EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL

ESARR ADVISORY MATERIAL/GUIDANCE MATERIAL (EAM/GUI)

EAM 2/GUI 1

ESARR 2 GUIDANCE TO ATM SAFETY REGULATORS

Severity Classification Scheme for Safety Occurrences in ATM

Edition	**:**	**1.0**
Edition Date	**:**	**12-11-1999**
Status	**:**	**Released Issue**
Class	**:**	**General Public**

DOCUMENT IDENTIFICATION SHEET

DOCUMENT DESCRIPTION

Document Title

Severity Classification Scheme for Safety Occurrences in ATM

REFERENCE :	**EDITION :**	1.0
EAM 2/ GUI 1	**EDITION DATE :**	12-11-1999

Abstract

This Guidance Material defines two **Severity Classification Schemes to be used when analysing ATM related occurrences:**

- One that allows the classification of occurrences according to the severity of their effect on the safe operations of aircraft and occupants; and
- One that allows the classification of occurrences according to the severity of their effect on the ability to provide safe Air Traffic Management Services .

These two classification schemes shall be applied to the Safety Measurement of ATM and support the implementation of the SRC Safety Regulatory Requirement "Reporting and Assessment of Safety Occurrences in ATM". (REF. ESARR 2 - Edition 1.0).

Keywords			
Severity	Frequency		Classification
Occurrence	Accident	Incident	ATM specific occurrence

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DOCUMENT STATUS AND TYPE

STATUS		**CATEGORY**		**CLASSIFICATION**	
Working Draft	☐	Safety Regulatory Requirement	☐	General Public	☑
Draft	☐	Comment/Response Document	☐	Restricted EUROCONTROL	☐
Proposed Issue	☐	ESARR Advisory Material	☑	Restricted SRC	☐
Released Issue	☑	Policy Document	☐	Restricted SRU	☐
		Document	☐		

ELECTRONIC BACKUP

INTERNAL REFERENCE NAME : P:\SRC\REGULATIONS\OFF.PUBLIC.\EAM\GUI\EAM 2\eam2gui1e10ri.doc

HOST SYSTEM	**MEDIA**	**SOFTWARE(S)**
EUROCONTROL Network	Type : Hard disk	MS Office Word 7.0
Printing Date : 12/11/99	Media Identification :	MS WINDOWS NT4.0

SOFTCOPIES OF SRC DELIVERABLES CAN BE DOWNLOADED FROM:

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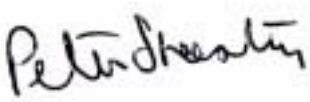
DOCUMENT APPROVAL

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)	12.11.1999
Chairman Safety Regulation Commission (SRC)	 (Arne AXELSSON)	12.11.1999

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	26/04/99	Working Draft A -Internal co-ordination with EUROCONTROL Agency	Creation
0.02	06/05/99	Working Draft B to HEIDI Group	All
0.03	19/05/99	Working Draft C taking account of oral comments from Heidi	All
0.04	28/05/99	Working Draft D taking account of further written comments from Heidi (HEIDI/6)- Document being split into two independent attachments. SRC and EUROCONTROL-wide consultations.	All
0.05	06/09/99	Draft E taking into account comments from SRC and EUROCONTROL wide-review.	All
0.06	10/09/99	Draft submitted to the Safety regulation Commission, after English editorial review.	All
0.07	08/10/99	Proposed Issue to the Provisional Council. Editorial modifications.	Section 1.2 Attachment B
1.0	12/11/99	Released Issue after approval by Provisional Council and Permanent Commission•.	All

• It is being understood that no contents changes have been effected to version 0.07. The update to version 1.0 only reflects the approval by the Provisional Council and Permanent Commission.

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EXECUTIVE SUMMARY

This guidance material has been prepared by the Safety Regulation Commission.

It is a companion document to the EUROCONTROL Safety Regulatory Requirement "Reporting and Assessment of Safety Occurrences in ATM" (REF: ESARR 2 - Edition 1.0).

