European Aviation Safety Agency

Acceptable Means of Compliance

and

Guidance Material

for the implementation and measurement of

Safety Key Performance Indicators (SKPIs)

(ATM performance IR)

Amendment 1
19 December 2013[1]

[1] For the date of entry into force of this Amendment, kindly refer to Decision 2013/032/R in the **Official Publication** of the Agency.

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I General

GM1 SKPI General

A. Purpose

This Annex contains acceptable means of compliance (AMC) and guidance material (GM) for measuring the safety Key Performance Indicators (KPIs) and Performance indicators (PIs) in accordance with the performance scheme Regulation which should be understood as Commission Regulation (EU) No 691/2010[2] as amended by Commission Implementing Regulation (EU) No 1216/2011 for the first reference period and Commission Implementing Regulation (EU) No 390/2013[3] for the second reference period.

AMCs are non-binding standards adopted by the European Aviation Safety Agency (EASA) (hereafter referred to as the 'Agency') to illustrate means to establish compliance with the performance scheme Regulation. When this AMC is complied with, the obligations on measurement of the safety KPIs in the performance scheme Regulation are considered as met.

However, the AMC contained in this Annex provide means, for the measurement of the safety KPIs. Should a Member States or an Air Navigation Service Provider (ANSP) wish to use different means to measure the safety KPIs, they should:

- inform the Agency thereof, and
- be able to demonstrate, by means of evidence, that the outcome of the application of any alternative means maintains the level of compliance with the performance scheme Regulation and reaches a result that is comparable with this Annex.

B. Objective

The objective of this Annex is to establish the methodology for the measurement and verification of the following safety key performance indicators (safety KPIs) under the performance scheme Regulation:

a) Effectiveness of Safety Management (EoSM) and Just Culture (JC), which should be measured through a periodic answering of the questionnaires the content of which is provided in Appendices 1 to AMC 2 SKPI, 1 to AMC 3 SKPI, 1 to AMC 9 SKPI and 1 to AMC 10 SKPI. The filled in questionnaires by the entity subject to evaluation, and distributed in accordance with performance scheme Regulation, should be verified as guided in AMC 3 and 9 SKPI.

b) Methodology for severity classification of reported safety-related occurrences. This should be done for each occurrence subject to the application of the methodology and should be verified as guided in AMC 4, 5, 6, 7 and 8 SKPI.

C. Definitions and Acronyms

Definitions

'ATM-specific occurrences' are events or situations where a providers ability to provide ATM, ATS, ASM or ATFM services is diminished or ceases ; .

'ATM/ANS system security' is a situation in which the ATM/ANS services are lost or disrupted as a result of breach of system security.

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[2] Commission Regulation (EU) No 691/2010 of 29 July 2010 laying down a performance scheme for air navigation services and network functions and amending Regulation (EC) No 2096/2005 laying down common requirements for the provisions of air navigation services (OJ L 201, 3.8.2010, p. 1). Regulation as last amended by the Commission Implementing Regulation (EU) No 1216/2011 (OJ L 310, 25.11.2011, p. 3).

[3] OJ L121, 9.5.2013.

'Best (good) practice' is a method, initiative, process, approach, technique or activity that is believed to be more effective at delivering a particular outcome than other means. It implies accumulating and applying knowledge about what is working and what is not working, including lessons learned and the continuing process of learning, feedback, reflection and analysis.

'Major incident' is 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).

'Not determined' means that insufficient information was available to determine the risk involved or inconclusive or conflicting evidence precluded such determination.

'Occurrence with no safety effect' is an occurrence which has no safety significance.

'Reliability factor' is the level of confidence in the assessment (scoring) undertaken, based on the data available.

'Runway Incursion' is any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.

'Safety culture' means the shared beliefs, assumptions and values of an organisation.

'Safety plan' is a high level safety issues assessment and related action plan. The safety plan is a key element of the safety programme.

'Safety programme' is an integrated set of regulations and activities aimed at improving safety.

'Separation minima infringement' is a situation in which prescribed separation minima were not maintained between aircraft.

'Serious incident' is an incident involving circumstances indicating that there was a high probability of an accident and is associated with the operation of an aircraft, which in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down.

'Significant incident' is 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.

Acronyms

A/D MAN	Arrival/Departure Manager
AMC	Acceptable Means of Compliance
ANS	Air Navigation Service
ANSP	Air Navigation Service Provider
A-SMGCS	Advanced Surface Movement Guidance & Control System
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management
ATS	Air Traffic Services
CA	Competent Authority
CISM	Critical Incident Stress Management

CWP	Controller Working Position
EoSM	Effectiveness of Safety Management
FAB	Functional Airspace Block
JC	Just Culture
GM	Guidance Material
KPI	Key Performance Indicator
MO	Management Objective
MTCD	Medium Term Conflict Detection
NSA	National Supervisory Authority
PI	Performance Indicator
QMS	Quality Management System
RAT	Risk Analysis Tool
RF	Reliability Factor
RI	Runway Incursion
RP	Reference Period
SA	Study Area
SFMS	Safety Framework Maturity Survey
SI	Standardisation Inspection
SIA	civil aviation Safety Investigation Authority
SKPI	Safety Key Performance Indicator
SLA	Service Level Agreement
SMI	Separation Minima Infringement
SMS	Safety Management System
SSP	State Safety Programme
STCA	Short Term Conflict Alert
TCAS RA	Traffic Collision Avoidance System Resolution Advisory

II Effectiveness of Safety Management KPI

AMC 1 SKPI Measurement of Effectiveness of Safety Management KPI — General

GENERAL DESCRIPTION

The Effectiveness of Safety Management (EoSM) indicator should be measured by verified responses to questionnaires at State/competent authority and service provision level, as contained in this Annex. For each question the response should indicate the level of implementation, characterising the level of performance of the respective organisation.

EFFECTIVENESS LEVELS AND EFFECTIVENESS SCORE

When answering the questions, one of the following levels of implementation should be selected:

- Level A which is defined as 'Initiating' — processes are usually ad hoc and chaotic;

- Level B which is defined as 'Planning/Initial Implementation' — activities, processes and services are managed;
- Level C which is defined as 'Implementing' — defined and standard processes are used for managing;
- Level D which is defined as 'Managing & Measuring' — objectives are used to manage processes and performance is measured; and
- Level E which is defined as 'Continuous Improvement' — continuous improvement of processes and process performance.

An effectiveness level should be selected only if all the elements described in the questionnaire are fully observed by an ANSP or Member State/competent authority. If an ANSP or a Member State/competent authority has identified elements in various adjacent effectiveness levels, then they should take a conservative approach and select the lower effectiveness level for which all elements are covered.

Based on the responses, the following scores should be derived:

- The overall effectiveness score should be derived from the combination of the effectiveness levels selected by the relevant entity (ANSPs or Member State/competent authority) against each question with the weightings as described in Appendix 2 to AMC 2 SKPI and Appendix 2 to AMC 3 SKPI;
- An effectiveness score for each Management Objective for the State/competent authority and for each study area for the ANSP.

GM 2 SKPI Measurement of Effectiveness of Safety Management KPI — General

A Management Objective (MO) has been derived and adapted for each of the elements of the ICAO State Safety Programme (SSP) and Safety Management System (SMS) as described in ICAO Annex 19.

For each Management Objective, a question (or questions) has been derived and the levels of effectiveness have been described.

For both State and ANSP levels, EASA and PRB will monitor the performance regarding this indicator based on the received answers and on the results of the verification process by the States/competent authority (CA) and by EASA as presented in Figure 2 in AMC 5 SKPI, section D.

The questionnaires' sole intent is to monitor the performance (effectiveness) of Member States/competent authorities and ANSPs regarding ATM/ANS safety management.

In order to facilitate this process for stakeholders, the Agency has developed an on-line tool which may be used by respondents, in place of the paper questionnaire, in order to complete and submit their responses to the questionnaires.

Member States/competent authorities and ANSPs are expected to provide evidence based answers to these questionnaires as far as is practicable. The response levels assessed in the completed EoSM questionnaires should be used with the sole purpose of generating recommendations and associated plans for improvement of safety management. These response levels should not be used to generate findings in the context of standardisation or oversight inspections audits.

In accordance with Commission Regulation (EU) No 628/2013[4], if during a standardisation inspection a finding is raised by the Standardisation Team, in relation to the NSA/CA responses to the EoSM questionnaire, corrective action by the NSA/CA is required. Further, where a finding identifies that any of the questions in the EoSM questionnaire is scored higher than it should be,

[4] Commission Implementing Regulation (EU) No 628/2013 of 28 June 2013 on working methods of the European Aviation Safety Agency for conducting standardisation inspections and for monitoring the application of the rules of Regulation (EC) No 216/2008 of the European Parliament and of the Council and repealing Commission Regulation (EC) No 736/2006. (OJ L 179/46 29.6.2013 p.46)

the score should be corrected and lowered to the appropriate level of implementation. A similar approach should be applied when the NSA/competent authorities raise findings to the ANSPs.

The outcome of standardisation inspections/oversight is not designed to be used for corrections of the scores towards a higher level of implementation.

AMC 2 SKPI Measurement of Effectiveness of Safety Management KPI — State level

The answers to the State-level questionnaire should be used to measure the level of effectiveness in achieving the Management Objectives defined in this Annex.

For each question, States should provide to the Agency information on the level of effectiveness (or level of implementation) and evidence to justify their answer.

Section A, below, defines which should be the corresponding Management Objectives for each component and element of the SSP framework.

The questionnaire which should be answered by the Member States/competent authority is in Appendix 1 to AMC 2 SKPI — Questionnaire for Measurement of Effectiveness of Safety Management KPI — State Level.

A. Components, Elements and Management Objectives

Component 1 — State safety policy and objectives
Element 1.1 State safety legislative framework:

Management objective
1.1 — Implement the EU safety legislative and regulatory framework including, where necessary, the alignment of the national framework.

Element 1.2 State safety responsibilities and accountabilities

Management objective
1.2 — Establish national safety responsibilities and maintain the national safety plan in line with the European Aviation Safety Plan, where applicable. The national safety plan should include the state policy to ensure the necessary resources.

Element 1.3 Accident and incident investigation

Management objective
1.3a — Establish and maintain the independence of the civil aviation safety investigation authorities, including necessary resources. 1.3b — Establish means to ensure that appropriate safety measures are taken after safety recommendations have been issued by a civil aviation safety investigation authority. 1.3c — Ensure that civil aviation safety investigation authorities involve subject matter expertise from the ATM/ANS domain.

