 14	Sling-load-transport-related occurrence		●		●		●	●	
HEL 15	Glare/dazzle from a laser device	●	●	●	●		●	●	
HEL 16	Jet blast and wake turbulence		●				●	●	

1.4
Ground handling

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
GH 1	Major error in weight and balance calculations		●			●		●	
GH 2	Incorrect loading of baggage, cargo or passengers, likely to have a significant effect on aircraft weight and/or balance		●			●		●	
GH 3	Lack of, incorrect or inadequate de-icing/anti-icing treatment		●			●		●	
GH 4	Presence of FOD (or objects that could become FOD) from ground handling activities		●				●	●	
GH 5	Collision or near-collision between an aircraft and a vehicle, machine or piece of equipment (including failure to respect ASA limits, etc.).		●				●	●	
GH 6	Damage to aircraft due to non-compliant parking / positioning		●				●	●	
GH 7	Damage to aircraft due to towing / pushback operations		●				●	●	
GH 8	Damage in the hold caused by loading or transport of baggage and cargo		●					●	

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
GH 9	Damage to aircraft of unknown origin		●				●	●	
GH 10	Spillage of a fluid generating a fire hazard								
GH 11	Non-compliance with fire safety rules inside the aircraft safety area (including refuelling)								
GH 12	Obstruction of access to fire-fighting equipment, obstruction of the fuelling truck exit route						●		
GH 13	Non-compliance with refuelling procedures when passengers are on board. Risk of delayed or inadequate evacuation in the event of outbreak of fire.								
GH 14	Outbreak of fire on equipment near an aircraft (GSE, etc.)								
GH 15	Transport of hazardous goods in a manner non-compliant with applicable regulations, creating a fire hazard		●					●	●
GH 16	Failure to respect the maximum loading height in the hold		●					●	
GH 17	Incorrect aircraft chocking (strong wind, apron slope, etc.)						●		
GH 18	Loading of incorrect quantities of fuel		●					●	

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
GH 19	Loading of an incorrect fuel type or contaminated fuel		●					●	
GH 20	Fuel cap not properly closed		●						
GH 21	Damage to aircraft or injury to persons due to suction / blast / interaction with engine, rotor or propeller								
GH 22	Interference during taxiing upon aircraft departure or arrival with a vehicle, piece of equipment, person or another aircraft.		●				●		
GH 23	Non-compliance with safety rules when using equipment or materials at height or when opening aircraft doors								
GH 24	Failure to lock or unlock doors, hatches or exits		●					●	●
GH 25	Occurrences related to ground handling operations in restrictive weather conditions (storm, strong wind, etc.)		●				●		
GH 26	Damage to aircraft caused by low visibility conditions							●	

1.5 ATM/ANS

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
AN 1	Runway incursion / near-incursion, waypoint error				●	●		●	
AN 2	Aircraft proximity hazard (separation due)			●			●		
AN 3	Aircraft proximity hazard (separation not due)			●			●		
AN 4	Intrusion into controlled airspace			●			●		
AN 5	Ground-air communications failure (absence, misunderstanding, incorrect transmission of information, incorrect readback, etc.)	●		●	●	●	●	●	
AN 6	Sector overload (ATFCM service failure, sector or position grouping, etc.)	●		●					
AN 7	Publication of incorrect aeronautical information / design defect in an aeronautical information product (including instrument procedures)	●	●	●	●	●	●	●	●
AN 8	Poor coordination with another operator on ground operation-related issues (collision on apron, FOD, GRF procedure, de-icing, apron congestion, etc.) or with another ANS provider	●	●	●	●	●	●	●	●

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
AN 9	Poor coordination with the aerodrome operator on infrastructure work/maintenance on or near a runway (landing or take-off on a shortened or closed runway, hindrance to emergency operations, etc.).				●	●		●	●
AN 10	Flight information service impossible / impaired	●	●	●	●	●	●	●	
AN 11	Alerting service impossible / impaired	●	●	●	●	●	●	●	●
AN 12	Ground-air communications system failure (malfunction, jamming)	●		●	●	●	●	●	
AN 13	Navigation service failure (ILS, etc.)	●		●					
AN 14	Monitoring service failure (loss of radar display, filtered transponder code, incorrect positions, etc.)	●		●	●				
AN 15	Transponder failure not detected	●		●					

