D

GUIDANCE MATERIAL:

SEVERITY CLASSIFICATION SCHEME

1 INTRODUCTION

This guidance material provides some hints for practical and effective use of the Severity Classification Scheme within the FHA stage. The Severity Classification Scheme specified by the Safety Regulation Commission in ESARR4 provides only the “effect on operations”.

The examples of effects on operations provided in the ESARR4 Severity Classification Scheme are only examples and are not directly applicable to every system under assessment, as they refer generally to hazards at overall ATM level but not to lower level hazards such as at sub-system level.

Therefore as requested by ESARR4 (Appendix A-2, Page 17, 2nd note a)), the approach is to customise the Severity Classification Scheme in order to

adequately reflects the operational environment and make it meaningful in the context of the sub-system under assessment.

2 DEFINITIONS OF SEVERITY INDICATORS

To support the classification of hazard's effect severity, 3 sets of severity indicators are proposed:

- Set 1: Effects on Air Navigation Service (includes airspace design (ASM), air traffic flow management (ATFM) and Air Traffic Management (ATM));
- Set 2: Exposure;
- Set 3: Recovery.

In each set, the different effects of hazards (as described in Guidance Material C) are ranked, in order to ease the assessment of the consequences on operations, including the effect on aircraft operations and the classification of hazard's effect severity.

Table D-1 defines the various severity indicators for each class of hazard's effect severity.

Note: Table D-1 includes some consideration of likelihood and credibility of hazard effect occurrence. These considerations mainly fit the second and fourth methods for setting safety objectives (See SAM-FHA Chapter 3 Annex G) which aim at identifying the worst credible effect of a hazard.

3 ORDER OF CONSIDERING THE SEVERITY INDICATORS

One or more sets of indicators may be used - there is some degree of overlap between them and the user should choose those which best suit their conceptual model of the system. Not all sets of indicators, or all indicators within a set, are necessarily relevant or meaningful in every assessment.

It is generally advisable to begin the assessment by considering the ***Set 1 - Effects on Air Navigation Service***. Hazard(s) with no potential for significant consequences on safety can thus be eliminated at an early stage.

For the severity indicators in set 1, it is suggested that assessors work downwards through the rows in the table, since this broadly follows the most probable sequence of events resulting from a hazard in an Air Navigation System (See Barrier analysis FHA Chapter 3 - Guidance Material I).

One considers first the effects of the hazards on ability to provide safe Air Navigation Service, on ground ATM system and aircraft functional capabilities and on ATCOs and Flight Crew working conditions. Then one considers the ATCOs and Flight Crew ability to cope with adverse operational and environmental conditions.

The indicators in ***Set 2 - Exposure*** are more independent, and can be considered in any order. Duration of exposure may however need to be considered iteratively with the indicator 'Rate of development' within Set 3.

For the indicators in ***Set 3 - Recovery***, it is suggested that assessors consider the possibility to detect the hazard and to recover from it. A judgement can then be made about how the rate of development of the situation compares with the time needed to perform these processes.

In some cases, it may be possible to evaluate a potential recovery process, following the likely chronological order of the steps involved: detection, diagnosis, annunciation and implementation of contingency measures.

Note:

It would be impossible to write down all the factors that affect severity in every system and environment, so the indicators are not necessarily exhaustive.

They are intended to draw the attention on major factors, but users will need to instantiate and possibly extend them for their particular system. Conversely, not all indicators are necessarily helpful or meaningful for every system.

Note:

*Rows with a "*****" should not be used when considering only the severity of the effect (Methods 1 & 3 to set safety objectives, see Guidance Material G of FHA Chapter 3)) as not only the worst credible case is considered but all the effects of the hazard.*

*Rows with a "*****" should be used when trying to identify the worst credible effect of the hazard.*

4 RECONCILING CLASSIFICATIONS FROM DIFFERENT INDICATORS

It is likely that the various severity indicators will suggest different severity classifications of the hazard effect. As a first assumption, the highest classification may be taken. However, this may be over-conservative – if the indicators suggesting a lower severity are in fact dominant.

Where different severity classifications result from different indicators, all should be recorded, for further analysis when the functions are allocated to system elements during the design process.

Similarly, where the severity classification is performed by a group, and no consensus can be reached, the differing views should be recorded. Inability to reach a consensus commonly occurs because the participants have different (and implicit) understandings or assumptions. These differences may become explicit, and hence be reconciled, at later stages of the system lifecycle, once the system is defined in more concrete terms.