Element 1.4 Enforcement policy

Management objective

1.4 — Establish appropriate, transparent and proportionate enforcement procedures, including the suspension, limitation and revocation of licences and certificates and the application of other effective penalties.

Element 1.5 Management of related interfaces

Management objective
1.5a — Ensure adequate management of the internal interfaces within the NSA. 1.5b — Ensure adequate management of the external interfaces with relevant stakeholders.

Component 2 — Safety risk management
Element 2.1 Safety requirements for the air navigation service provider's SMS

Management objective
2.1 — Establish controls which govern how service providers' safety management systems (SMS) will identify hazards and manage safety risks.

Element 2.2 Agreement on the service provider's safety performance

Management objective
2.2 — Agree on safety performance of an individual, national or FAB service provider.

Component 3 — Safety assurance
Element 3.1 Safety oversight

Management objective
3.1a — Attribution of powers to the NSA responsible for safety oversight of air navigation service providers. 3.1b — Establishment of a national safety oversight system and programme to ensure effective monitoring of the air navigation service provider's (ANSP) compliance with the applicable regulations and monitoring of the safety oversight function.

Element 3.2 Safety data collection, analysis and exchange

Management objective
3.2 — Establishment of mechanisms to ensure the capture and storage of data on hazards and safety risks and analysis of that data at ANSP and State level as well as its dissemination and exchange.

Element 3.3 Safety-data-driven targeting of oversight of areas of greater concern or need

Management objective
3.3 — Establishment of procedures to prioritise inspections, audits and surveys towards the areas of greater safety concern or need or in accordance with the identified safety risks.

Component 4 — Safety promotion
Element 4.1 Internal training, communication and dissemination of safety information

Management objective
4.1a — Training of NSA personnel on applicable legislative and regulatory framework. 4.1b — Promotion of awareness of safety information and communication and dissemination of safety-related information amongst the aviation authorities within a State.

Element 4.2 External training, communication and dissemination of safety information

Management objective
4.2a — Education/training of ANSP personnel and air traffic controllers (ATCO) training organisations on applicable legislative and regulatory framework. 4.2b — Promotion of awareness of safety information and communication and dissemination of safety-related information with external stakeholders.

Component 5 — Safety culture
Element 5.1 Establishment and promotion of safety culture

Management objective
5.1 — Establishment and promotion of safety culture within the competent authority/NSA.

Element 5.2 Measurement and improvement of Safety Culture

Management objective
5.2 — Establishment of procedures to measure and improve safety culture within the competent authority/NSA.

B. Scoring and Numerical Analysis

When scoring the EoSM at State level, each response provided by the State or the competent authority in their questionnaire should be assigned a numerical value from 0 to 4, corresponding to levels A to E.
In addition, each question should be weighted from 0 to 1 according to its relevance to each Management Objective. The list of weighting factors for each question and MO can be found in Appendix 2 to AMC 2 SKPI — List of Weightings for Evaluation of Effectiveness of Safety Management Questionnaire — State level.
Mathematically, the effectiveness score for each Management Objective is calculated from the questionnaire responses and weighting factors as follows:

$$S_j = \frac{100 \sum_{k=1}^{n_j} r_{kj} . w_{kj}}{4 \sum_{k=1}^{n_j} w_{kj}}$$

Where:

- S_j is the effectiveness score for the State in management objective j;
- r_{kj} is the numeric value of the response of State to question k in management objective j (value 0 to 4);
- w_{kj} is the weight factor of question k to management objective j (value 0 to 1);
- n_j is the number of questions in management objective j for which responses were provided by the State.

In order to measure the effectiveness of safety management for the State, the following scores should be evaluated and monitored:

- Overall effectiveness score: the overall score for each State estimated by taking the average of the scores over all Management Objectives.
- An effectiveness score for each Management Objective: scores over each Management Objectives, calculated with the use of the weightings from Appendix 2 to AMC 2 SKPI — List of Weightings for Evaluation of Effectiveness of Safety Management Questionnaire — State level.

C. Mechanism for Verification

The results of States' questionnaires are to be verified by means of EASA standardisation inspections.

The coordination between EASA and the competent authority should be done through the national ATM/ANS standardisation coordinator appointed by the State. The process is described in Figure 1 below.

The national coordinator should be responsible for coordination within the State authorities and for coordination with the ANSPs to provide the Agency with the responses to the questionnaires.

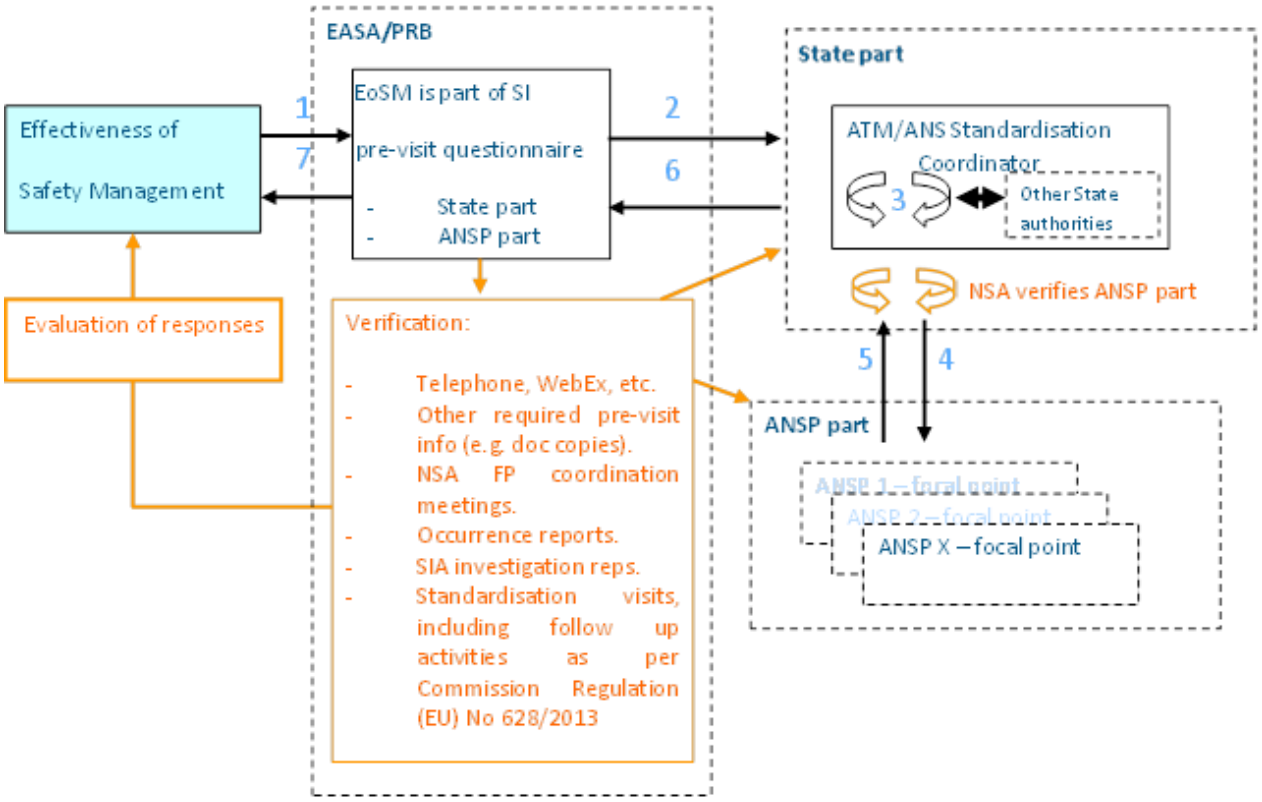


Figure 1 — Visualisation of the Mechanism for Verification at State level

GM 3 SKPI Effectiveness of Safety Management – Justifications for selected levels of implementation

This GM provides some general principles for providing justifications and a worked example for the levels selected.

General Principles

It is anticipated that during a reference period there will be no changes other than clarifications, to the Effectiveness of Safety Management questionnaire. This not only enables the progress of States to be monitored during a reference period, it also means that State's responses to the questionnaire only need to be updated within a reference period, instead of being completely revised. It should, therefore, be anticipated that for some questions (but not the whole questionnaire) the response from a State will be the same as in previous years.

The verification process performed by the Agency uses the justifications and evidence provided in the answers to the questionnaire, alongside pre-audit questionnaires, standardisation visits and information from the State NPP and USOAP audits. Where insufficient justification has been provided, the verification relies on alternative information such as additional requests for clarification from the NSA point of contact. Therefore, in the interest of efficiency, States are encouraged to provide the necessary justifications in the first instance.

Extensive justification, when levels of implementation A or B are selected, is not necessary. A simple statement of the fact or of when the work was, or will be, initiated is sufficient. Justifications for levels C, D, and E are required and the general principles of what formulates a good answer from the perspective of verification are shown below.

(a) Justifications should be inclusive and explanatory, they should cover all relevant information and explain how the state achieved the level selected. Answers should not simply re-state the question.

(b) Answers should clearly explain why a state is *at the level selected and* should avoid explaining why they are not at the level above the one selected.

(c) In many of the questions, if the State selects level D or above, it must meet the requirements of both the level selected and the levels below. Where this is the case, the justification should cover all applicable levels, although a degree of consolidation is both acceptable and advisable.

(d) The questionnaire often refers to 'a mechanism', however, it should be recognised that the differing organisational structures and project management styles between NSAs may mean that, instead of a single mechanism, there could be a series of processes, projects or initiatives that deliver the desired end results. Such a description of the processes, projects or initiatives and their interaction, provided that they are coordinated, is equally acceptable.

(e) Justifications should contain specific information such as:

  (1) Names or titles of the processes, documents, legislation or entities being described,

  (2) The job roles of the people responsible for the development, implementation or review of the item being described,

  (3) The intended purpose of the item being described

  (4) When it was developed and implemented and how often it is reviewed,

  (5) An outline of the means or method used for development, implementation or review (such as meetings, project teams. etc.)

  (6) The applicability of the item, for example whether it currently includes all the aspects intended or whether there are exceptions.

(f) Where evidence can be easily provided, such as links to documents that are published online, these should have been provided, regardless of the language in use.

(g) Where references are made to evidence in published documents, the reference should describe where the evidence can be found in the document and where the document itself can be found. For example, hyperlinks may be provided to documents published online, but where the document is very long, a reference to the chapter or page number would be helpful.