1.6 Aerodrome

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
ADR 1	Disturbance of navigation radio aids (ILS, VOR, etc.) or visual aids (PAPI, etc.)	●	●			●		●	
ADR 2	Traffic conflicts between vehicles and aircraft (refusal to give way, etc.)		●		●			●	●
ADR 3	Operational inadequacy (contamination or deterioration) of surface condition		●		●	●	●	●	
ADR 4	Infrastructure and equipment out of order or unsuited to weather conditions (condition of aerodrome lighting, including approach lights)		●	●	●		●	●	
ADR 5	Lack of communication and/or information on work impacting airport configuration and flight operations		●		●	●		●	
ADR 6	Poor coordination / execution of ground operations (collision on apron, de-icing management)	●	●		●		●	●	●
ADR 7	Lack of infrastructure readability (aircraft/vehicle routing errors, taxiway take-off line-up)		●		●	●		●	
ADR 8	Line-up taxiways and runway exits not appropriate for operations		●	●	●		●		

Reference	Safety issue	CFIT	LOC-I	Mid-air collision	Ground collision	Runway excursion	Damage / injuries in flight	Damage / injuries on the ground	Smoke fire pressurisation
ADR 9	Lack of bird and other wildlife hazard management		●		●	●	●	●	●
ADR 10	Ground-air interface failure (misunderstanding, inappropriate transmission of information, etc.)	●	●	●	●	●	●	●	●
ADR 11	Fire-fighting equipment inoperative or ineffective for Aircraft rescue and fire-fighting service							●	●
ADR 12	FOD (FOD on runway, ingestion or projection, aircraft damage)		●			●	●	●	●
ADR 13	Engine blast (projections of objects, damage to aircraft)	●	●		●			●	
ADR 14	Raising of protective surfaces and condition of the strip	●			●			●	

1.7 Continuing airworthiness

Continuing Airworthiness Management Organisations (CAMOs)

Reference	Safety issue	Ultimate Event
CAMO 1	Incorrect monitoring or planning of an aircraft maintenance requirement	Operation of an aircraft not meeting continuing airworthiness requirements – i.e. (EU)1321/2014 – or delivery of an aircraft or aircraft part not meeting the requirements of that regulation.
CAMO 2	Failure to incorporate requirements relating to maintenance or the type of operation into the maintenance programme	
CAMO 3	Failure to order an aircraft maintenance task	
CAMO 4	Ordering and/or contracting a maintenance task from an approved organisation whose scope of activity does not cover the maintenance task to be carried out	
CAMO 5	Termination of implementation of an AD, modification or repair without regard for the corresponding operational requirements	

Maintenance organisations

Reference	Safety issue	Ultimate Event
AMO 1	Non-detection during an inspection or misjudgement of a defect outside the criteria defined in the maintenance data	Operation of an aircraft not meeting continuing airworthiness requirements – i.e. (EU)1321/2014 – or delivery of an aircraft or aircraft part not meeting the requirements of that regulation.
AMO 2	Foreign Object Debris forgotten or ingested	
AMO 3	Partial or non-execution of a maintenance task	
AMO 4	Incorrect assembly or installation of an aircraft part (including adjustment)	
AMO 5	Rectification of a defect or repair not applicable to the defect found	
AMO 6	Installation of a part or equipment or use of a consumable, ingredient or material not applicable to the aircraft or the type of ETOPS operation, etc.	
AMO 7	Procurement and storage of products, parts or materials that are unusable or non-compliant with the approved definition	
AMO 8	Use of unsuitable or unusable ground support tools, instruments or equipment	
AMO 9	Ground test incorrectly carried out	
AMO 10	Critical task not inspected or duplicate inspection incorrectly performed	