This document aims at defining two **Severity Classification Schemes for ATM related occurrences:**

- One that allows the classification of occurrences according to the severity of their effect on the safe operations of aircraft and occupants; and

- One that allows the classification of occurrences according to the severity of their effect on the ability to provide safe Air Traffic Management Services.

These two classification schemes shall be applied generally to the Safety Measurement of ATM, as part of the assessment of ATM related occurrences.

1. CHAPTER 1 : INTRODUCTION

1.1 PURPOSE

The Safety Regulation Commission has developed a harmonised EUROCONTROL Safety Regulatory Requirement for ATM related occurrence reporting. This safety requirement specifies that each State shall ensure "that the severity of occurrences is determined, the risk posed by occurrences classified, and the results recorded."

This Guidance Material defines two **Severity Classification Schemes for safety occurrences in ATM:**

- One that allows the classification of occurrences according to the severity of their effect on the safe operations of aircraft and occupants; it enables to determine the actual level of risk that existed for aircraft and occupants (Refer to Attachment A); and

- One that allows the classification of occurrences according to the severity of their effect on the ability to provide safe Air Traffic Management Services (Refer to Attachment B).

These two classification schemes shall be applied generally to the Safety Measurement of ATM, as part of the assessment or investigation of safety occurrences in ATM.

Both Severity Classification Schemes consider as well the actual frequency of each of these occurrences to enable national organisations to determine the level of efforts to be placed into the assessment/investigation of the occurrence as well as to potentially support the development of trends in safety.

The Severity Classification Schemes can also contribute:

- To determine the actual safety level achieved by an ATM system in service and assess its compliance with minimum safety objectives bearing on ATM[1];

- To assess, in the course of the on going oversight process, if the safety objectives/requirements bearing on an operational or technical enhancements to the ATM system are actually being met in service.

[1] Conclusions should be drawn with care and associated assumptions/limitations identified, when deriving statistics from actual accident and incident numbers and assessing their compatibility with target objectives.

1.2 APPROACH

The approach adopted in this document follows the general approach developed by the SRC in its Technical Work Programme:

> "*In principle, each element of ATM addressed within the Work Programme represents two tasks - one setting safety targets for that area, and an equivalent task measuring safety performance*".

The Safety Regulation Commission has developed a harmonised EUROCONTROL Safety Regulatory Requirement which supports the *setting of safety objectives and requirements* when introducing a change in the ATM system. This Safety Regulatory Requirement[2] specifies that hazard identification, associated severity and frequency assessment as well as risk management are systematically conducted for changes to existing ATM systems.

Therefore, as this Guidance material applies to parallel tasks measuring safety performance, the terminology used in the development of the Severity Classification schemes is compatible with:-

- the terminology used in the EUROCONTROL ATM Hazard Classification Scheme[3]; and
- the terminology used in the JAA[4] Hazard Classification scheme.

The proposed classifications have been aligned to existing ICAO terms, definitions and classification, including existing classification of AIRPROX.

In addition, it should also be noted that a number of existing national classification schemes have been used as inputs to this document.

[2] Refer to ESARR 4

[3] Refer to ESARR 4

[4] Joint Aviation Authorities- JAR 25

1.3 DOCUMENT STRUCTURE

The document is structured as follows:

Attachment A:

> Severity classification of occurrences (I.e., accidents and incidents) according to the severity of their effect on the safe operations of aircraft and occupants.

This attachment also contains examples of classification of specific occurrences in specific environment/conditions.

Attachment B:

> Severity classification of occurrences (I.e., ATM specific occurrences) according to the severity of their effect on the ability to provide safe Air Traffic Management Services.

This attachment also contains examples of classification of specific occurrences in specific environment/conditions.

It is expected that this document be complemented by a EUROCONTROL Agency Guidance Material, describing harmonised processes, methods and criteria to classify occurrences according to their level of severity.

***** End of Section *****

ATTACHMENT A:

Severity Classification Scheme of Occurrences according to the Severity of their Effect on the Safe Operations of Aircraft and Occupants.

The severity of an accident is to be expressed according to:

- the *level of damage* to the aircraft (ICAO Annex 13 identifies four levels: destroyed, substantially destroyed, slightly damaged and no damage) ;
- the *type and number of injuries* (ICAO Annex 13 identifies three levels of injuries: fatal, serious and minor/none).

