

**EUROCONTROL SAFETY REGULATORY REQUIREMENT
(ESARR)**

ESARR 4

**RISK ASSESSMENT AND
MITIGATION IN ATM**

Edition	:	1.0
Edition Date	:	05-04-2001
Status	:	Released Issue
Class	:	General Public

DOCUMENT IDENTIFICATION SHEET

DOCUMENT DESCRIPTION

Document Title

**EUROCONTROL Safety Regulatory Requirement - ESARR 4
Risk Assessment and Mitigation in ATM**

REFERENCE:

ESARR 4

EDITION :

1.0

EDITION DATE :

05-04-2001

Abstract

This EUROCONTROL Safety Regulatory Requirement has been prepared by the Safety Regulation Commission. This requirement concerns the use of risk assessment and mitigation, including hazard identification, in Air Traffic Management when introducing and/or planning changes to the ATM System.

This requirement shall apply to all providers of ATM services in respect of those parts of the ATM/CNS System and supporting services for which they have managerial control.

Keywords

Risk Assessment	Hazard	Severity Classification	Air Traffic Management
Risk Mitigation	Safety Objective	Safety Requirement	

CONTACT PERSON : Martine Blaize

TEL: +32 2 729 4632

DIVISION: DGOFF/SRU

DOCUMENT STATUS AND TYPE

STATUS		CATEGORY		CLASSIFICATION	
Working Draft	<input type="checkbox"/>	Safety Regulatory Requirement	<input checked="" type="checkbox"/>	General Public	<input checked="" type="checkbox"/>
Draft	<input type="checkbox"/>	ESARR Advisory Material	<input type="checkbox"/>	Restricted EUROCONTROL	<input type="checkbox"/>
Proposed Issue	<input type="checkbox"/>	Comment Response Document	<input type="checkbox"/>	Restricted SRC	<input type="checkbox"/>
Released Issue	<input checked="" type="checkbox"/>	Policy Document Document	<input type="checkbox"/>	Restricted SRU	<input type="checkbox"/>

ELECTRONIC BACKUP

INTERNAL REFERENCE NAME : P:\SRC\REG.\ESARR\ESARR4\ESARR4v1.0RI.doc

HOST SYSTEM

EUROCONTROL Network
Printing date:06/04/01

MEDIA

Type : Hard disk
Media Identification :

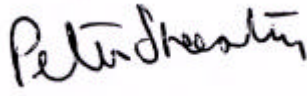
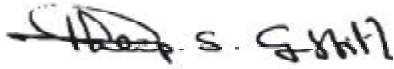
SOFTWARE(S)

MS Office Word 7.0
MS WINDOWS NT4.0

SOFTCOPIES OF SRC DELIVERABLES CAN BE DOWNLOADED FROM:
<http://www.eurocontrol.be/src/index.html>

DOCUMENT APPROVAL

The following table identifies all authorities who have successively approved the present issue of this document.

AUTHORITY	NAME AND SIGNATURE	DATE
Head Safety Regulation Unit (SRU)	 (Peter STASTNY)	05-04-2001
Chairman Safety Regulation Commission (SRC)	 (Philip S. GRIFFITH)	05-04-2001

DOCUMENT CHANGE RECORD

The following table records the complete history of the successive editions of the present document.