1.8
Systemic safety-resilience

Safety management systems

Reference	Safety issue
SYS 1.1	Failure to promote the SMS
SYS 1.2	Lack of coordination with another operator or service provider
SYS 1.3	Lack of design, knowledge and use of procedures
SYS 1.4	Failure to determine root causes when analysing safety occurrences
SYS 1.5	Reduced focus on or less priority given to safety (erosion of the SMS)

HOF Training Skills

Reference	Safety issue
SYS 2.1	Lack of manager HOF knowledge, skills and involvement
SYS 2.2	Lack of knowledge development, maintenance and sharing
SYS 2.3	Lack of management and assessment of the skills of staff with authority in the field of human factors / level of skills of HOF trainers
SYS 2.4	Lack of appropriate language skills

Systemic or cyclical crisis

Reference	Safety issue
SYS 3.1	Non-compliance with procedures
SYS 3.2	Shortage of operational and technical staff, reduced resources allocated in crisis situations
SYS 3.3	Lack of liaison (including oversight) with suppliers and subcontractors
SYS 3.4	Lack of organisational and individual resilience

Physiological and psychological management of staff

Reference	Safety issue
SYS 4.1	Difficulty managing the risk of fatigue (including sleep management) among aviation personnel
SYS 4.2	Reduction in the well-being of aviation professionals and difficulties for the organisation in addressing the risk (presenteeism, absenteeism, use of psychotropic substances, alcohol, etc.).
SYS 4.3	Impact of work organisation (schedule, workload, operational pressure, etc.) and related consequences (physiological and psychological)
SYS 4.4	Lack of support programmes for aviation personnel (when required)
SYS 4.5	Lack of a just culture or positive safety culture (managerial pressure exerted or perceived, etc.)

Human factors and human performance

Reference	Safety issue
SYS 5.1	Lack of decision-making in complex systems
SYS 5.2	Failure to include Human Factors in technical design and documentation (maintenance and manufacturing)

Safety / security overlap

Reference	Safety issue
SYS 6.1	Lack of coordination between safety and security within an organisation

Other safety issues identified

Reference	Safety issue
SYS 7.1	SYS 6.0 Vulnerability of aircraft and systems leading to an impairment of flight safety due to cyber-attacks

2

RISK MANAGEMENT **METHODS**

2.1 Creation of a Hazard List

A hazard can be defined as a situation or object likely to cause or contribute to an incident or accident. Hazards can be found at any level in an organisation.