The Classification Scheme for incidents is illustrated in Table I.

The proposed Classification Scheme for incidents consists of categories of severity for the risk that existed and for the frequency of their occurrence. These are combined as a classification matrix whose columns correspond to the frequency categories and rows correspond to the severity categories[5].

The Severity Classification Scheme for incidents considers indeed the actual frequency of each of these occurrences[6] to enable national organisations to determine the level of effort to be placed into the assessment of the occurrence as well as to potentially support the development of trends in safety.

SEVERITY	**A**	Serious incident	**A1**	**A2**	**A3**	**A4**	**A5**
	B	Major incident	**B1**	**B2**	**B3**	**B4**	**B5**
	C	Significant incident	**C1**	**C2**	**C3**	**C4**	**C5**
	D	Not determined	**D1**	**D2**	**D3**	**D4**	**D5**
	E	No safety effect	**E1**	**E2**	**E3**	**E4**	**E5**
			1	2	3	4	5
			Very Frequent	Frequent	Occasional	Rare	Extremely rare
			FREQUENCY				

Table I. - Severity Classification Scheme for Aircraft Incidents

[5] Any incident classified as major or significant should be regarded as a less-than-serious-incident.

[6] Equivalent to a counting of the number of accidents and incidents.

A.1 Accident/Incident Frequency Definitions

The Severity Classification Scheme specifies five qualitative frequency categories. It is recommended that each State initiate the development of quantitative boundaries, which would take into account national traffic volumes and specific operating conditions of the national ATM system (and related sub-systems).

These qualitative frequencies are defined in Table II.

FREQUENCY	DEFINITION
Extremely rare	Has never occurred yet throughout the total lifetime of the system.
Rare	Only very few similar incidents on record when considering a large traffic volume or no records on a small traffic volume.
Occasional	Several similar occurrences on record - Has occurred more than once at the same location.
Frequent	A significant number of similar occurrences already on record - Has occurred a significant number of times at the same location.
Very Frequent	A very high number of similar occurrences already on record- Has occurred a very high number of times at the same location.

Table II. - Definitions of Accident/Incident Frequency

A.2 Accident/Incident Severity Definitions

The Classification Scheme specifies six severity categories for ATM related occurrences impacting the safe operations of the aircraft: Accident, Serious Incidents, Major Incidents, Significant Incidents, No effect, Risk Not determined*.* These definitions are provided in Table III.

SEVERITY	DEFINITION
Accident	**ICAO Annex 13**: "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 such persons have disembarked, in which: - A person is fatally or seriously injured (as a result of..) - The aircraft sustains damage or structural failure (which..) - The aircraft is missing or is completely inaccessible" SRC note: *ATM related accidents includes more specifically collisions between aircraft, between aircraft and obstacles[7], Controlled Flight Into Terrain and Loss of Control in Flight due to meteorological conditions and VORTEX.*
Serious Incident	**ICAO Annex 13**: "An incident involving circumstances indicating that an accident nearly occurred. Note: The difference between an accident and a serious incident lies only in the result." SRC note: *ATM related serious incidents would include more specifically critical near collisions between aircraft, between aircraft and obstacles, critical near Controlled Flight Into Terrain and critical near Loss of control in flight due to meteorological conditions and VORTEX.*
Major Incident	An incident associated with the operation of an aircraft, in which safety of aircraft may have been compromised, having led to a near collision between aircraft, with ground or obstacles (i.e., safety margins not respected which is not the result of an ATC instruction). SRC note*: ATM related major incidents would include more specifically near collisions between aircraft, near collisions between aircraft and obstacles, near Controlled Flight Into Terrain.*
Significant Incident	An incident involving circumstances indicating that an accident, a serious or major incident could have occurred, if the risk had not been managed within safety margins, or if another aircraft had been in the vicinity. SRC note*: ATM related significant incidents would include more specifically situations where collisions/near collisions could have occurred in other conditions.*
No safety effect	An incident which has no safety significance.
Not determined	Insufficient information was available to determine the risk involved or inconclusive or conflicting evidence precluded such determination.