EDITION	DATE	REASON FOR CHANGE	SECTIONS PAGES AFFECTED
0.01	29/01/99	Creation- Working Draft from SRU to RTF (Based on the current version of the EATCHIP Safety Assessment Methodology)	All
0.02	16/03/99	Working Draft incorporating initial RTF inputs.	All
0.03	29/06/99	Working Draft incorporating RTF comments	All
0.04	08/07/99	Working Draft D incorporating additional RTF comments	All
0.05	29/07/99	Working Draft incorporating additional RTF comments.	All
0.06	05/08/99	Working Draft incorporating additional RTF comments.	All
0.07	18/08/99	Working Draft after RTF review.	Sections 2.1, 4.1, 5.2, 5.3, 8.1 and 8.2
0.08	15/09/99	Draft for SRC consultation.	Sections 2.1, 4.1, 5.2, 5.3, 8.1 and 8.2
0.09	16/11/99	Draft to introduce first pages (Configuration control). No changes to requirement itself.	Pages 1 to 6 added
0.10	21/12/99	Draft taking into account comments from SRC. Draft with appendix A populated. Submitted to the first meeting of Ad Hoc Group of experts in hazard classification scheme.	Pages Appendix A
0.11	11/01/00	Draft taking into account results of the first meeting of Ad Hoc Group of experts in hazard classification scheme and preliminary changes in terminology to ensure consistency between ESARR 3 and ESARR 4. Takes also into account a revised and more limited Appendix B.	Title Appendix A Appendix B All sections where 'risk management' is used.
0.12	21/01/00	Draft to take into account draft definitions for Appendix B as well as results of the second meeting of Ad Hoc Group of experts in hazard classification scheme.	Appendix A and Appendix B
0.13	02/03/00	Draft to take into account RTF, EMEU and SQS comments and to finalise the development of ECAC quantitative ATM Safety Minima. Sent to SRC-wide consultation.	Executive summary Appendices A&B

0.14	31/05/00	Draft to take into account SRC Comments. Submitted to RTF9 for validation before EUROCONTROL-wide consultation	All
0.20	14/07/00	Draft addressing SRC comments from 2 nd consultation. Resolution of comments as agreed by RTF9. For submission to EUROCONTROL-wide consultation	Sections 4, 5.1, 5.2, 8.2 and Appendices A&B
0.30	11/10/00	Draft addressing EUROCONTROL-wide comments from 1st consultation. Draft resolution of comments as proposed by SRU to HCM4.	Sections 1,3, 5,8 and Appendices A&B
0.31	21/11/00	Draft addressing EUROCONTROL-wide comments from 1st consultation. Draft resolution of comments as agreed by HCM4 and send to HCM5 for confirmation.	Sections 1,3, 5,8 and Appendices A&B
0.32	19/12/00	Draft addressing EUROCONTROL-wide comments from 1st consultation. Draft resolution of comments as agreed by HCM5 and send to RTF10 for confirmation.	Sections 1,3, 5,8 and Appendices A&B
0.40	10/01/01	Draft addressing EUROCONTROL-wide Comments from 1st consultation. Resolution of comments as agreed by HCM and by RTF. Draft Proposed Issue agreed by HCM.	Appendices A&B
0.50	17/01/01	Draft addressing EUROCONTROL-wide Comments from 1st consultation. Resolution of comments as agreed by HCM and by RTF. Proposed Issue submitted to SRC10 for approval	Appendices A&B
0.60	13/02/01	Editorial changes by SRC 10. Proposed Issue agreed by SRC.	Section 8.1.1 Appendix A
0.70	01/03/01	Changes following EMEU and CMIC comments. Proposed Issue agreed by SRC by correspondence. Proposed Issue submitted to PC10 for approval	Section 3.2
1.0	05/04/01	Approval by EUROCONTROL Commission - Released Issue.	All

TABLE OF CONTENTS

DOCUMENT IDENTIFICATION SHEET.....	2
DOCUMENT APPROVAL.....	3
DOCUMENT CHANGE RECORD.....	4
TABLE OF CONTENTS.....	6
EXECUTIVE SUMMARY.....	7

DOCUMENT STRUCTURE

RISK ASSESSMENT AND MITIGATION IN ATM

1. Scope.....	8
2. Rationale.....	8
3. Applicability.....	9
4. Safety Objective.....	9
5. Safety Requirement.....	9
6. Implementation.....	11
7. Exemptions.....	11
8. Additional Material.....	11
Appendix A: Risk Classification Scheme.....	13
Appendix B: Terms and Definitions – Glossary.....	18

EXECUTIVE SUMMARY

This document has been prepared by the Safety Regulation Commission.

This requirement concerns the use of Risk Assessment and Mitigation, including hazard identification, in Air Traffic Management when introducing and/or planning changes to the ATM System. In this requirement, Risk Assessment and Mitigation are being addressed adopting a total aviation system approach.

This requirement shall apply to all providers of ATM services in respect of those parts of the ATM System for which they have managerial control.

The provisions of this requirement are to become effective within three years from the date of adoption by the EUROCONTROL Commission.