(h) Where reference is made to internal documents, these should be cross-referenced with evidence from previous standardisation visits (if applicable). The reference should include sufficient detail for the verification team to be able to ask for the document, or the section of the document referred to, in a follow-up question to the state.

Example Response

An example of a well-structured answer is shown below and the principles shown are applicable to any question at any level. In the example provided, the response shows that the State has achieved all of levels C and D, and even some of level E, but because it has not achieved *all* of level E it must select level D. In the answer it can be seen that the information provided is concise but describes the processes by providing references, naming the entities or job functions responsible for the work (but not naming individuals), and by providing additional information that allows the verification team to understand the quality of the work being done.

By providing more information regarding the policy, more confidence can be placed in the answer and the verification team has a better idea of the way in which the NSA manages the policy in question. The extra information also indicates that the NSA is already moving towards achieving level E, although not all of the level E requirements are met.

The justification describes the way in which the requirements at level C are met, providing a reference and, because in this case it is available, a hyperlink to the document online. States should ensure that referenced documents really do contain the information described and that hyperlinks are correct.

Element 2.2 Agreement on the service provider's safety performance

MO2.2: Agree on safety performance of an individual, national or FAB service provider.

NSA has agreed with individual air navigation service providers on the safety performance (co
the ones contained in the national performance plans).

A	Initiating	Acceptable safety levels are established through the ATM safety regulatory framework in a limited number of areas and in an ad hoc manner.	A
B	Planning/ Initial Implementation	There is a plan in place to establish and formalise acceptable safety levels for the ATM system through the ATM safety regulatory framework. Implementation activities have commenced.	B
C	Implementing	Formalised acceptable safety levels have been established for the ATM system through the implementation of the State Safety Programme.	C
D	Managing & Measuring	**All of Implementing plus:** An evaluation of the acceptable safety levels is carried out on a regular basis and changes are introduced when necessary.	D
E	Continuous Improvement	**All of Managing & Measuring plus:** The acceptable safety level review process is proactively incorporated within the overall aviation safety system. Based on proactive recommendations, acceptable safety levels are linked to potential safety-critical hazards and events through the State Safety Programme.	E

Please provide justification for selected answer

D: The national competent authority has developed an acceptable level of safety policy document (ref ALS2, first published in July 2011) which has been promulgated externally via an ANS NOTICE (available from the NSA website at www.NSA.gov.xx/ANSNOTICE7-2011). The policy identifies a number of national level ANS safety targets. Further work is currently being undertaken by the NSA to broaden this activity to derive individual unit level safety targets for those units where the level of activity makes this approach practicable. An evaluation of safety performance is undertaken by the ANS and Safety Analysis Departments on a 6 monthly basis. In addition, prior to conducting on-site audits of major units, safety performance trends for a selected number of safety indicators is reviewed. In addition, a summary of annual national ANS safety performance is reported upon formally in the Annual Safety Oversight Report, which can be found online at www.NSA.gov.xx/AnnualSafetyOversightReport2012

By providing an example via the hyperlink, the verification team can check the quality of the work to understand how well the requirements are being met.

By providing the timescales (every six months) and the names of the departments involved, the justification describes succinctly that the evaluation is carried out on a regular basis. By describing the review process prior to major audits the justification shows that the criteria are met in more than one way, providing more confidence in the answer.

AMC 3 SKPI Measurement of Effectiveness of Safety Management KPI — ANSP level

The answers to the ANSP-level questionnaire should be used to measure the level of effectiveness in achieving the management objectives defined in this AMC.

For each question, ANSPs should provide to their NSA/competent authority information on the level of effectiveness (or level of implementation) and evidence to justify its answer as indicated below.

Section A defines for each component and element of the ICAO Safety Management Framework the corresponding Management Objectives.

The questionnaire which should be answered by the ANSPs is in Appendix 1 to AMC 3 SKPI — Questionnaire for Measurement of Effectiveness of Safety Management KPI — ANSP level.

A. Components, Elements and Management Objectives

Component 1 — ANSP safety policy and objectives

Element 1.1 Management commitment and responsibility

Management objective
1.1 — Define the ANSPs' safety policy in accordance with Regulation (EU) No 1035/2011 (Common Requirements).

Element 1.2 Safety accountabilities — Safety responsibilities

Management objective
1.2 — Define the responsibilities of all staff involved in the safety aspects of service provision and responsibility of managers for safety performance.

Element 1.3 Appointment of key safety personnel

Management objective
1.3 — Define the safety management function to be the responsible for the implementation and maintenance of SMS.

Element 1.4 Coordination of emergency response planning/contingency plan

Management objective
1.4 — Define a contingency plan properly coordinated with the Network Manager, other interfacing ANSPs, other relevant stakeholders and FABs.

Element 1.5 SMS documentation

Management objective
1.5 — Develop and maintain the relevant SMS documentation that defines the ANSP's approach to the management of safety.

Element 1.6 Management of related interfaces

Management objective
1.6a — Ensure adequate management of the internal interfaces. 1.6b — Ensure adequate management of the external interfaces which may influence directly the safety of their services.

Component 2 — Safety risk management
Element 2.1 Safety risk assessment and mitigation

Management objective
2.1 — Develop and maintain a formal process that ensures the management of safety risks.

Component 3 — Safety assurance
Element 3.1 Safety performance monitoring and measurement

Management objective
3.1 — Establish means to verify the safety performance of the ANSP and the effectiveness of safety risk management.

Element 3.2 The management of change

Management objective
3.2 — Establish a formal process to identify changes and to ensure that safety risk assessment and mitigation are systematically conducted for identified changes.

Element 3.3 Continuous improvement of the SMS

Management objective
3.3 — Establish a formal process to systematically identify safety improvements.

Element 3.4 Occurrence reporting, investigation and improvement

Management objective
3.4 — Ensure that ATM operational and/or technical occurrences are reported and those which are considered to have safety implications are investigated immediately, and any necessary corrective action is taken.

Component 4 — Safety promotion
Element 4.1 Training and education

Management objective
4.1 — Establish a safety training programme that ensures that personnel are trained and competent to perform SMS-related duties.

Element 4.2 Safety communication

Management objective
4.2 — Establish formal means for safety promotion and safety communication.

Component 5 — Safety culture
Element 5.1 Establishment and promotion of safety culture

Management objective
5.1 — Establish and promote safety culture within the ANSP.

Element 5.2 Measurement and improvement of safety culture

Management objective
5.2 — Establish procedures to measure and improve safety culture within the ANSP.

B. Mapping between Management Objectives, Study Areas and Questions

The following table contains the mapping between the Management Objectives, Study Areas and the questions:

MO	SA — Q
Safety policy and objectives	
1.1	SA2-3
1.2	SA2-1, SA2-4
1.3	SA2-2
1.4	SA4-3
1.5	SA4-1
1.6a	SA7-1
1.6b	SA7-2
Safety risk management	
2.1	SA6-1
Safety assurance	
3.1	SA9-1, SA9-2
3.2	SA6-1
3.3	SA3-1, SA3-2, SA10-1, SA11-2
3.4	SA1-3, SA8-1
Safety promotion	
4.1	SA5-1
4.2	SA4-2, SA8-2, SA8-3, SA9-3, SA11-1, SA11-3
Safety culture	
5.1	SA1-1
5.2	SA1-2

Table 1: Mapping Management Objectives to Study Area questions

SA — Q	MO
Safety culture	
SA1-1	5.1
SA1-2	5.2
SA1-3	3.4
Safety Responsibilities	
SA2-1	1.2
SA2-2	1.3
SA2-3	1.1
SA2-4	1.2
Compliance with international obligations	
SA3-1	3.3
SA3-2	3.3
Safety standards and procedures	
SA4-1	1.5
SA4-2	4.2
SA4-3	1.4
Competency	
SA5-1	4.1
Risk management	
SA6-1	2.1, 3.2
Safety interfaces	
SA7-1	1.6a
SA7-2	1.6b
Safety reporting, investigation and improvement	
SA8-1	3.4
SA8-2	4.2
SA8-3	4.2
Safety performance monitoring	
SA9-1	3.1
SA9-2	3.1
SA9-3	4.2
Operational safety surveys and SMS audits	
SA10-1	3.3
Adoption and sharing of best practises	
SA11-1	4.2
SA11-2	3.3
SA11-3	4.2

Table 2: Mapping Study Area questions to Management Objectives

Given this mapping, at any point an interpretation from Management Objective to Study Area and vice versa should be possible.

C. Scoring and Numerical Analysis

In order to be able to measure the effectiveness of safety management of the ANSP, the answers to the questions should be quantified and weighting factors which link the questions, study areas and the management objectives should be applied.

The responses provided by the ANSP on their questionnaires are assigned a numerical value from 0 to 4, corresponding to levels A to E.

In addition, each question should be weighted:

- from 0 to 5 according to its relevance to each Study Area;
- from 0 to 1 according to its relevance to each Management Objective.

The list of weighting factors for each question, Study Area and Management Objective can be found in Appendix 2 to AMC 3 SKPI — List of Weightings for evaluation of Effectiveness of Safety Management Questionnaire — ANSP level.

Mathematically, the effectiveness score is calculated from the questionnaire responses and weighting factors as follows:

$$S_j = \frac{100 \sum_{k=1}^{n_j} r_{kj} . w_{kj}}{4 \sum_{k=1}^{n_j} w_{kj}}$$

Where:

- S_j is the effectiveness score for ANSP in Study Area/Management Objective j;
- r_{kj} is the numeric value of the response of ANSP to question k in Study Area/Management Objective j;
- w_{kj} is the weight factor of question k to Study Area/Management Objective j; and
- n_j is the number of questions in Study Area/Management Objective j for which ~~non-nil~~ responses were provided by the ANSP.

In order to measure the effectiveness of safety management for the ANSP, the following scores should be evaluated and monitored:

- Overall effectiveness score: the overall score for each ANSP estimated by taking the average score over all Study Areas, using the weighting factors in Appendix 2 to AMC 3 SKPI — List of Weightings for evaluation of Effectiveness of Safety Management Questionnaire — ANSP level, section 2.1.
- An effectiveness score for each Management Objective: scores for each management objectives calculated with the use of the weighting of questions described in Appendix 2 to AMC 3 SKPI — List of Weightings for evaluation of Effectiveness of Safety Management Questionnaire — ANSP level, section 2.2.

D. Mechanism for Verification

The verification of the ANSP questionnaires by the NSA/competent authority should take place before the questionnaires and their results are submitted to EASA. The verification mechanism is presented in Figure 2.
ANSPs should assign a focal point for the purpose of the verification process.