Table III. - Definitions of Accident/Incident Severity

[7] "Obstacles" include here vehicle/person/animal/object

SEVERITY	EXAMPLES of Occurrences
Accident	**ICAO Annex 13:** - "Mid air Collision between aircraft or between aircraft and other objects - Collision with the ground including Controlled Flight Into Terrain or Collision on the ground, between aircraft or between aircraft and other objects".
Serious Incident (A)	**ICAO Doc 4444**: **Airprox - Risk Of Collision**: "The risk classification of an aircraft proximity in which serious risk of collision has existed". Critical near collision between aircraft or between aircraft and obstacle(s). Separations lower than half the separation minima (e.g., 2NM). **ICAO Annex 13/Attachment D**: - "Near Collisions requiring an avoidance manoeuvre to avoid a collision or an unsafe situation or when an avoidance action would have been appropriate - Controlled Flight Into Terrain only marginally avoided - Aborted take-offs on a closed or engaged runway/Take-offs from a closed or engaged runway with marginal separation from obstacles/Landings or attempted landings on a closed or engaged runway/take off or landing incidents, such as under-shootings, overrunning or running off the runway".
Major Incident (B)	**ICAO Doc 4444**: **Airprox- Safety Not Assured**: "The risk classification of an aircraft proximity in which the safety of the aircraft may have been compromised". Loss of separation (separation higher that half the separation minima/e.g., 4NM) which is not fully under ATC control**.** Safety margins not respected (higher than half the applicable safety margins) which is not fully under ATC control**.** A Crew avoidance manoeuvre and/or an ATC instruction allowed to reduce the risk, without eliminating it, as safety margins were still infringed.
Significant Incident (C)	**ICAO Doc 4444-Airprox- No risk Of Collision**: "The risk classification of an aircraft proximity in which no risk of Collision has existed". After visual contact between two aircraft, no avoidance manoeuvre was seen as necessary or was carried out within safety margins. Aircraft deviation from ATC clearance (such as flight level, route, heading, runway), Unauthorised penetration of airspace, Runway incursion with no other traffic in the vicinity (hence, where no avoiding action was necessary).
No safety effect (E)	Occurrences which have no safety significance.
Not determined (D)	**ICAO Doc 4444-Airprox- Risk Not determined**- "The risk Classification of an aircraft proximity in which insufficient information was available to determine the risk involved or inconclusive or conflicting evidence precluded such determination".

ATTACHMENT B:

Severity Classification Scheme of ATM specific occurrences according to the Severity of their Effect on the ability to provide Safe ATM Services

The proposed Classification Scheme consists of categories of severity and for the frequency of their occurrence. These are combined as a classification matrix whose columns correspond to the frequency categories and rows correspond to the severity categories.

The Severity Classification Scheme considers indeed the actual frequency of each of these occurrences[8] to enable national organisations to determine the level of effort to be placed into the assessment of the occurrence as well as to potentially support the development of trends in safety.

The Classification Scheme for ATM specific occurrences impacting the ability to provide safe ATM services is in Table I.

SEVERITY	**AA**	Total inability to provide safe ATM services	**AA1**	**AA2**	**AA3**	**AA4**	**AA5**
	A	Serious inability to provide safe ATM services	**A1**	**A2**	**A3**	**A4**	**A5**
	B	Partial inability to provide safe ATM services	**B1**	**B2**	**B3**	**B4**	**B5**
	C	Ability to provide safe but degraded ATM services	**C1**	**C2**	**C3**	**C4**	**C5**
	D	Not determined	**D1**	**D2**	**D3**	**D4**	**D5**
	E	No effect on ATM services	**E1**	**E2**	**E3**	**E4**	**E5**
			1	2	3	4	5
			Very Frequent	Frequent	Occasional	Rare	Extremely rare
			FREQUENCY				

Table I. - Severity Classification Scheme for ATM specific occurrences

[8] Equivalent to a counting of the number of ATM specific occurrences.

B.1 ATM specific occurrences Frequency Definitions

The Severity Classification Scheme specifies five qualitative frequency categories.