EUROCONTROL SAFETY REGULATORY REQUIREMENT

Risk assessment and mitigation in ATM

1. Scope

- 1.1 This requirement concerns the use of a quantitative risk based-approach in Air Traffic Management when introducing and/or planning changes to the ATM System¹.
- 1.2 This requirement covers the human, procedural and equipment (hardware, software) elements of the ATM System as well as its environment of operations.
- 1.3 This requirement covers the complete life-cycle of the ATM System, and, in particular, of its constituent parts.
- 1.4 This requirement does not address the assessment of introducing and/or planning organisational or management changes to the ATM service provision².

2. Rationale

- 2.1 The increasing integration, automation and complexity of the ATM System requires a systematic and structured approach to risk assessment and mitigation, including hazard identification, as well as the use of predictive and monitoring techniques to assist in these processes.
- 2.2 Errors in the design, operation or maintenance of the ATM System or failures in the ATM System could, through a decrease in safety margins, result in, or contribute to, a hazard to aircraft. Increasingly, more reliance and therefore a greater safety burden, is being placed upon all parts of the ATM System. In addition, the increased interaction of ATM across State boundaries requires that a consistent and more structured approach be taken to the risk assessment and mitigation of all ATM System elements throughout the ECAC States.
- 2.3 In addition, and in certain cases, the implementation of ESARR 3 (Use of Safety Management Systems by ATM Service Providers) also necessitates the provision of more specific requirements to be used. ESARR 4 provides such detailed requirements, hence developing further sections 5.2.4 and 5.3.4 of ESARR 3.
- 2.4 Accordingly, a harmonised approach to the identification, assessment and management of risk is a necessary step in ensuring high levels of ATM safety across the ECAC area.

¹ Considering its airborne and ground (including spatial) components.

² The implementation of Safety Management System is being addressed in ESARR 3 « Use of Safety Management Systems by ATM Service Providers ».

3. Applicability

- 3.1 This requirement shall apply to all providers of ATM services in respect of those parts of the ATM System and supporting services, within their managerial control³.
- 3.2 This requirement shall apply to military ATM service providers except in those cases in which military ATS or Air Defence are only and exclusively involved in the control of military aircraft, in a segregated military airspace environment.

4. Safety Objective

4.1 Within the overall objective of ensuring safety, the objective of this requirement is to ensure that the risks associated with hazards in the ATM System are systematically and formally⁴ identified, assessed, and managed within safety levels, which as a minimum, meet those approved by the designated authority.

5. Safety Requirement

- 5.1 An ATM service provider shall ensure that hazard identification as well as risk assessment and mitigation are systematically conducted for any changes to those parts of the ATM System and supporting services within his managerial control, in a manner which :-
- a. addresses the complete life-cycle of the constituent part of the ATM System under consideration, from initial planning and definition to post-implementation operations, maintenance and de-commissioning;
 - a. addresses the airborne and ground⁵ components of the ATM System, through co-operation with responsible parties; and
 - b. addresses the three different types of ATM elements (human, procedures and equipment), the interactions between these elements and the interactions between the constituent part under consideration and the remainder of the ATM System.
- 5.2 The hazard identification, risk assessment and mitigation processes shall include:-
- a. a determination of the scope, boundaries and interfaces of the constituent part being considered, as well as the identification of the functions that the constituent part is to perform and the environment of operations in which it is intended to operate;
 - b. a determination of the safety objectives to be placed on the constituent part, incorporating :-
 - (i) an identification of ATM-related credible hazards and failure conditions, together with their combined effects,
 - (ii) an assessment of the effects they may have on the safety of aircraft, as well as an assessment of the severity of those effects, using the severity classification scheme provided in Appendix A, and

³ Whatever the national or international institutional arrangements supporting the provision of ATM services, the provisions of this requirement have to be met.

⁴ Used in its common English sense.

⁵ Including spatial components.