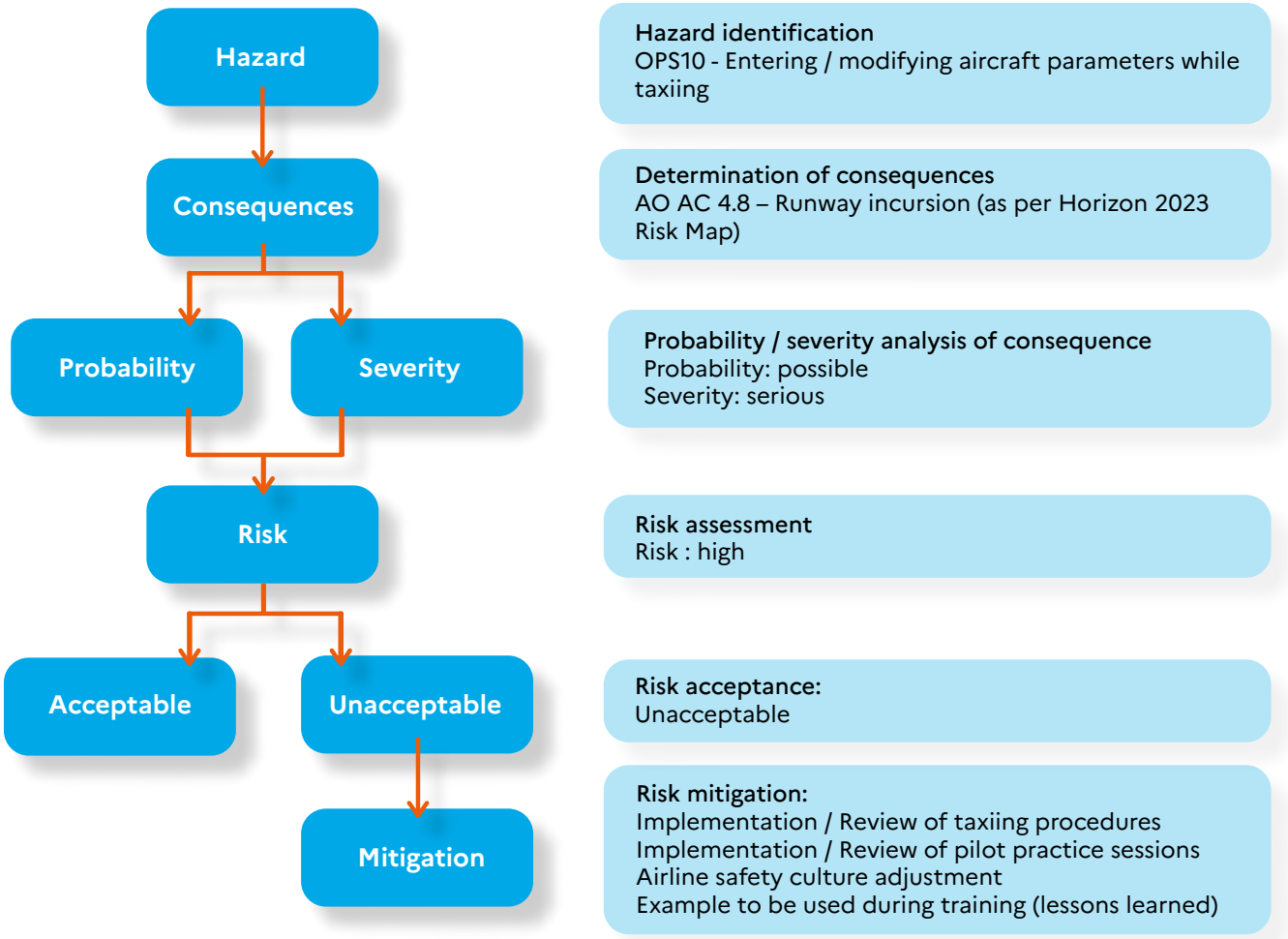
Hazards can be identified in many ways, including but not limited to: occurrence reporting systems, inspections, investigations, audits, analyses, weather reports, national or regional aviation safety plans (EPAS, DGAC Horizon Plan), etc.

The generic categories and sub-categories of hazard can be defined as follows (non-exhaustive list):

An example of a hazard list developed at the DSAC 2021 symposium on runway incursions (https://www.ecologie.gouv.fr/sites/default/files/Sym_DSAC_Incursions_Piste.pdf) is provided in the appendix.

Technical	Environment
Internal equipment	Meteorology
External equipment	Wildlife
Internal facilities	Natural disasters
External facilities	Site geography
Organisation	**Human**
Culture	Psychological
Documentation	Physiological
Internal processes	Well-being
External processes	Communication
External impacts (recession, etc.)	Interface (man machine-process)
External changes	Skills
Management	Medical
Training sessions	Performance

Hazard lists can then be used to build a risk map, or to feed a Bowtie diagram, by implementing an analysis process that can be illustrated by the flowchart below.



2.2 Bowtie method

The Bowtie method allows the risks associated with complex safety issues to be assessed, understood and managed.

It provides a clear view on a bowtie diagram of the key factors of a risk scenario, the hazards and threats, the associated prevention and recovery barriers and the potential consequences (ultimate event).

Identifying prevention and recovery barriers and analysing their effectiveness are central to the method. In particular, it identifies actions to be implemented to reinforce the barriers detected as being ineffective, defective or lacking.

Identification of the occurrence corresponding to the loss of control of an operational process:

The first part of the method consists of defining the occurrence corresponding to the loss of control of an operational process (the undesirable event or UE).

In the example given here, the UE is "Incorrect altimeter setting on approach (excluding ILS and LPV)".