It is recommended that each State initiates the development of quantitative boundaries which would take into account the specific operating conditions of the national ATM system (and related sub-systems).

These qualitative frequencies are defined in Table II.

FREQUENCY	DEFINITION
Extremely rare	Has never occurred yet throughout the total lifetime of the ground part of the ATM system.
Rare	No similar occurrences on record when considering a particular location or element of the ground part of the ATM system.
Occasional	Several similar occurrences on record, has occurred more than once at the same location, or more than once to similar element of the ground part of the ATM system.
Frequent	A significant number of similar occurrences already on record - Has occurred a significant number of times at the same location or involving a particular element of the ground part of the ATM system.
Very Frequent	A very frequent number of similar occurrences already on record - Has occurred a high number of times at the same location or involving a particular element of the ground part of the ATM system.

Table II. - Definitions of ATM specific occurrences Frequency

B.2 ATM specific occurrences Severity Definitions

The Classification Scheme specifies six severity categories*.* These qualitative severities are defined in Table III.

SEVERITY	DEFINITION
Total inability to provide safe ATM service	An occurrence associated with the total inability to provide any degree of ATM Services in compliance with applicable Safety Regulatory Requirements, where: ➢ There is a sudden and non managed total loss of ATM service or situation awareness ➢ There is a totally corrupted ATM service or corrupted information provided to ATS personnel.
Serious inability to provide safe ATM service	An occurrence associated with almost a total and sudden inability to provide any degree of ATM Services in compliance with applicable Safety Regulatory Requirements. It involves circumstances indicating that the ability to provide ATM services is severely compromised and has the potential to impact many aircraft safe operations over a significant period of time.
Partial inability to provide safe ATM service	An occurrence associated with the sudden and partial inability to provide ATM Services in compliance with applicable Safety Regulatory Requirements.
Ability to provide safe but degraded ATM service	An occurrence involving circumstances indicating that a total, serious or partial inability to provide safe and non degraded ATM Services could have occurred, if the risk had not been managed/controlled by ATS personnel within Safety Regulatory Requirements, even if this implied limitations in the provision of ATM Services.
No effect on ATM service	Occurrences which have no effect on the ability to provide safe and non degraded ATM Services.
Not determined	Insufficient information was available to determine the risk involved or inconclusive or conflicting evidence precluded such determination.

Table III. - Definitions of ATM specific occurrences Severity

SEVERITY	EXAMPLES OF ATM SPECIFIC OCCURRENCES
Total inability to provide safe ATM service (AA)	Sudden inability to provide any degree of safe ATM Service within several airspace sectors without warning and for a significant period of time. No contingency Measure could be applied. ATCO losing totally his/her ability to control the situation. Situation has every chance to lead to many accidents/serious incidents
Serious inability to provide safe ATM service (A)	Inability to maintain a safe ATM Service in one or more sectors for a significant period of time. High increase in workload for the ATCO- Provision of misleading information to the ATCO – ATCO losing seriously his/her ability to control the situation. Situation has every chance to lead to a limited number of accidents/serious incidents.
Partial inability to provide safe ATM service (B)	Inability to maintain a safe ATM Service within one or more airspace sectors without warning and for a significant period of time. The ATCO's workload increased significantly and he/she was provided with less information than required for normal operations. Limitations to ATM Services were imposed and/or contingency Separation Measures were applied to compensate for the loss or corrupted function(s) but the risk of infringing safe separation was high and multiple losses of separation did/could have occurred until traffic levels were reduced.
Ability to provide safe but degraded ATM service (C)	Inability to maintain a non degraded ATM Service within one or more airspace sectors without warning and for a significant period of time. Safety Regulatory Requirements however respected. Contingency measures/ ATC procedures were not seen as necessary or, when taking place, they were able to compensate/mitigate for the loss/corruption of functionality, but the ATCO's workload was high and/or the overall system capacity was affected. Back up ATM Service/systems were lost or were sending corrupted information.
No effect on ATM service (E)	Occurrences which do not impact the ability to provide ATM Services within Safety Regulatory Requirements.
Not determined (D)	Insufficient information was available to determine the risk involved or inconclusive/conflicting evidence precluded such determination.

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