- (iii) a determination of their tolerability, in terms of the hazard's maximum probability of occurrence, derived from the severity and the maximum probability of the hazard's effects, in a manner consistent with Appendix A;
- c. the derivation, as appropriate, of a risk mitigation strategy which :-
 - (i) specifies the defences to be implemented to protect against the risk-bearing hazards⁶,
 - (ii) includes, as necessary, the development of safety requirements⁷ potentially bearing on the constituent part under consideration, or other parts of the ATM System, or environment of operations, and
 - (iii) presents an assurance of its feasibility and effectiveness⁸;
- d. verification that all identified safety objectives and safety requirements have been met
 - (i) prior to its implementation of the change,
 - (ii) during any transition phase into operational service,
 - (iii) during its operational life, and
 - (iv) during any transition phase till decommissioning.

(Note: It is considered as essential that the activities depicted in a), b), c) and d) are fully co-ordinated between those parties responsible for developing and implementing the safety requirements bearing on the constituent parts of the ATM System). See 5.1 (b) above.

(Note: It is recognised that a combination of quantitative (e.g. mathematical model, statistical analysis) and qualitative (e.g. good working processes, professional judgement) arguments may be used to provide a good enough level of assurance that all identified safety objectives and requirements have been met).

5.3 The results, associated rationales and evidence of the risk assessment and mitigation processes, including hazard identification, shall be collated and documented in a manner which ensures:-

- a. that correct and complete arguments are established to demonstrate that the constituent part under consideration, as well as the overall ATM System are, and will remain, tolerably safe⁹ including, as appropriate, specifications of any predictive, monitoring or survey techniques being used;
- b. that all safety requirements related to the implementation of a change are traceable to the intended operations/functions.

⁶ To meet the safety objectives, and potentially to reduce and/or eliminate the risks induced by identified hazards.

⁷ These safety requirements would be identified by the user of the system within the relevant standards and would need to be assessed, accepted and implemented prior to any operational use of the constituent part of the ATM system under consideration.

⁸ The depth and scope of the analysis may depend on the types of functions performed, the severity of the effects of the hazards, and the complexity of the constituent part of the ATM system under consideration.

⁹ I.e., meeting allocated safety objectives and requirements.

6. Implementation

- 6.1 The provisions of this requirement are to become effective within three years from the date of adoption by the EUROCONTROL Commission.

7. Exemptions

None

8. Additional Material

- 8.1 Acceptable means of compliance

- 8.1.1 For existing parts of the ATM System, an analysis based on available historical data, such as safety occurrence (i.e. , accident, incident, ATM specific occurrence) statistics, human errors, equipment faults, mostly based on system safety monitoring and occurrence reporting schemes may contribute evidence to the safety assurance process, hence complementing the safety analysis depicted in section 5 of this requirement.

- 8.2 Other guidance

- 8.2.1 EATMP SAM SAF ET1.ST03.1000-MAN- (Ed 1.0) is considered as a useful guidance when implementing this safety regulatory requirement¹⁰. The applicability of the methodology would need to be specified at the beginning of any risk assessment and mitigation process.

(Note: Future revisions of that document are also to be foreseen, to encompass assessment of the human, equipment and procedures elements and develop further the system safety assessment process beyond the Functional Hazard Assessment).

- 8.2.2 Link with ATM software qualification

- 8.2.2.1 The safety objectives allocated to each hazard drive the determination of specific means to attain the proper level of confidence in the success of implementing the mitigation strategies and related safety requirements.

- 8.2.2.2 These means may include a set of different levels of constraints being set on specific software elements of the ATM System.

- 8.2.3. Safety monitoring and data collection

- 8.2.3.1 Safety monitoring and data collection mechanisms could be specifically developed as an enabling tool to the validation of the safety assumptions and requirements as identified during the risk assessment and mitigation processes, including hazard identification, as well as the assessment of the safety added value of the programme. For example, such mechanisms could be used for the validation of theoretical data such as Mean Time Between Failures) and models (such as fault tree, reliability flow charts) used in the safety assessment and safety assurance processes.

¹⁰ WARNING:- The terminology used in that guidance is not fully consistent with that used by the Safety Regulation Commission. The compliance of this guidance with ESARR 4 still needs to be assessed by SRC.

8.2.3.2 In addition, safety monitoring and data collection mechanisms consistent with the provisions of ESARR 2¹¹, could also be developed as enabling tools to define global safety indicators in order to control and monitor the safety levels reached in operation by the ATM System.