It can be helpful to develop an Event Tree (if achievable) for the specific hazard for which the effects and their severity are difficult to be commonly agreed and so

help to identify the worst credible case. The Event Tree can ease common understanding and help to agree on:

- the scope of the system under assessment;
- the external mitigations means (barriers which are NOT part of the system under assessment);
- the operational environment;
- the mode of operation.

5 SOME CAUTIONS IN THE USE OF THE SEVERITY CLASSIFICATION SCHEME

Users are reminded to be cautious about the extent to which the Severity Classification Scheme is reliable upon:

- The Severity Classification Scheme is an aid to subjective judgement, not a rigid tool;
- The indicators are prompts, which help to ensure that all relevant factors have been taken into account, not rigidly defined parameters in a mathematical expression;
- The Severity Classification Scheme should be used iteratively through the development cycle - classification should be reviewed as functions are allocated to system elements and the development of these element progresses.

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Severity Class	1 [Most Severe]	2	3	4	5 [Least Severe]
Effects on Operations	**Accidents**	**Serious Incidents**	**Major Incidents**	**Significant Incidents**	**No Immediate Effect on Safety**
SEVERITY INDICATORS SET1: EFFECTS ON AIR NAVIGATION SERVICE					
Effect on Air Navigation Service within the area of responsibility	Total inability to provide or maintain safe service	Serious inability to provide or maintain safe service	Partial inability to provide or maintain safe service	Ability to provide or maintain safe but degraded service	No safety effect on service
ATCO and/or Flight Crew Working Conditions	Workload, stress or working conditions are such that they cannot perform their tasks at all	Workload, stress or working conditions are such that they are unable to perform their tasks effectively	Workload, stress or working conditions such that their ability is significantly impaired	Workload, stress or working conditions are such that their abilities are slightly impaired	No effect
Effect on ground ATM System and/or Aircraft Functional Capabilities	Total loss of functional capabilities	Large reduction of functional capabilities	Significant reduction of functional capabilities	Slight reduction of functional capabilities	No effect
ATCO and/or Flight Crew Ability to Cope with Adverse Operational and Environmental Conditions *	*Unable to cope with adverse operational and environmental conditions*	*Large reduction of the ability to cope with adverse operational and environmental conditions*	*Significant reduction of the ability to cope with adverse operational and environmental conditions*	*Slight reduction of the ability to cope with adverse operational and environmental conditions*	*No effect*
Effect on Barrier model (See FHA Chapter 3 – GM I)	Inability for any “prevention”, “resolution” nor “recovery” of conflict situation.	Inability for “prevention” and/or “resolution” of conflict situation, however “recovery” possible.	Inability for “prevention” of conflict situation, “resolution” partially impaired.	“Prevention” of conflict situation impaired.	No effect
SEVERITY INDICATORS SET 2: EXPOSURE					
Exposure time	The presence of the hazard is almost permanent. Reduction of safety margins persists even after recovering from the immediate problem.	Hazard may persist for a substantial period of time	Hazard may persist for a moderate period of time.	Hazard may persist for a short period of time such that no significant consequences are expected.	Too brief to have any safety-related effect
Number of aircraft exposed / area of responsibility	All aircraft in the area of responsibility	All aircraft in several ATC Sectors	Aircraft within a small geographic area or an area of low traffic density	Single aircraft	No aircraft affected
SEVERITY INDICATORS SET 3: RECOVERY					
Annunciation, Detection and Diagnosis *	*Undetected misleading indication.*	*Ambiguous indication. Not easily detected. Incorrect diagnosis likely*	*May require some interpretation. Detectable. Incorrect diagnosis possible*	*Clear annunciation. Easily detected, reliable diagnosis*	*Clear annunciation. Easily detected and very reliable diagnosis*
Contingency measures (other systems or procedures) available	No existing contingency measures available. Operators unprepared. Limited ability to intervene.	Limited contingency measures, providing only partial replacement functionality. Operators not familiar with procedures or may need to devise a new procedure at the time.	Contingency measures available, providing most of required functionality. Fall back equipment usually reliable. Operator intervention required, but a practised procedure within the scope of normal training	Reliable, automatic, comprehensive contingency measures	Highly reliable, automatic, comprehensive contingency measures

Rate of development of the hazardous condition, compared to the time necessary for annunciation, detection, diagnosis and application of contingency measures	Sudden. It does not allow recovery	Fast	Similar	Slow	Plenty of time available.

TABLE D-1 – EATMP SAM Severity Classification Scheme (* row not to be used only when looking at the WORST CREDIBLE CASE: Methods 2 & 4 to set Safety Objectives)

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