Identification of potential outcomes (downstream):

The other side of the Bowtie diagram identifies the potential outcomes of the risk scenario. These outcomes, referred to as ultimate events, are generally accidents within the meaning of ICAO Annex 13.

In the example given here, the ultimate events can be:

- → controlled flight into terrain (CFIT);
- → a runway excursion (RE);
- → a mid-air collision (MAC).

Identification of hazards and threats upstream of the undesirable event:

The potential causes that could contribute to this risk scenario should then be identified. These causes, presented in the form of hazards and threats, are grouped together on the "upstream" side of the Bowtie diagram.

In our example, these hazards and threats may be:

- → crew or ATC lack of awareness that the approach is sensitive to the altimeter setting;
- → non-standard ATC wording;
- → ATC lack of awareness that the crew is making a QNH-sensitive instrument approach;
- → etc.

Identification of prevention and recovery barriers:

Prevention barriers are put in place to prevent hazards (or threats) from leading to UEs. If the UE is reached nonetheless, recovery barriers are in place to prevent the ultimate event. The barriers in this example are categorised as follows:

- → design (aircraft, equipment, infrastructure) – (hardware);
- → regulations, procedures (SOP), processes – (software);
- → situational awareness / airworthiness (Liveware);
- → alert system, abnormal procedures, → training / skills;
- → SMS-SSP (operation of the SMS, FDM, oversight/inspection by the authority, etc.);

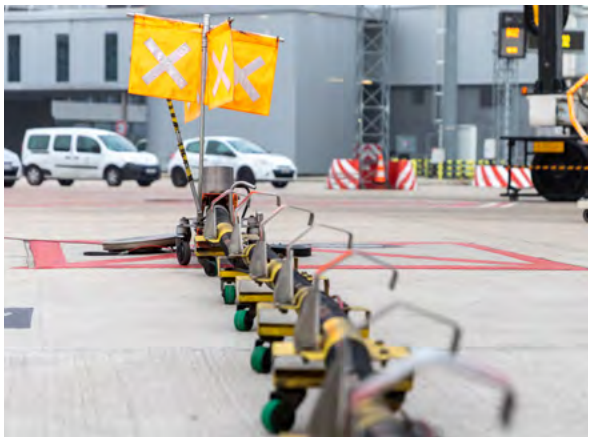
In this example, the prevention barriers identified included:

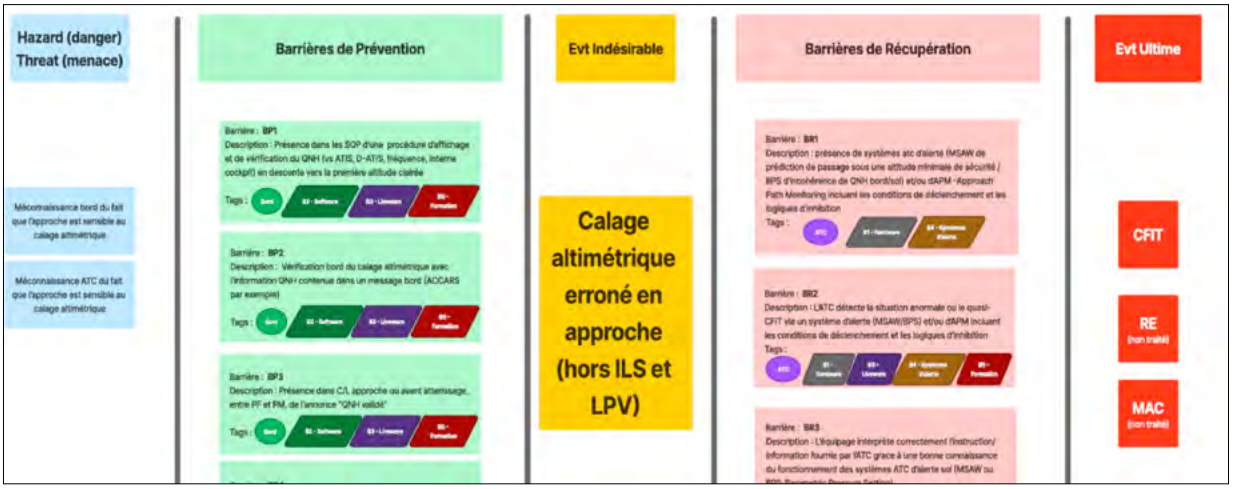
- → regulatory: ATIS at a maximum rate of 100 words per minute;
- → procedural: ATC informed by the crew of the type of approach;
- → actions to promote safety: promoting and prioritising the use of geometric approaches;
- → technical: ATC alert when a selected QNH is incorrect;
- → etc.