8.2.3.3 Safety monitoring should therefore be seen as a complementary means of qualification before and during operational use.

8.3 Definitions
Refer to Appendix B.

¹¹ ESARR 2 : « Reporting and Analysis of Safety Occurrences in ATM ».

APPENDIX A

Risk Classification Scheme

A-1 Hazard Identification and Severity Assessment in ATM

Before the risks associated with introduction of a change to the ATM System in a given environment of operations can be assessed, a systematic identification of the hazards shall be conducted.

The severity of the effects of hazards in that environment of operations shall be determined using the classification scheme shown in **Figure A-1**.

*(Note: **Figure A-1** provides a framework for assessing the severity of effects of hazards in a specific environment of operations. It does this by providing a qualitative ranking scheme for the severity/magnitude of the effect of hazards **on operations**, which may arise from the various failure modes of elements of the ATM System.)*

As there is no such scheme today as an accident/incident causation model, the severity classification shall rely on a specific argument demonstrating the most probable effect of hazards, under the worst case scenario.

(Note: The potential for a hazard to lead to an accident or an incident (i.e., considering both the proximity of the accident and the degree of ability to recover from the hazardous situation) is dependent on many factors. Therefore, it is not usually practicable to identify and evaluate the severity explicitly without assessing the effects of the hazards on the various constituent parts of the ATM System.)

In order to deduce the effect of a hazard on operations and to determine its severity, the systematic approach/process shall include (but not be restricted to) the effects of hazards on the various elements of the ATM System, such as:-

- ❑ Effect of hazard on air crew, (E.g., workload, ability to perform his/her functions);
- ❑ Effect of hazard on the Air Traffic Controllers, (E.g., workload, ability to perform his/her functions);
- ❑ Effect of hazard on the aircraft functional capabilities;
- ❑ Effect of hazard on the functional capabilities of the ground part of the ATM System;
- ❑ Effect of hazard on the ability to provide safe Air Traffic Management Services; (E.g., magnitude of loss or corruption of Air Traffic Management Services/functions).

(Note: These should be seen as characteristics which need to be considered in order consistently to identify all the hazards and assess the severity of their effects on operations.)

(Note: The scope of the hazard identification and severity assessment is not limited to the boundaries of the components of the system being changed, but should include all components and systems involved in the service provided in the environment of operations.)

(Note: The severity assessment should also include considerations of:-

- various types of exposure to the hazard (E.g., Number of aircraft exposed to the hazard, geographical region exposed, etc.);*
- characteristics of the environment of operations.*

(Note:- It is advisable that elements of the environment of operations which can be used as compensating factors in the severity assessment be identified and agreed with the safety regulators before initiating the safety assessment process.)

Severity Class	1 [Most Severe]	2	3	4	5 No safety effect [Least Severe]
Effect on Operations*)	Accidents	Serious incidents	Major incidents	Significant incidents	No immediate effect on safety
Examples of effects on operations Include*):	<ul style="list-style-type: none"> <input type="checkbox"/> one or more catastrophic accidents, <input type="checkbox"/> one or more mid-air collisions <input type="checkbox"/> one or more collisions on the ground between two aircraft <input type="checkbox"/> one or more Controlled Flight Into Terrain <input type="checkbox"/> total loss of flight control. <p>No independent source of recovery mechanism, such as surveillance or ATC and/or flight crew procedures can reasonably be expected to prevent the accident(s).</p>	<ul style="list-style-type: none"> <input type="checkbox"/> large reduction in separation (e.g., a separation of less than half the separation minima), without crew or ATC fully controlling the situation or able to recover from the situation. <input type="checkbox"/> one or more aircraft deviating from their intended clearance, so that abrupt manoeuvre is required to avoid collision with another aircraft or with terrain (or when an avoidance action would be appropriate). 	<ul style="list-style-type: none"> <input type="checkbox"/> large reduction (e.g., a separation of less than half the separation minima) in separation with crew or ATC controlling the situation and able to recover from the situation. <input type="checkbox"/> minor reduction (e.g., a separation of more than half the separation minima) in separation without crew or ATC fully controlling the situation, hence jeopardising the ability to recover from the situation (without the use of collision or terrain avoidance manoeuvres). 	<ul style="list-style-type: none"> <input type="checkbox"/> increasing workload of the air traffic controller or aircraft flight crew, or slightly degrading the functional capability of the enabling CNS system. <input type="checkbox"/> minor reduction (e.g., a separation of more than half the separation minima) in separation with crew or ATC controlling the situation and fully able to recover from the situation. 	No hazardous condition i.e. no immediate direct or indirect impact on the operations.