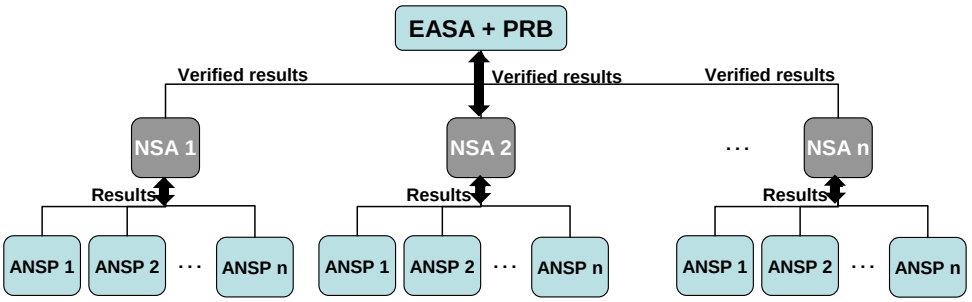


Figure 2 — Representation of verification mechanism of the ANSPs (normal procedure)

The competent authority/NSA may allocate the detailed verification task to a qualified entity or other entity.

GM 4 SKPI Measurement of Effectiveness of Safety Management KPI — ANSP level — Scoring and numerical analysis

EXAMPLE FOR EoSM MEASUREMENT AT ANSP LEVEL

The EoSM KPI is based on the EUROCONTROL Safety Framework Maturity Survey (SFMS) which has been implemented for several years at ANSP level. The numerical analysis at ANSP level has been validated during the implementation of the SFMS by EUROCONTROL and is based on Study Areas (SA). This is the reason why in section B of AMC 5 SKPI the mapping is provided in order to match the Study Areas to the Management Objectives. The overall score of EoSM is using the weightings of the SA as established in SFMS and the scoring of each MO is based on average weightings.

Example:

The following tables represent the results for calculating the scores for EoSM at ANSP level as follows:

- Table 1 presents the association between the selected level of implementation and the numerical value from 0 to 4;
- Table 2 illustrates the score calculated for each Study Area (SA) and the overall effectiveness score (average) of the EoSM at ANSP level; and
- Table 3 presents the effectiveness score for each Management Objective.

QUESTIONS	Selected level	Numerical value
SA1-1	A	0
SA1-2	E	4
SA1-3	E	4
SA2-1	B	1
SA2-2	D	3
SA2-3	E	4
SA2-4	D	3
SA3-1	D	3
SA3-2	D	3
SA4-1	C	2
SA4-2	D	3
SA4-3	B	1
SA5-1	D	3
SA6-1	D	3
SA7-1	C	2
SA7-2	B	1
SA8-1	A	0
SA8-2	C	2
SA8-3	C	2
SA9-1	D	3
SA9-2	B	1
SA9-3	C	2
SA10-1	D	3
SA11-1	C	2
SA11-2	B	1
SA11-3	B	1

Table 1

SAs	SA score
1	52.7
2	57.4
3	60.3
4	54.7
5	52.7
6	53.5
7	47.7
8	51.4
9	51.1
10	56.0
11	54,4
average	**53,8**

Table 2

MOs	MO score
1.1	100
1.2	50
1.3	75
1.4	25
1.5	50
1.6a	50
1.6b	25
2.1	75
3.1	50
3.2	75
3.3	62.5
3.4	50
4.1	75
4.2	51
5.1	0
5.2	100

Table 3

The application of the formula for calculation of the overall effectiveness score

$$S_j = \frac{100\sum_{k=1}^{n_j} r_{kj}.w_{kj}}{4\sum_{k=1}^{n_j} w_{kj}}$$

is illustrated for the calculation of the score for SA1 as follows:
S1 = 100*(0*5+4*5+4*4+1*4+3*2+4*5+3*2+3*1+3*1+2*2+3*3+1*3+3*4+3*4+2*5+1*3+0*5+2*5+2*3+3*2+1*4+2*4+3*4+2*4+1*4+1*5)/(4*(5+5+4+4+2+5+2+1+1+2+3+3+4+4+5+3+5+5+3+2+4+4+4+4+4+5))
S1 = 52,7

In this calculation the numerical values for each question from Table 1 are multiplied by the corresponding weightings for SA1, taken from section 2.1 of Appendix 2 to AMC 5 SKPI:

$$100\sum_{k=1}^{n_j} r_{kj}.w_{kj}$$

Then the result is divided by the sum of weights: $4\sum_{k=1}^{n_j} w_{kj}$

GM 5 SKPI Measurement of Effectiveness of Safety Management KPI — ANSP level — Verification Mechanism

VERIFICATION OF ANSP EoSM BY THE NSA/COMPETENT AUTHORITY

When verifying the questionnaires completed by an ANSP for EoSM, the NSA may organise bilateral interview sessions. In these interview sessions the NSA coordinator may ask the ANSP focal point some additional questions and request some additional evidence in order to verify the correctness of the answers provided to the questionnaires. Examples of the verification questions, together with examples of the possible outcome of the fulfilment of the objectives of EoSM for each level of implementation, are provided in Appendix 1 to GM 5 SKPI — Verification of ANSP EoSM by the NSA/competent authority.

COORDINATION BETWEEN THE NSAs FOR THE VERIFICATION OF THE ANSPs

The competent authorities/NSAs might need better coordination between them in the verification process in order to achieve consistent and comparable results at European level. Such coordination could be coordinated and facilitated by EASA, supported by PRB and EUROCONTROL. One potential solution could be the extension of the terms of reference of the NSA Coordination Platform (NCP) in the field of harmonisation of the verification mechanism of the safety KPIs at ANSP level.

Notwithstanding the above and notwithstanding the fact that NSA may delegate the verification task to another entity, the responsibility for verification of the safety KPI measurement at ANSP level stays with the overseeing competent authority/NSA.

III Severity Classification Based on the Risk Analysis Tool Methodology

AMC 4 SKPI Severity Classification Based on the Risk Analysis Tool Methodology — General

GENERAL DESCRIPTION

The severity part of the risk analysis tool methodology dedicated to operational occurrences should follow the principle of evaluating several criteria and allocating a certain score to each criterion, depending on how severe each criterion is evaluated to be.

Each criterion should have a limited number of options with corresponding scores. Some criteria have an ATM Ground and an ATM Airborne component and both scores should be counted when evaluating the ATM Overall score. Other criteria should be only relevant either for ATM Ground or ATM Airborne.

The overall score for severity of an occurrence should be the sum of the scores allocated to each applicable individual criterion.

The overall score for the severity of an occurrence should be built from the sum of the score allocated to the risk of collision/proximity (itself a sum of the score allocated to the separation and the score allocated to the rate of closure) and the degree of controllability over the occurrence.

The severity of the ATM-specific occurrences should refer to the service provider's capability to provide safe ATM/CNS services. The criteria which should be considered are: the service affected, service/function provided, operational function, type of failure, extent of the failure scope and duration.

The severity of occurrences reported by Member States should be the ATM Overall. For ATM-specific occurrences, the ATM Overall coincides with ATM Ground severity.

Member States should ensure that arrangements are in place for reporting of the ATM Overall severity score.

AMC 5 SKPI Severity Classification Based on the Risk Analysis Tool Methodology — Methodology for Separation Minima Infringements

The severity of Separation Minima Infringements should be calculated as the sum of the scores totalled in each of the two main criteria:

1. Risk of collision;
2. Controllability.

A. Risk of collision

The risk of collision should be determined by the sum of the scores for the following sub-criteria:

1. Separation — based solely on the minimum distance achieved between aircraft or aircraft and obstacles. The greatest value between the horizontal and vertical in percentage of the applicable separation should be considered.
2. Rate of closure based on the relative relevant (horizontal/vertical) speed measured at the moment the separation is infringed. The greatest of the predefined intervals for each of the horizontal and vertical speeds should be considered for the evaluation, if the separation is lost after the crossing point (i.e. if the aircraft are on diverging headings when the separation is lost, then the rate of closure is considered 'none').

The following table should be used to determine the scores of the criteria 'separation' and 'rate of closure':

	Risk of collision	ATM ground	ATM airborne	ATM overall	RF weight
Separation	Minimum separation achieved	0	0	0 to 10 ATM Ground **OR** ATM airborne	20
	Separation > 75 % minimum	1	1		
	Separation > 50 %, < = 75 % minimum	3	3		
	Separation > 25 %, < = 50 % minimum	7	7		
	Separation <= 25 % minimum	10	10		
Rate of closure	Rate of closure NONE	0	0	0 to 5 ATM Ground **OR** ATM airborne	10
	Rate of closure LOW (< = 85 knots, < = 1 000 ft/mn)	1	1		
	Rate of closure MEDIUM (> 85 and < = 205 knots, > 1 000 and < = 2 000 ft/mn)	2	2		
	Rate of closure HIGH (> 205 and < = 700 knots, > 2 000 and < = 4 000 ft/mn)	4	4		
	Rate of closure VERY HIGH (> 700 knots, > 4 000 ft/mn)	5	5		

For the risk of collision, either ATM Ground or ATM Airborne severity should be scored, not both. The ATM Airborne severity should be used only in cases where ATC is not responsible for

providing separation (i.e. certain classes of airspaces; e.g. close encounter between IFR and VFR flights in Class E airspace).

B. Controllability

Controllability should be the second major criterion of severity and describes the 'level of control' maintained over the situation [Air Traffic Controllers (ATCOs) and pilots supported by Safety Nets].

The controllability score should be defined by the following sub-criteria:

1. Conflict detection,
2. Planning,
3. Execution,
4. Ground safety nets (e.g. STCA),
5. Recovery,
6. Airborne safety nets (e.g. TCAS),
7. Airborne execution of TCAS RA.

Conflict detection should refer to ATM ground detection; therefore the ATM Overall score should have the same score as ATM Ground. ATM Airborne should not be scored here. There are three possible scenarios:

- 'Potential conflict DETECTED' includes cases where the conflict is detected but ATC decided to accept the situation.
- 'Potential conflict detected LATE' when there is not enough time to make and/or execute the plan. It should not be scored whenever separation is lost; consideration should be taken with regard to the circumstances involved. In units with STCA with 'look-ahead' time (predictive STCA) the conflict could be detected due to the predictive STCA. If ATCO became aware of the conflict only through the predictive STCA, then it should be scored as 'Potential conflict detected LATE'.
- The score 'Potential conflict NOT detected' is self-explanatory.