In this example, the recovery barriers identified included:

- → the presence of an ATC alert system, such as MSAW. This system triggers a warning as soon as it anticipates that the aircraft will fall below a safe altitude;
- → the presence on board of a TAWS or EGPWS which warns of a risk of proximity to the ground;
- → etc.

The safety barrier concept is used in many risk management tools such as the ERCS or the ARMS method (Aviation Risk Management Solution, see the risk classification guidance below). It is central to the SMS and SSP approach to safety topics since the SMS and the SSP must be coordinated to ensure that the barriers are present, functional and effective.





→ Figure 4: extract from the Bowtie diagram on incorrect altimeter setting on approach

Safety barrier assessment, monitoring and management:

Safety analysis relevance is based on the assessment, monitoring and management of the effectiveness of safety barriers in terms of their ability to mitigate risks. Performance indicators and qualitative assessments allow changes in these risks to be monitored on an ongoing basis.

The 2022 safety report (p. 44 to 47) contains the Bowtie diagram developed on incorrect QNH setting during a non-precision approach.

2.3 Safety occurrence report risk classification

Article 7 of EU Regulation No. 376/2014 stipulates that safety occurrence reports shall include a safety risk classification for the occurrence concerned. This classification is a decision-making tool for safety occurrence handling by organisations and their decision to take corrective actions as and when necessary.

This regulation does not require organisations to use any particular classification method, so they are free to choose the method best suited to the risks identified by them and processed by their safety management system.

DSAC has therefore produced guidance explaining how the risk classification process fits into the general framework for the handling of safety occurrences by organisations. This guidance also presents the risk classification methods most widely used by French organisations today.

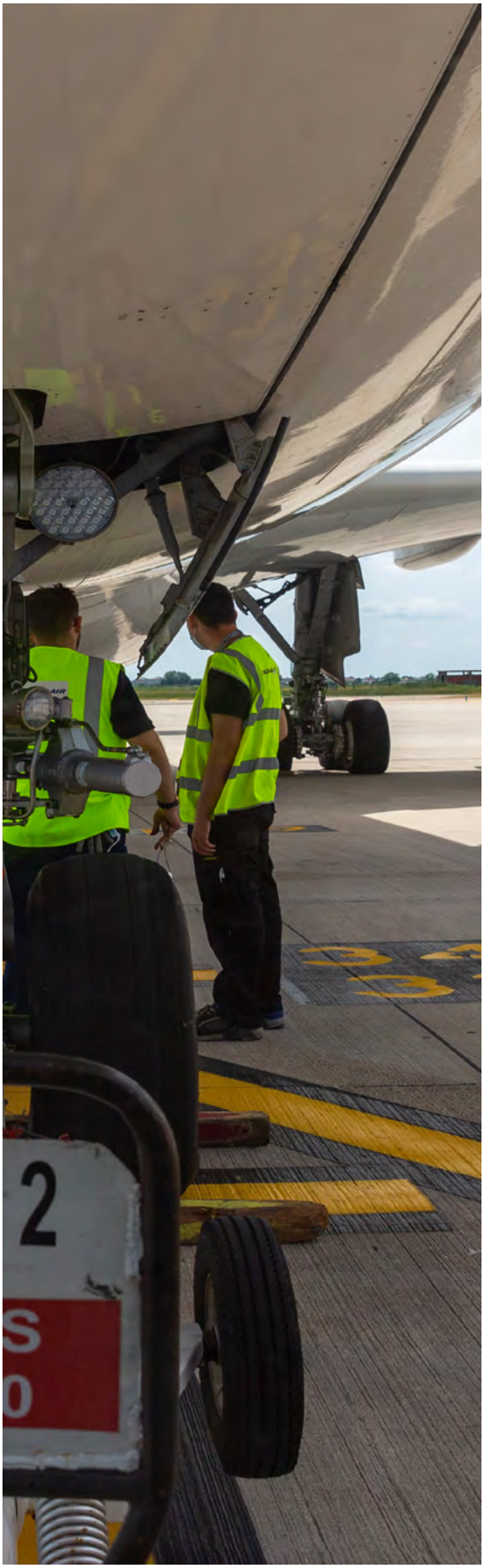
It is designed for all organisations to which Regulation (EU) No. 376/2014 applies. This guidance is part of the Authority's implementation of the European Risk Classification Scheme (ERCS), as defined in EU Delegated Regulation 2020/2034.