FIG. A-1: Severity Classification Scheme in ATM

Note: The worst credible effect in the environment of operations determines the severity class.

*:- The Severity Classification of effects is common to that in ESARR 2 but the examples chosen relate to a *a priori* assessment. This list is by no means exhaustive.

A-2 Risk Classification Scheme in ATM

Safety objectives based on risk shall be established (1) in terms of the hazards maximum probability of occurrence, derived both from the severity of its effect, according to **Figure A-1** and from the maximum probability of the hazard’s effect, according to **Figure A-2**.

(Note: **Figure A-2** should be considered as a Risk Classification scheme (i.e. a Severity Classification/Probability Classification relationship matrix). It associates a Severity Class, as determined using Figure A-1, with a tolerable probability (i.e., a maximum tolerable probability of ATM directly contributing to safety occurrences) to show that the more severe the effect of the hazard the less desirable it is that the hazard occurs.)

(Note: **Figure A-2** only refers to an overall safety performance of ATM at ECAC and national level and is not directly applicable to the classification of individual hazards. To achieve this a method of apportionment of the overall probability to the constituent parts of the ATM system may need to be developed- This apportionment may be done per phase of flight and/or, per accident types.)

Severity Class	1	2	3	4	5
Maximum tolerable probability (of ATM direct contribution)	1,55.10 ⁻⁸ Per Flight/Hour	To be included in a future revision of ESARR 4, once enough safety data have been collected according to ESARR 2♦.	To be included in a future revision of ESARR 4, once enough safety data have been collected according to ESARR 2♦.	To be included in a future revision of ESARR 4, once enough safety data have been collected according to ESARR 2♦.	To be included in a future revision of ESARR 4, once enough safety data have been collected according to ESARR 2♦.

♦ To be determined at national level based on past evidence on numbers of ATM related incidents.

FIG. A-2: Risk Classification Scheme in ATM

(Note:- **Figure A-2** assumes an ECAC Safety Minimum (2) of a “maximum tolerable probability of ATM directly contributing to an accident of a Commercial Air Transport aircraft of 1,55 *10⁻⁸ accidents per Flight Hour” (3).)

(Note:-The quantitative definitions for the safety objectives associated with the maximum tolerable probabilities of ATM directly contributing to incidents of severity class 2, 3, 4 and 5 in **the ECAC region** (4) remain to be determined once enough and consistent safety data have been collected by EUROCONTROL, which are consistent with the requirements outlined in ESARR 2.)

(Note:-The quantitative definitions for the safety objectives associated with the maximum tolerable probabilities of ATM directly contributing to incidents of severity class 2, 3, 4 and 5 should be determined at national level based on past evidence on numbers of ATM-related incidents and associated severity classes (5).)

As a necessary complement to the demonstration that these quantitative objectives are met, additional safety management considerations shall be applied so that more safety is added to the ATM system whenever reasonable.

(Note: A similar approach is also recommended for designing the ATM System in areas where exclusive General Aviation operations are carried out.)

(Note: In order to deal with specific constituent parts of the ATM system (sub-systems), the table (Fig A-2) will have to be refined so that it adequately reflects the operational environment of the sub-system under consideration (e.g. interfaces with other systems, phases of flight, classes of airspace). This will necessitate:-

- a) the redefinition of the severity categories such that they are meaningful in the context of the sub-system under consideration, and*
- b) the accommodation of mitigations in other sub-systems for events in the sub-system under consideration which may lead to a hazard.*

No guidance is given here as to how the refinement should be achieved.)

(Note: Units used to describe risk may need to be changed depending on: the sub-system under consideration, phases of flight and classes of airspace.)