In cases such as level busts or other incidents where ATC cannot form prior plan, conflict detection should not be applicable and a zero should be scored to maintain the Reliability Factor tracked as explained in section D.

		ATM ground	ATM airborne	ATM overall	RF weight
Detection	Potential conflict DETECTED	0		0 to 5 ATM ground	10
	Potential conflict detected LATE	3			
	Potential conflict NOT detected	5			

Planning refers to the ATM Ground plan and, therefore, the ATM Overall score should have the same score as ATM Ground. ATM Airborne should not be scored here. The performance, the timing and efficiency of the ATM Ground planning should be assessed. The plan refers to the first plan developed by ATC to solve the potentially hazardous/conflict situation detected in the previous step. This plan should be referred to in the subsequent execution steps but not necessarily in the recovery step.

- When the planning is either late or does not lead to a timely and effective resolution of the conflict, then 'Plan INADEQUATE' should be scored.
- When 'Conflict NOT detected' is scored, then also 'NO Plan' and 'NO Execution' should be scored.
- Whenever conflict detection is not applicable (such as level bust cases), then the planning sub-criterion is not applicable and a zero should be scored to maintain the Reliability Factor tracked as explained in section D.

		ATM ground	ATM airborne	ATM overall	RF weight
Planning	Plan CORRECT	0		0 to 5 ATM ground	10
	Plan INADEQUATE	3			
	NO plan	5			

Execution refers in general to ATM Ground execution in accordance with the developed plan but it should have ATM Ground and ATM Airborne components. Execution refers to the execution of the first plan developed by ATC to solve the detected hazardous/conflict situation. When assessing the execution, the time and efficiency of that execution should be assessed. Airborne execution of the received instructions/clearances should be scored as ATM Airborne.

- ATM Ground execution should be scored as 'Execution INADEQUATE' when it is not timely or not effective. It refers to the same plan developed in the planning criterion, prior to the separation infringement. It includes the cases when it is contrary to any prior good planning. The airborne execution should be scored separately as ATM Airborne.
- When no conflict is detected, 'NO plan' and 'NO execution' should apply. 'NO execution' also should comprise cases when there is detection and a plan but this is not implemented at all.
- Whenever conflict detection and planning are not applicable, such as deviation from ATC clearance (e.g. runway incursion due to pilot deviation from ATC clearance), then the execution criterion for ATM Ground should also not be applicable and should be scored 0.
- In case of no pilot deviation from the instructed plan by the ATCO, ATM Overall should have the same score as ATM Ground and ATM Airborne should be scored 0.

		ATM ground	ATM airborne	ATM overall	RF weight
Execution	Execution CORRECT	0	0	0 to 15 ATM ground + ATM airborne	10
	Execution INADEQUATE	3	5		
	NO Execution	5	10		

Ground Safety Nets (STCA) (Short Term Conflict Alert or other similar ground safety net)

Only Current (not-predictive) STCA should be scored here. This criterion follows the principles of TCAS, except when the STCA is a ground-based defence. Cases of false/nuisance alerts should be disregarded. This sub-criterion should have only the ATM Ground element. ATM Airborne should not be scored here.

- If current STCA triggers and is used by the ATCO, then it served its purpose as designed and a 'zero' should be scored for ATM ground. As such, the units with and without STCA are scored in the same manner;

- When the conflict is detected by the ATCO before the STCA triggers, then a zero should be scored;
- 'No detection' should be scored when the conflict was not detected or detected late by the ATM Ground and STCA should have been triggered according to its implemented logic, but it failed to function. Hence the ground safety net barrier did not work.

		ATM ground	ATM airborne	ATM overall	RF weight
STCA ATM ground	Current STCA triggered	0		0 or 5	
	No current STCA	5			

Recovery from the actual incident is the phase requiring immediate action to restore the safety margins (e.g. separation) or at least to confine the hazard. Recovery starts from the moment the safety margins have been breached (potentially due to an inadequate or missing initial plan to solve the hazardous situation). This sub-criterion applies to both ATM Ground and ATM Airborne. Therefore, ATM Overall should be **the sum** of the ATM Ground and ATM Airborne values.
From this step (recovery) the plan should be considered as a new one and as different from the first plan established in the detection/planning phase. It is seeking the performance of bringing the system back within its safety envelope (such as re-establishment of the separation minima). Recovery might include, depending on type of occurrence (e.g. airspace in which it occurred and services to be provided), cases where traffic information or avoiding actions were issued by ATC.

- 'Recovery CORRECT' should be scored when the actions taken after the separation minima infringement were adequate and the separation was re-established within a reasonable timeframe.
- Scoring 'Recovery INADEQUATE' indicates that the ATM reaction, after the actual incident is declared, had not improved the situation.
- When scoring 'NO recovery', consideration should be given as to whether a TCAS RA or pilot see-and-avoid action was triggered, as this could be the reason to not follow the ATC instructions. In this case, there should be no penalty on the ATM Airborne part.
- When the aircraft are already diverging, then recovery should be scored as not applicable and a zero value should be given.

		ATM ground	ATM airborne	ATM overall	RF weight
Recovery	Recovery CORRECT	0	0	0 to 25 ATM ground + ATM airborne	10
	Recovery INADEQUATE	5	6		
	NO recovery or the ATM ground actions for recovery have worsened the situation or ATM airborne has worsened the situation	10	15		

Airborne Safety Nets (TCAS) — The TCAS sub-criterion should be scored only for useful TCAS RAs (as per ICAO definitions). A similar logic applies for see-and-avoid environments where TCAS does not function. Note: For this sub-criterion ATM Overall should take the score of ATM Airborne. ATM Ground should be scored for the purposes of Reliability Factor evaluation

as described in section D and ATM Ground severity evaluation when done separately from the ATM Overall.

- The 'No TCAS RA' option should be used in situations when the geometry of the encounter would require a TCAS RA (based on ICAO TCAS logic) and that did not occur.
- 'TCAS triggered…' should be scored as not applicable (i.e. a score of zero should be given) if adequate ATC instructions are issued before the pilot reaction due to TCAS RA.
- For cases where TCAS RA contributed significantly to the recovery and re-establishment of separation, 'TCAS triggered...' should be scored.

		ATM ground	ATM airborne	ATM overall	RF weight
TCAS	TCAS triggered or see-and-avoid pilot decision (in the absence of TCAS)	10	0	0 or 10 ATM airborne	10
	NO TCAS RA	0	10		

Airborne execution of TCAS RA (or application of see-and-avoid in cases where TCAS is not applicable) and recovery is a criterion to gather the complementary performance to ATM ground.

- 'Airborne INSUFFICIENTLY followed RA' should apply when pilot action is not reacting fully in accordance with the TCAS RA.
- 'Airborne INCORRECTLY followed RA (or, in the absence of RA, took other inadequate action)' should be scored whenever the pilot actions were either missing or contradictory (e.g. did not follow the RA). A contradictory reaction or non-reaction to a TCAS RA should be considered as the worst possible case.

		ATM ground	ATM airborne	ATM overall	RF weight
Pilot execution of TCAS RA	Airborne followed RA (or, in absence of RA, took other effective action, as a result of see-and-avoid decision)		0	0 to 15 ATM airborne	10
	Airborne INSUFFICIENTLY followed RA		10		
	Airborne INCORRECTLY followed RA (or, in the absence of RA, took other inadequate action)		15		

The score of the controllability criterion should be the sum of the scores of its components: Detection, Planning, Execution, STCA, Recovery, TCAS RA and Pilot Action.

C. Final scores

Once all criteria have been evaluated and scored accordingly, the final score for severity should be the sum of the scores for 'Risk of collision' and 'Controllability'.
When the overall scores have been calculated as above, the equivalence with the severity for ATM Overall should be as follows:

ATM Overall Score	Severity class
Between 0–9	No safety effect (E)
Between 10–17	Significant incident (C)
Between 18–30	Major incident (B)
Higher than 31	Serious incident (A)

D. Reliability Factor

Every criterion of the methodology should have its own importance for the evaluation of severity. If there is no information for evaluation of a certain criterion or the information available is ambiguous or the scoring panel cannot agree on the choice that should be made, then these should be identified as missing elements from the methodology.

In order to record and track the influence of the missing elements on the final severity score, an Overall Reliability Factor (RF) should be calculated in parallel with the severity score. The RF should be based purely on the amount of criteria which are considered when evaluating the severity score.

Each criterion should have its associated RF weight. The predefined RF weight per criterion is presented in the last column (RF) in the tables in sections A and B. The value of the Overall RF should be the sum of the RF weights associated to the criteria which are taken into account for the severity evaluation.

Not all criteria should be always applicable (e.g. units without Safety nets, or Safety nets did not trigger). Any criterion positively known not to be applicable to the particular situation under consideration should be scored with a zero value and its associated RF weight should be added to the overall RF.

In the situation where a certain criterion is applicable but there is not enough information to make a judgement from the investigation report (due to lack of data or lack of clarity of the details), the score for that criterion should have value 'blank'. 'Blank' value for a certain criterion indicates that the relevant RF weight should not take part in the calculation of the Overall RF.

If during the evaluation of two different occurrences a certain criterion is scored in the first case as zero (0) and in the second case as 'blank', the ATM overall severity score in both cases should have the same value but the RF should be lower in the second case.

If a score is recorded for a specific criterion, then its RF weight should be added to the overall RF value as follows:

- For the Separation, Rate of closure, Conflict detection, Planning, Ground safety nets (STCA) criteria, which have only ATM Ground component, full RF value should be added if the ATM Ground value is recorded (except for Separation and Rate of closure where the ATM Ground value could be replaced by ATM Airborne).
- For the Execution, Recovery and Airborne Safety Nets (TCAS) criteria, which have both ground and airborne components, half of the RF value should be added if the ATM Ground value is recorded and half of the weight if the ATM Airborne value is recorded.
- For the airborne execution of TCAS RA criterion, which has only an airborne component, full RF value should be added if the ATM airborne is recorded.

The RF should reach a value of 100 when all data for all criteria have been entered.

The Overall RF associated to the occurrence should be calibrated in such a way that the results of the severity assessment should be acceptable if the Overall RF has a minimum value of 70. Whenever there is not enough information (RF < 70) the occurrence should be categorised as

'Not determined' (D), regardless[5] of the severity indicated after application of the methodology.

