



GUIDANCE MATERIAL:

ESARR4 COMPLIANCE MATRIX

1 INTRODUCTION

This version of this Guidance Material was prepared by SAM authors before assessment by SRC-AMC Panel. Consequently, the compliance list hereafter proposes the view of SAM authors on its compliance. This Guidance Material will be updated once outcome of the assessment is produced by SRC-AMC Panel.

SRC DOC 12 V1.1 will include the final compliance statement of SAM V2.

This document (SRC DOC 12 V1.1) was still a “Proposed Issue” at the time of SAM V2.1 release.

2 ESARR4 COMPLIANCE MATRIX

ESARR 4 Para	ESARR 4 Text	SAM Compliance & Reference	Comment
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 :-	FHA, PSSA, SSA	
5.1a	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;	FHA – PSSA - SSA	
5.1b	addresses the airborne and ground ¹ components of the ATM System, through co-operation with responsible parties; and	FHA – PSSA - SSA	
5.1c	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.	FHA – PSSA - SSA	Part IV annex E & F: Recommendations for ANS SW; Part IV annex G: SAAP: Safety Assessment of TAM procedures; Part IV Annex J: HAZOP & TRACER for human element;
5.2	The hazard identification, risk assessment and mitigation processes shall include:-		
5.2a	a determination of the scope, boundaries and interfaces of the constituent part being considered, as well as the identification of the	FHA & PSSA & SSA Chapter 1	FHA & PSSA & SSA Chapter 1 GM A

¹ Including spatial components.

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	functions that the constituent part is to perform and the environment of operations in which it is intended to operate;		
5.2b	a determination of the safety objectives to be placed on the constituent part, incorporating :-	FHA Chapter 3	
5.2b(i)	an identification of ATM-related credible hazards and failure conditions, together with their combined effects,	FHA Chapter 3.1 & 3.2	FHA Chapter 3 GM A & B & C
5.2b(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	FHA Chapter 3.2 & 3.3	FHA Chapter 3 GM C & D
5.2b(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;	FHA Chapter 3.4 & 3.5	FHA Chapter 3 GM E, F, G
5.2c	c. the derivation, as appropriate, of a risk mitigation strategy which :-	See (i to iii) below	
5.2c(i)	Specifies the defences to be implemented to protect against the risk-bearing hazards	PSSA Chapter 3	
5.2c(ii)	Includes, as necessary, the development of safety requirements ² potentially bearing on the constituent part under consideration, or other parts of the ATM System, or environment of operations, and	PSSA Chapter 3	PSSA Chapter 3 GM A
5.2c(iii)	Presents an assurance of its feasibility and effectiveness	PSSA Chapter 3.5 PSSA Chapter 4	PSSA Chapter 3.5 GM A PSSA Chapter 4 GM A & B
5.2d	Verification that all identified safety objectives and safety requirements have been met	SSA	
5.2d(i)	prior to its implementation of the change,	SSA Chapter 3.1	

² 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.

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5.2d(ii)	During any transition phase into operational service,	SSA Chapter 3.2	
5.2d(iii)	During its operational life, and	SSA Chapter 3.3	
5.2d(iv)	During any transition phase till decommissioning.	SSA Chapter 3.4 & 3.5	
	<i>(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.</i>	FHA PSSA	FHA & PSSA Chapter 2 GM A §4
	<i>(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).</i>	SSA Chapter 3 & 4	
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:-	FHA & PSSA & SSA Chapter 5	FHA, PSSA, SSA Chapter 5 Guidance Material A PartIV annex I
5.3a	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 safe ³ including, as appropriate, specifications of any predictive, monitoring or survey techniques being used;	FHA & PSSA & SSA Chapter 5	FHA, PSSA, SSA Chapter 5 Guidance Material A PartIV annex I
5.3b	that all safety requirements related to the implementation of a change are traceable to the intended operations/functions.	FHA & PSSA Chapter 4	FHA & PSSA Chapter 4 GM A & B
6	Implementation		
7	Exemptions		
	None	No claim required	

³ I.e., meeting allocated safety objectives and requirements.