Endnotes :

(1) These objectives and related safety requirements allocated to the airborne part of the ATM System should be considered as additional to those requirements derived from applicable Joint Aviation Requirements (e.g., JAR 25-1309 and JAR 25-11). Indeed, some elements of the airborne part of the ATM System contribute both to the airworthiness of the aircraft (perceived as isolated from its environment) as well as to the provision of a safe Air Traffic Management System (e.g. SSR : which must not harm the aircraft in which it is fitted but must perform correctly in order to meet the needs of ATM).

(2) This ATM safety minimum represents a quantified order of magnitude of part of the ATM 2000+ strategy safety objectives (refer to Volume 2, paragraph 4.2.1). Related justifications, with calculation baseline and related assumptions are documented in SRC POLICY DOC 1.

(3) Or a maximum tolerable probability of ATM directly contributing to an accident of a commercial Air Transport aircraft of $2,31 \cdot 10^{-8}$ accidents per flight.

(4) In airspace and aerodromes where Commercial Air Transport aircraft are operated.

(5) The quantitative definitions for the ECAC region will be developed once the implementation of ESARR 2 has enabled the collection of incident data at ECAC level, which provides some justifications for their development.

APPENDIX B

Terms and Definitions - Glossary

Term	Definition / Description	Examples and/or Comments (as required)
A		
Accident	<p>An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which:</p> <p>a) a person is fatally or seriously injured as a result of:</p> <ul style="list-style-type: none"> - being in the aircraft, or - direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or - direct exposure to jet blast, <p>except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or</p> <p>b) the aircraft sustains damage or structural failure which:</p> <ul style="list-style-type: none"> - adversely affect the structural strength, performance or flight characteristics of the aircraft, and - would normally require major repair or replacement of the affected component <p>except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damages limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or</p> <p>c) the aircraft is missing or is completely inaccessible.</p> <p>Note 1.-For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified as a fatal injury by ICAO. Note 2.- An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.</p>	Consistent with ICAO Annex 13
Assessment	An evaluation based on engineering, operational judgement and/or analysis methods.	
ATM Service Provider	An organisation responsible and authorised to provide ATM service(s).	
ATM Service	A service for the purpose of ATM.	
ATM System	ATM System is a part of ANS System composed of a Ground Based ATM component and an airborne ATM component.	Notes:- a. The ATM System includes

Safety Regulation Commission
 Safety Regulatory Requirement - ESARR 4
 Risk assessment and mitigation in ATM

		the three constituent elements: human, procedures and equipment (hardware and software). b. The ATM system assumes the existence of a supporting CNS system.
ATM	The aggregation of ground based (comprising variously ATS, ASM, ATFM) and airborne functions required to ensure the safe and efficient movement of aircraft during all appropriate phases of operations.	
Assumption	Statement, principle and/or premises offered without proof.	Consistent with SAE ARP 4754/4761
C		
CNS/ATM	The aggregation of functions used in provision of CNS services and used by ATM.	
CNS system	All the hardware and software that make up a function, tool or application that is used to provide one or more air traffic management services. The CNS system is an enabler to the provision of ATM services.	
Commercial Air Transport	The operation of an aircraft on one or more stages on a scheduled or non-scheduled basis, which is available to the public for remuneration or hire (technical stops are counted in ICAO's statistics).	
D		
Designated authority	The competent body designated by State authority, responsible for aviation safety regulation.	
Direct (ATM system contribution to accident / Incident)	Where at least one ATM event or item was judged to be DIRECTLY in the causal chain of events leading to an accident or incident. Without that ATM event, it is considered that the occurrence would not have happened.	
E		
Environment of operations	The environment of operations consists of the physical and institutional characteristics of the airspace within which operations occur. The environment includes ATM services being provided, technologies used, airspace organisation, ambient conditions and people.	
Error	A mistake in specification, design, or implementation or an occurrence arising as a result of incorrect action or decision by personnel operating or maintaining the system (flight crew, Air Traffic Controller, service provider or maintenance personnel).	
F		
Failure	The inability of any element of the Air Traffic Management System to perform its intended function or to perform it correctly within specified limits.	
Failure Condition	A condition having an effect on the aircraft and/or its occupants, either directly or indirectly through loss of separation, which is caused or contributed to by one or more failures, or errors, considering flight phase and relevant adverse operational (density of air traffic, TMA etc...) or environmental conditions.	