www.ecologie.gouv.fr/sites/default/files/GUIDE_Classification_des_risques.pdf

2.4 Risk exposure reduction tools (e.g. TEM)

The SMS of organisations identifies major safety barriers. Organisations and stakeholders use this identification to reduce exposure to risk, for example by using the Threat and Error Management (TEM) method. This method involves identifying threats, taking account of errors and implementing strategies to manage them. It is a highly documented method covered by the DGAC Safety Info document 2020/01: https://www.ecologie.gouv.fr/sites/default/files/Info_securite_Threat_and_Error_Management.pdf.

TEM is also one of the elements of Crew Resource Management (CRM) training required by EASA (EU Regulation No. 965/2012 ORO.FC.115 and AMCs), in the same way as the other components of CRM.



APPENDIX

3.1
List of hazards associated with the "runway incursion" risk

The following hazard list was developed at the DSAC 2021 "Runway incursion" symposium.

Human: Psychology and Physiology

GEN-HF1	Psychological limitations (medicines & psychoactive substances, fatigue, stress, lack of O_2)
GEN-HF2	Cognitive limitations (medicines & psychoactive substances, fatigue, stress, lack of O_2)
GEN-HF3	Physiological limitations (medicines & psychoactive substances, fatigue, stress, lack of O_2)
GEN-HF4	Sensory limitations
GEN-HF5	Significant workload (training situation, solo helicopter flight, etc.)

Human: Non-technical skills

GEN-NT1	Lack of leadership, critical thinking, teamwork and decision-making skills
GEN-NT2	Poor stress management

Organisation

GEN-ORGA1	Non-existent or non-compliant documentation
GEN-ORGA2	Poor management of incursion risk (no or inadequate indicators, inadequate risk matrix, etc.)
GEN-ORGA3	Non-existent or inadequate procedures (SOPs, ATC, drivers)
GEN-ORGA4	Non-compliant initial or recurrent training

GEN-ORGA5	Insufficient terrain variability during pilot training
GEN-ORGA6	Little taxiing practice during initial training
GEN-ORGA7	Poor change management (new MMI, implementation of a new system: RWSL, *follow the green*, etc.)
GEN-ORGA8	Pressure from the organisation on traffic personnel
GEN-ORGA9	No briefing before taking up duties
GEN-ORGA10	Temporal and/or operational pressure
GEN-ORGA11	Lack of safety promotion
GEN-ORGA12	Poor communication between airfield users (general aviation, winching, parachuting, ATC, commercial aviation, etc.)

Environment

GEN ENVI1	Low visibility conditions (fog, mist, sun, snow, etc.)
GEN ENVI2	Geographical positioning
GEN ENVI3	Crisis situation impacting normal operations (health crisis, etc.)