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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.	No claim required	
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 requirement. The applicability of the methodology would need to be specified at the beginning of any risk assessment and mitigation process.	SAM !	
	<i>(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).</i>	SAM V2	
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.	SAM Part IV annexes E & F	
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.	SAM Part IV annexes E & F	
8.2.3	Safety monitoring and data collection		

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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.	SSA	
8.2.3.2	In addition, safety monitoring and data collection mechanisms consistent with the provisions of ESARR 2 ⁴ , 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.	SSA	
8.2.3.3	Safety monitoring should therefore be seen as a complementary means of qualification before and during operational use.	FHA, PSSA & SSA	
8.3	Definitions Refer to Appendix B.		
	Appendix A - Risk Classification Scheme		
A1	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.	SAM.	
	The severity of the effects of hazards in that environment of operations shall be determined using the	FHA Chapter 3 GM C & D	

⁴ ESARR 2 : « Reporting and Analysis of Safety Occurrences in ATM ».

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	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.)	No claim required	
	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.	FHA Chapter 3 GM C & D	
	(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.)	FHA Chapter 3 GM C & D	
	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:-	FHA Chapter 3 GM D	
	❖ Effect of hazard on air crew, (E.g., workload, ability to perform his/her functions);	FHA Chapter 3 GM D	
	❖ Effect of hazard on the Air Traffic Controllers, (E.g., workload, ability to perform his/her functions);	FHA Chapter 3 GM D	
	❖ Effect of hazard on the aircraft functional capabilities;	FHA Chapter 3 GM D	

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	❖ Effect of hazard on the functional capabilities of the ground part of the ATM System;	FHA Chapter 3 GM D	
	❖ 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).	FHA Chapter 3 GM D	
	(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.)	FHA Chapter 3	
	(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.)	FHA Chapter 3	
	(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.	FHA Chapter 3 GM D	
	(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.)	FHA Chapter 3 GM D	
A2	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	FHA Chapter 3 GM E, F, G	

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	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.)	FHA Chapter 3 GM E	
	(Note: Figure A-2 <u>only</u> refers to an overall safety performance of ATM at ECAC and national level and is <u>not directly applicable to the classification of individual hazards</u> . 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.)	FHA Chapter 3 GM E, F, G, J	
	(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 $1,55 \cdot 10^{-8}$ accidents per Flight Hour" (3).)	No claim required	
	(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.)	FHA Chapter 3 GM E, J	

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	(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).)	FHA Chapter 3 GM E, F, G, J	
	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.	FHA Chapter 3 GM E	
	(Note: A similar approach is also recommended for designing the ATM System in areas where exclusive General Aviation operations are carried out.)	No claim required but nothing is mentioned.	
	(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:-	No claim required.	
	the redefinition of the severity categories such that they are meaningful in the context of the sub-system under consideration, and	FHA Chapter 3 GM D	
	the accommodation of mitigations in other sub-systems for events in the sub-system under consideration which may lead to a hazard.	FHA & PSSA	
	No guidance is given here as to how the refinement should be achieved.)	FHA Chapter 3 GM J	

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	(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.)	FHA Chapter 3 GM E, F, G	
	<p><u>Endnotes :</u></p> <p>(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).</p> <p>(2) <i>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.</i></p> <p>(3) <i>Or a maximum tolerable probability of ATM directly contributing to an accident of a commercial Air Transport aircraft of 2,31 *10⁻⁸ accidents per flight.</i></p> <p>(4) <i>In airspace and aerodromes where Commercial Air Transport aircraft are operated.</i></p> <p>(5) <i>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.</i></p>	No claim required	
Figure A2	See table below. - Risk classification scheme	FHA Chapter 3 GM E, J	

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