Safety Regulation Commission
 Safety Regulatory Requirement - ESARR 4
 Risk assessment and mitigation in ATM

G		
General Aviation Operation	An aircraft operation other than a commercial air transport operation or aerial work operation.	
H		
Hazard	Any condition, event, or circumstance which could induce an accident.	
I		
Inadequate separation	In the absence of prescribed separation minima, a situation in which aircraft were Perceived to pass too close to each other for pilots to ensure safe separation.	
Incident	An occurrence, other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operation.	
L		
Target Level of Safety (or safety level or safety minima)	A level of how far safety is to be pursued in a given context, assessed with reference to an acceptable or tolerable risk.	
Loss of safety margins	All situations where an aircraft is too close to something else (e.g., another aircraft, ground, obstacle, restricted area, meteorological anomalies) and the ability to recover from the hazardous situation is jeopardised.	Note:- Includes “inadequate separation” and “separation minima infringement”.
M		
Mitigation (or risk mitigation)	Steps taken to control or prevent a hazard from causing harm and reduce risk to a tolerable or acceptable level.	
N		
P		
Procedures (Refer to Operational ATC procedures in ESARR 2)	Written procedures and instructions used by ATC personnel in the pursuance of their duties directly in connection with the provision of the ATM services.	Note:- ATC procedures include the control and handling of traffic including transfer of control, the application of separation criteria, resolution of conflicts, methodologies for maximising traffic flows and general communication between controllers and between pilots and controllers. Also, how particular ATC tasks are executed using available equipment and action in the event of equipment failure.

Safety Regulation Commission
 Safety Regulatory Requirement - ESARR 4
 Risk assessment and mitigation in ATM

O		
R		
Risk	The combination of the overall probability, or frequency of occurrence of a harmful effect induced by a hazard and the severity of that effect.	
Risk Assessment	Assessment to establish that the achieved or perceived risk is acceptable or tolerable.	
Risk Mitigation	See "Mitigation".	
S		
Safety	Freedom from unacceptable risk of harm.	
Safety Assurance	All planned and systematic actions necessary to provide adequate confidence that a product, a service, an organisation or a system achieves acceptable or tolerable safety.	
Safety Minima	Refer "to target level of safety".	
Safety objective	A safety objective is a planned safety goal. The achievement of an objective may be demonstrated by appropriate means to be determined in agreement with the safety regulator. <u>More specifically for this ESARR 4</u> , a safety objective is a qualitative or quantitative statement that defines the maximum frequency or probability at which a hazard can be expected to occur.	
Safety level	Refer to 'target level of safety'.	
Safety requirement	A risk mitigation means, defined from the risk mitigation strategy, that achieves a particular safety objective. Safety requirements may take various forms, including organisational, operational, procedural, functional, performance, and interoperability requirements or environment characteristics.	
Separation minima infringement	A situation in which <u>prescribed separation minima</u> were not maintained between aircraft.	Note:- Whether or not it led to the submission of an AIRPROX report.
Safety Monitoring	A systematic action conducted to detect changes affecting the ATM System with the specific objective of identifying that acceptable or tolerable safety can be met.	
Severity	Level of effect/consequences of hazards on the safety of flight operations (I.e., combining level of loss of separation and degree of ability to recover from the hazardous situation).	
Severity Class	Gradation, ranging from 1 (most severe) to 5 (least severe), as an expression of the magnitude of the effects of hazards on flight operations	
Supporting services	Systems, services and arrangements, including Communication, navigation and Surveillance services, which support the provision of an ATM service.	
System	A combination of physical components, procedures and human resources organised to perform a function.	
T		
Target Level of	A level of how far safety is to be pursued in a given context, assessed with reference to an acceptable or	

Safety Regulation Commission
Safety Regulatory Requirement - ESARR 4
Risk assessment and mitigation in ATM

Safety (or 'safety level' or 'safety minima')	tolerable risk.	
V		
Validation	Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled (usually used for internal validation of the design).	
Verification	Confirmation by examination of evidence that a product, process or service, fulfils specified requirements.	