GM 6 SKPI Severity Classification Based on the Risk Analysis Tool Methodology for Separation Minima Infringements — General description

The process for evaluation of occurrences severity is presented in the following diagram:

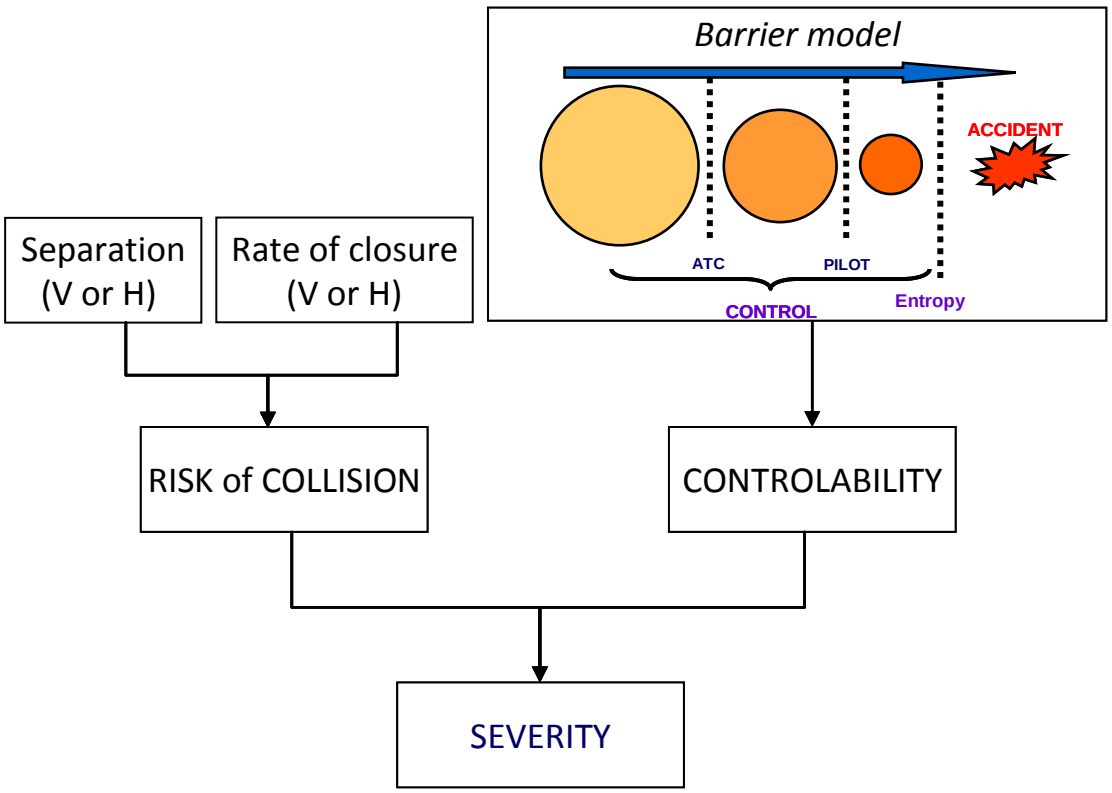


Figure 3 — Visualisation of evaluation of occurrences severity

Distinction between ATM Ground and ATM Overall severity may be made in order to allow ANSPs to identify their own contribution to any occurrence, identify causes and possible mitigation plans and/or corrective actions. In order to be able to fill in all necessary fields for the ATM Overall severity, information not immediately available to ANSPs may be required, such as information on the existence or not of a TCAS RA on the causal factors on the airborne side.

Different occurrences scenarios may be considered when evaluating severity as it is done in EUROCONTROL Risk Analysis Tool (RAT):

[5] It can be contended that if the occurrence has already reached maximum possible severity, any additional data will not change the severity value. However, the occurrence is still recorded as not determined, since it is important to identify any missing data.

Scenario	Description
1. More than one aircraft	When two or more aircraft are involved in the occurrence and a standard separation is defined — usually for incidents with airborne aircraft, e.g. usually involving separation minima infringements.
2. Aircraft — aircraft tower	When the occurrence is an encounter between two aircraft under tower ATC. This includes situations where a) both aircraft are airborne; b) both aircraft are on the ground; c) one aircraft is airborne and one is on the ground. In addition, this should be used for occurrences involving one aircraft and a vehicle that, at the time of occurrence, was occupying/intersecting an active runway.
3. Aircraft with ground Movement	When the occurrence is an encounter between an aircraft and a vehicle (includes towed aircraft). In this situation, the aircraft could be on the ground or it could be airborne.
4. One aircraft	When only one aircraft is involved in the occurrence (e.g. airspace infringement, level bust without involvement of a second aircraft, loss of separation with ground and/or obstacles). This also applies for near-CFIT occurrences.
5. ATM-specific occurrence	To be applied in cases of technical occurrences influencing the capability to provide safe ATM/ANS services.

The following link may be made between the occurrences scenarios as in RAT and the occurrence types referred to in the performance scheme Regulation:

- Separation minima infringements: scenario 1;
- Runway incursions: scenarios 2, 3 and 4;
- ATM-specific occurrences: scenario 5.

GM 7 SKPI Severity Classification Based on the Risk Analysis Tool Methodology — Methodology for Separation Minima Infringements — Risk of Collision — Score Determination

Example: If in a Separation Minima Infringement occurrence:

- the minimum separation achieved was 60 % horizontally and 30 % vertically;
- the rate of closure at separation loss was 160 kts and 3 000 ft/min;
- ATC was providing radar separation,

then:

- ATM Ground is scored 3 for separation (highest value of the two separations, i.e. the value for 60 % horizontally);
- ATM Ground is scored 4 for rate of closure (highest value of the two possible marks, i.e. the value 3 000 ft/min);
- ATM Overall for Risk of collision is 7 with RF 30.

GM 8 SKPI Severity Classification Based on the Risk Analysis Tool Methodology — Methodology for Separation Minima Infringements — Controllability score determination

The score of controllability may be used to facilitate an evaluation of the amount of hazard or entropy. If the situation is controlled, even if separation is lost, it is nevertheless recovered by the ATM system and not by chance. For this step the typical defence barriers as they apply chronologically may be followed.

The ATM Ground elements may be used to evaluate whether and how ATC (ATC means not only the ATCO, but the ATCO supported by ATM system) worked the conflict situation between the aircraft later involved in the actual occurrence. The global picture should be considered and

not only the two aircraft between which separation was lost. In certain cases while trying to work an aircraft pair, ATC could generate an occurrence between another pair. All aircraft relevant to the occurrence under analysis should be considered.

When evaluating the criterion **Ground Safety Nets (STCA)**

- Predictive STCA is meant to be an STCA that triggers an alarm with sufficient time in advance of an infringement of the separation minima allowing air traffic controllers enough time to react;
- Current STCA is meant to be an STCA that triggers at the time when the separation minima starts to be infringed.

When evaluating the criterion **Airborne Safety Nets (TCAS)** it should be noted that this sub-criterion has an ATM Ground element, but the ATM Overall only takes the value of ATM Airborne. The purpose of the ATM Ground element here is to allow evaluating the ATM Ground value as described in GM 8. When ATM Ground is scored 10, the ATM Airborne and ATM Overall for criterion **Airborne Safety Nets (TCAS)** should be scored zero. In such a case, it is quite possible to have ATM Ground with higher score than ATM Overall and when evaluating severity in accordance with the table in GM 8 SKPI this could result in a higher severity for ATM Ground than for ATM Overall. This indicates the higher contribution to the occurrence of the ATM Ground component compared to the ATM Overall.

Example of controllability score determination:

Conflict detected, planning inadequate, execution inadequate by ATC, correct by pilot, STCA not applicable, recovery correct by ATC and pilot, TCAS RA needed but not triggered, pilot response not applicable:

	Conflict detection	Planning	Execution	Ground Safety Nets (STCA)	Recovery	Airborne Safety Nets (TCAS)	Airborne execution of TCAS RA	Total score
Ground	Yes	Inadequate	Inadequate	N/A	Correct	N/A		6
	0	3	3	0	0	0		
Airborne			Correct		Correct	No	N/A	10
			0		0	10	0	
RF	*10*	*10*	*5+5*	*10*	*5+5*	*5+5*	*10*	*70*

ATM Overall Controllability
= Conflict detection + Planning + Execution + Ground Safety Nets (STCA) + Recovery + Airborne Safety Nets (TCAS) + Airborne Execution of TCAS RA
= 0+3+3+0+0+10+0
= 16

GM 9SKPI Severity Classification Based on the Risk Analysis Tool Methodology — Methodology for Separation Minima Infringements — Final scores

Example: Following the score determination in GM 6 and 7 SKPI,

Severity ATM Ground = Risk of collision score Ground + Controllability score Ground = 7 + 6 = 13

Severity ATM Overall = Risk of collision score Overall + Controllability score Overall = 7 + 16 = 23

When evaluating the ATM Ground value only, the table from AMC 7 SKPI, D may be extended as follows:

ATM Ground value	Severity class		ATM Overall value	Severity class
Between 0–9	No safety effect		Between 0–9	No safety effect
Between 10–17	Significant incident		Between 10–17	Significant incident
Between 18–30	Major incident		Between 18–30	Major incident
Higher than 31	Serious incident		Higher than 31	Serious incident

Example:
Severity class ATM Ground for score 13 = Significant incident
Severity class ATM Overall for score 23 = Major incident

GM 10 SKPI Severity Classification Based on the Risk Analysis Tool Methodology — Methodology for Separation Minima Infringements — Reliability Factor

Example: When scoring 'Not Applicable' as in GM 7 for the Airborne Execution of TCAS RA (because there was no TCAS RA in the example provided), the value of the score is 0. Nevertheless, the relevant value of the RF is added to the RF Overall.

Example: In the examples of GM 6 and GM 7 the RF for each criterion is also recorded. The overall RF based on these examples is calculated to be 100, which means that the severity in this example is evaluated with all necessary data available. In this case, and in other cases where the overall RF is calculated to be 70 or more, the resulting severity may be considered as valid.

The same example as in GM 7 may be presented with some data missing (value 'blank') as follows:

	Conflict detection	Planning	Execution	Ground Safety Nets (STCA)	Recovery	Airborne Safety Nets (TCAS)	Airborne execution of TCAS RA	Total score
Ground	No data	Inadequate	Inadequate	N/A	Correct	No data		6
	blank	3	3	0	0	Blank		
Airborne			No data		No data	No data	No data	10
			blank		blank	Blank	blank	
RF	*0*	*10*	*5+0*	*10*	*5+0*	*0+0*	*0*	*30*

In order to evaluate the Overall RF of this example we need to add to the RF of Controllability the RF of Risk of Collision. If we use the value of RF of Risk of Collision as calculated in GM 7 (30), the Overall RF will have a value of 60. Since the Overall RF < 70, the occurrence should be categorised as 'Not determined' (D).