Technical: Infrastructure

ADR1	Non-compliant marking / lighting (faded, covered by grass, etc.)
ADR2	Non-existent marking / lighting
ADR3	Complicated taxiway naming
ADR4	Complex TWY layout
ADR5	Very short runway access TWY
ADR6	Taxiway plan not suited to traffic
ADR7	Confusion between runways and TWYs (former runway converted into a TWY)
ADR8	QFU alignment confusion
ADR9	Hot Spot survey not up to date

ADR10	Construction or work preventing good visibility of runways and taxiways (including hot spots)
ADR11	No procedure (ANSP-ADR) in the event of stop bar failure
ADR12	High-speed turn-off used for runway line-up
ADR13	Runway layout generating a long Runway Occupancy Time
ADR14	Use of runway as TWY
ADR15	Inappropriate signage or marking of a closed taxiway or runway
ADR16	No secondary roads for vehicles to avoid runways and TWYs
ADR17	Inappropriate/missing signage and marking for vehicles authorised to use manoeuvring areas
ADR18	Increased frequency of runway inspections
ADR19	Poor or no coordination with other departments and operators during work, new installations, new equipment, etc.
ADR20	Inadequate briefing and/or supervision of contractors during work on or near runways / ILS sensitive areas
ADR21	Presence of obstacles (buildings, aerials, construction machines, work, etc.) blocking the controller's visibility of runways and TWYs (particularly hot spots).
ADR22	Parachute drop zone too close to runways
ADR23	Complicated or unusual taxiing

Human drivers: Technical skills

ADR24	Wrong wording used by drivers
ADR25	Infrequent or no communication of the position of one or more vehicles on the runway
ADR26	No driver confirmation
ADR27	Driver inattention
ADR28	Radio unsuitable, missing or out of order

Human: technical skills

OPS1	Inappropriate analysis / TEM
OPS2	Prolonged period of inactivity with an impact on skills
OPS3	Difficulty adapting to MMI
OPS4	Inadequate briefing (AIP, NOTAM, Hot spot, etc. not fully included)
OPS5	Incorrect identification of marking and signals
OPS6	Poor radio communication (incorrect wording, incomplete readback, etc.)
OPS7	Performing other tasks during taxiing (calculating flight duty time, public address, engine start-up checklist, etc.).
OPS8	Poor application of airline procedures during taxiing (SOPs, etc.)
OPS9	Poor / non-compliant application of sterile flight deck rules (task interruption, etc.)
OPS10	Entering / modifying aircraft parameters while taxiing
OPS11	Excessive taxiing speed
OPS12	Crew's haste (expected clearance)
OPS13	Inadequate or no use of *Airports Charts* (small display, knowledge of terrain, etc.)
OPS14	No confirmation (Pilot-Pilot and Pilot-ATC)
OPS15	Inadequate pilot management of a conditional clearance
OPS16	Poor adjustment to manage temporal-operational pressure (slot, delay, flight duty time, Fuel Saving Policy, etc.), weather conditions, exceptional situation (strike, security event, incident/accident, etc.).
OPS17	Use of high-speed turn-off for line-up
OPS18	Failure to check that the runway is clear before crossing or using it

In functional blocks of generic hazards (DSNA)

Mental representation	Use of visuals (tower windows and cameras)
Mental representation	Availability and use of GROUND surveillance system (ground surveillance image where available)
Mental representation	Use of flight information strips
Mental representation	VHF listening
Mental representation	Inter- or intra-site coordination
Decision	Appropriate clearance
Execution	Communication of clearance (normal or emergency)
Recovery	All barriers above + reaction to safety nets

Horizon 2028 • National Aviation Safety Plan - Risk Management Tools
Publishing Director: Damien Cazé, Director General of Civil Aviation
DSAC Technical, Communication and Public Relations Advisor: Quentin Guiet
Coordination: MEAS
Illustrations: René Deymonaz
Photos: Stéphane Corcos, Richard Metzger, Nicolas Téclès, Benoît Bleunven, Sylvain de Buyser, Léna Téclès, Arnaud Bouissou, William Topa, Josiah Farrow, Kristina Delp, Chris Leipelt, John Mcarthur, Andrew Ruiz, AirFrance Photolibrary
Designed and produced by: Evane Legastelois
February 2024

French Civil Aviation Safety Directorate
50, rue Henry Farman
75720 Paris cedex 15
Telephone: +33 1 58 09 43 21
ecologie.gouv.fr