AMC 6 SKPI Severity Classification Based on the Risk Analysis Tool Methodology — Methodology for Runway Incursions

Applying the severity classification methodology for Runway Incursions, the severity should be calculated as the sum of the total scores in each of the two main criteria:

1. Risk of collision;
2. Controllability.

A. Risk of collision

The risk of collision should be determined by the sum of the scores for the following sub-criteria:

1. Separation. When evaluating the severity of runway incursion this criterion should be interpreted as safety margin infringed. The moderation panel/investigators should, based on experts judgment, choose a score between 0 and 10, based on the perceived safety margin achieved. If there is no agreement on the safety margin, then the moderation panel/investigators will not score the criterion at all and the field should be left blank. This should be reflected in the value of the Reliability Factor by not adding the RF weight for the separation criterion.

	Risk of collision	ATM ground	ATM airborne	ATM overall	RF weight
separation	Safety margin achieved	0	0	0 to 10 ATM Ground **OR** ATM airborne	20
	Safety margin infringed minor	1–3	1–3		
	Safety margin infringed medium	4–6	4–6		
	Safety margin infringed significant	7–9	7–9		
	Safety margin infringed critical	10	10		

2. Rate of closure — based on the vertical and horizontal speed, measured at the moment the safety margin is considered to have been lost. The greatest of the predefined intervals for each of the horizontal and vertical speeds are to be considered for the evaluation.

Depending on the situation, speed intervals should be applied as follows:

- More than one aircraft — no standard separation defined,
- Aircraft with ground movement.

In cases of unauthorised entry on the runway when no other aircraft/vehicle/person was present, the rate of closure should be 'NONE'.

	More than one aircraft — no standard separation defined	Aircraft with ground movement	ATM ground	ATM airborne	ATM overall	RF weight
rate of closure	Rate of closure NONE	Rate of closure NONE	0	0	0 to 5 ATM Ground **OR** ATM airborne	10
	Rate of closure LOW (<= 50 knots, <= 500 ft/mn)	Rate of closure LOW (<= 20 knots)	1	1		
	Rate of closure MEDIUM (>50 and <= 100 knots, > 500 and <= 1 000 ft/mn)	Rate of closure MEDIUM (>20 and <= 40 knots)	2	2		
	Rate of closure HIGH (>100 and <= 250 knots, > 1 000 and <= 2 000 ft/mn)	Rate of closure HIGH (>40 and <= 80 knots)	4	4		
	Rate of closure VERY HIGH (>250 knots,	Rate of closure VERY HIGH	5	5		

	> 2 000 ft/mn)	(>80 knots)				

For the risk of collision, *either* ATM Ground *or* ATM Airborne severity should be scored and not both ATM Ground and ATM Airborne. The ATM Airborne severity should be used only in cases where ATC is not responsible for providing separation.

B. Controllability

The scoring for controllability should follow the same logic as in AMC 5 section B, with only a few exceptions, as follows:

- STCA is not appropriate for this encounter, hence it should be replaced by more general aerodrome ground safety nets, such as RIMCAS (Runway Incursion Monitoring and Collision Avoidance System);
- Airborne Safety Nets (TCAS) is not normally available when Runway Incursions occur, therefore only pilot see-and-avoid action should be considered. Lack of see-and-avoid should be scored in the case of low visibility and IMC conditions.
- All other sections are identical with the previous scenario, with the exception of the Safety Nets where A-SMGCS (Advanced Surface Movement Guidance & Control System) or RIMCAS should be considered, and the see-and-avoid part where driver action should also be taken into account, alongside that of the pilot.

The controllability score should be defined by the following aspects:

1. Conflict detection,
2. Planning,
3. Execution,
4. General ground safety nets, e.g. A-SMGCS,
5. Recovery,
6. Airborne Safety Nets (see-and-avoid),
7. Pilot/driver execution of see-and-avoid.

The controllability scoring should be identical in all aspects with section B of AMC 5 SKPI.

C. Final scores

The final scoring should be identical in all aspects with section C of AMC 5 SKPI.

D. Reliability Factor

The Reliability Factor evaluation should be identical to the description in section D of AMC 5 SKPI.

AMC 7 SKPI Severity Classification Based on the Risk Analysis Tool Methodology — Methodology for ATM-specific occurrences

A. Overview

The ATM-specific occurrences severity evaluation should be based on a combination of criteria. For each criterion a number of options should be available.

The combination of the chosen options for each criterion should provide the severity of an ATM-specific occurrence.

The following criteria should be considered when determining the severity of an ATM-specific occurrence:

1. Service affected,
2. Service/Function provided,
3. Operational function,
4. Type of failure,
5. Extension,
6. Scope,
7. Duration.

B. Options for ATM-specific occurrences

The following options should be considered when evaluating each criterion in AMC 7 SKPI section A:

1. Criterion 'Service affected' — the effect of the system failure should be assigned to one of the following services:
    a. (Upper) Area Control Centre — ATC service for controlled flights in a block of airspace;
    b. Approach Control — ATC service for arriving or departing controlled flights;
    c. Aerodrome Control — ATC service for aerodrome traffic;
    d. Oceanic Control — ATC service for controlled flights over the high seas;
    e. Flight Information Service — service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.
2. Criterion 'Service/Function provided' — the following options should be available for the Service/Function criterion:
    a. Communication — aeronautical fixed and mobile services to enable ground-to-ground, air-to-ground communications for ATC purposes;
    b. Navigation — those facilities and services that provide aircraft with positioning and timing information;
    c. Surveillance — those facilities and services used to determine the respective positions of aircraft to allow safe separation;
    d. Air Traffic Services — the various flight information services, alerting services, air traffic advisory services and ATC services (area, approach and aerodrome control services);
    e. Airspace management — a planning function with the primary objective of maximising the utilisation of available airspace by dynamic time-sharing and, at times, the segregation of airspace among various categories of airspace users on the basis of short-term needs;
    f. Air Traffic Flow and Capacity Management — the air traffic flow management is a function established with the objective of contributing to a safe, orderly and expeditious flow of air traffic by ensuring that ATC capacity is utilised to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate air traffic service providers.
    g. Information Service — a service established within the defined area of coverage responsible for the provision of aeronautical information and data necessary for the safety, regularity and efficiency of air navigation;
3. Criterion 'Operational function' — the selected option for the criterion 'Service/Function provided' should be considered when selecting the option for the criterion 'Operational function'. The following options should be available:

a. For Communication services:

- Air/Ground Communication — two-way communication between aircraft and stations or locations on the surface of the earth;
- Ground/Ground Communication — two-way communication between stations or locations on the surface of the earth.

b. For Navigation service:

- Navigation Function.

c. For Surveillance service:

- Air Surveillance — those facilities and services used to determine the respective positions of aircraft in the air to ensure safe separation;
- Ground Surveillance — those facilities and services used to determine the respective positions of aircraft on the ground to allow the detection of conflicts;
- Surface Movement Guidance and Control — a function providing routing, guidance and surveillance for the control of aircraft and vehicles in order to maintain the declared surface movement rate under all weather conditions within the aerodrome visibility operational level while maintaining the required level of safety.

d. For Air Traffic Services:

- Flight Plan Information — specified information provided to air traffic service units, relative to an intended flight or portion of a flight of an aircraft;
- Flight Information and Alert — provision of Flight Information (e.g. last position) in support to alerting services;
- Ops Room Management Capability — the functions which enables to combine/split sectors, assign roles on controllers working position;
- Decision Making Support Tools — such as Medium Term Conflict Detection, Arrival/Departure Manager, Collaborative Decision Making;
- Safety Nets — a (ground-based) safety net is a functionality within the ATM system that is assigned by the ANSP with the sole purpose of monitoring the environment of operations in order to provide timely alerts of an increased risk to flight safety which may include resolution advice.

e. For Airspace Management:

- Real Time Airspace Environment — the display on the executive air traffic controller Controllers Working Position of the entire airspace configuration at a given time (e.g. restricted/danger areas).

f. For Air Traffic Flow and Capacity Management:

- Tactical & Real Time — the function that provides traffic prediction, flow monitoring and warning.

g. For Support Information Services:

- Aeronautical Information — provision of aeronautical information and data necessary for the safety, regularity and efficiency of air navigation;
- Meteorological Information — meteorological report, analysis, forecast and any other statement relating to existing or expected meteorological conditions.

4. Criterion 'Type of failure' — the following options should be available for the 'Type of failure' criterion:

a. Total loss of service/function — the service/function is not available to the controller or pilot;

b. Partial loss of service/function — not all of the service/function is available to ATC or pilot (e.g. loss of one or several sub-functions);

c. Redundancy reduction — loss of a technical backup. There are fewer technical ways to provide the service/function;

d. Undetected corruption of service/function — data presented is incorrect but is not detected and used as being correct — if the corruption is detected it means the function will have to be removed totally (total loss of function) or partially (partial loss of function);

e. Loss of supervision — unable to control or monitor the function. If this means that the main function has to be removed, then this would be a total loss;

f. Corruption of supervision — undetected corruption of supervision. It has no impact unless a second action takes place. If left alone there will be no impact. If an operator does something in response to an incorrect indication then a different type of failure could occur.

5. Criterion 'Extension' — the physical extension of the failure should be categorised as one of the following options:

   a. Controller Working Position — one Controller Working Position (CWP);

   b. Sector suite — a set of CWPs which work together to control a sector(s);

   c. Multiple suites — self-explanatory;

   d. Unit — as applicable, the entire ACC/UAC/APP operations room, the whole Tower, etc.

6. Criterion 'Scope' — the operational scope of the effect should be classified as one of the following options:

   a. One — one frequency, one aircraft as applicable;

   b. Some — as applicable more than one frequency, more than one a/c, etc., and less than all;

   c. All — all frequencies, all aircraft as applicable.

7. Criterion 'Duration' — T1 is the time interval between the initiation of the technical event and the moment when it triggers actual or potential operational consequences either for the air traffic controller (ATCO) or the pilot.

   a. Duration less than T1 — this option should be chosen when the technical failure did not last long enough to trigger actual or potential operational consequences on the air traffic controller or the pilot. In such a case the severity of the ATM-specific occurrence should have no impact on the safe provision of air traffic services and should be classified with severity E. Consequently, there is no need for the user to further apply the RAT methodology for this technical failure (just record the severity E);

   b. Duration greater than or equal to T1 — this option should be selected when the technical failure lasted longer than or equally to T1 and triggered actual or potential operational consequences on the air traffic controller or the pilot.

C. Severity

The severity of ATM-specific occurrences should be classified as follows:

1. AA — Total inability to provide safe ATM services (equivalent to 'Serious incident') — an occurrence associated with the total inability to provide any degree of ATM services, where:

a. there is a sudden and non-managed total loss of ATM service or situation awareness;

b. there is a totally corrupted ATM service or corrupted information provided to ATS personnel.

2. A — Serious inability to provide safe ATM services (also equivalent to 'Serious incident') — an occurrence associated with almost a total and sudden inability to provide any degree of ATM services in compliance with applicable safety 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.

3. B — Partial inability to provide safe ATM services (equivalent to 'Major incident') — an occurrence associated with the sudden and partial inability to provide ATM services in compliance with applicable safety requirements.

4. C — Ability to provide safe but degraded ATM services (equivalent to 'Significant incident') — 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 requirements, even if this implied limitations in the provision of ATM services.

5. D — Not determined — insufficient information was available to determine the risk involved or inconclusive or conflicting evidence precluded such determination.

6. E — No effect on ATM services — occurrences which have no effect on the ability to provide safe and non-degraded ATM services (equivalent to 'No safety effect').

The severity on an ATM-specific occurrence should be established, based on the combination of options chosen for each criterion.

GM 11 SKPI Severity Classification Based on the Risk Analysis Tool Methodology — Methodology for ATM-specific occurrences

A. Examples of some criteria for evaluating ATM-specific occurrences

Criterion 'Type of failure'

The following figure illustrates Total Loss and Redundancy Reduction in Air-Ground Communication.

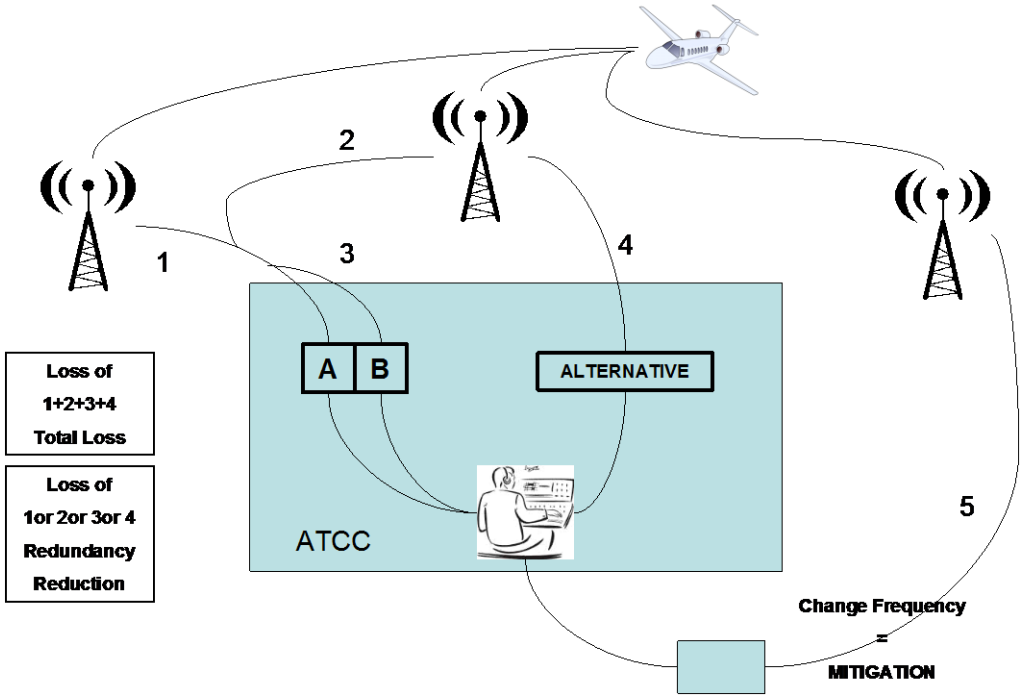


Figure 4 — Total Loss and Redundancy Reduction in air-ground communication

Criterion 'Extension'

The figure bellow illustrates an ATC unit with several sector suites, each of which consists of 3 Controllers Working Positions (CWP):

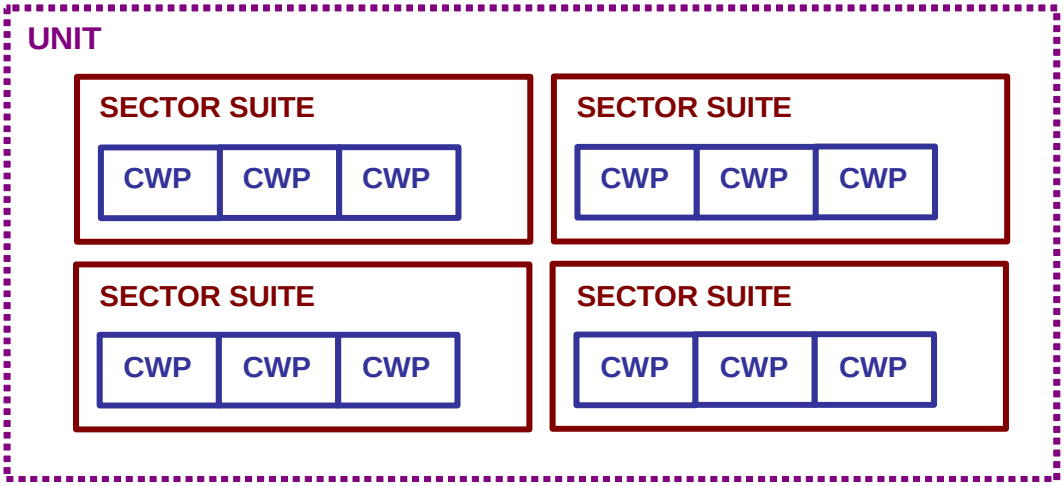


Figure 5 — ATC unit, sectors and suites

Criterion 'Scope'

The table below gives an indication of what one/some/all represents for different operational functions (criterion 'Scope').

Services	Operational functions	Scope (how many … were impacted)
Communication	Air/Ground Communication	Communication(s) ATCO/Pilot
Communication	Ground/Ground Communication	Communication(s) ATCO/ATCO
Navigation	Navigation	Pilot(s)
Surveillance	Air Surveillance	Displayed Radar Track(s)
Surveillance	Ground Surveillance	Displayed Radar Track(s)
Surveillance	Surface Movement Guidance & Control	Aircraft(s)/Vehicle(s)
Air Traffic Services	Flight Plan Information	Flight Plan(s)
Air Traffic Services	Flight Information & Alert	Flight(s)
Air Traffic Services	Ops Room Management	N/A (extension should be sufficient)
Air Traffic Services	Decision Making Support	Fight(s)
Air Traffic Services	Safety Nets	Conflict(s)
Air Traffic Services	Real Time Airspace Environment	Route(s), Area(s), …
Air Traffic Flow Capacity Management	Tactical & Real Time	Flight(s)
Information Services	Aeronautical Information	Information Type(s)
Information Services	Meteorological Information	Information Type(s)

Criterion 'Duration'

When criterion 'Duration' is evaluated, T1 should be used for separating technical glitches with no operational consequences from failures that impact the ANSP's ability to provide safe ATM services.

Some of the values of T1 may be predefined, for example when they are part of the SLA between the technical and operational units (departments) or when they are part of the ATS unit safety case. When the value of T1 is predefined by the ANSP, it should be done based on inputs provided by the ATCOs and/or pilots. Alternatively, if a T1 is not predefined at the moment of the investigation, the evaluation of the 'duration' criterion may be done by determining if a particular occurrence/failure triggered actual or potential operational consequences (the criterion should be scored greater than or equal to T1).

This value cannot be established at European level as it is dependent on the functionalities of the ATM provider's system architecture, airspace complexity, traffic load and concept of operations. When choosing the option 'less than T1' or 'greater than or equal to T1' there is no need to know exactly the duration of the event but whether it has a potential or real operational impact, i.e. is greater, or not, than the T1 value established locally.

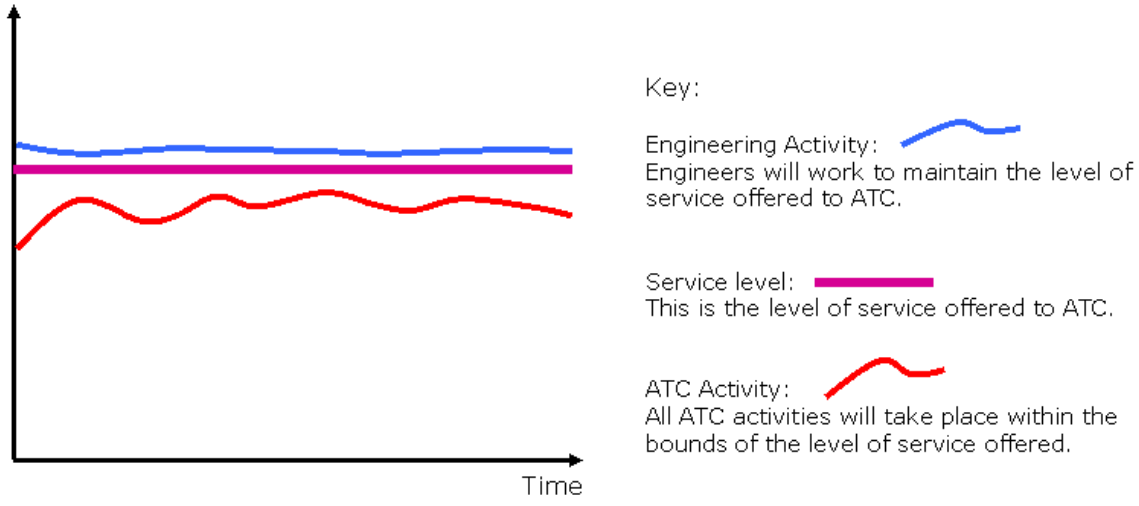
Typical examples of operational impact where 'Duration' is greater than or equal to T1:

- ATC/Pilot had to do something different;
- ATC/Pilot is presented with incorrect, reduced or no information;
- Workload increase;
- Capacity reduction;
- Reduced ability to provide safe services;
- ATCO can no longer cope with the situation.

The charts below illustrate the ATM system both in a steady state and failure modes, in order to ease the understanding of the role of T1.

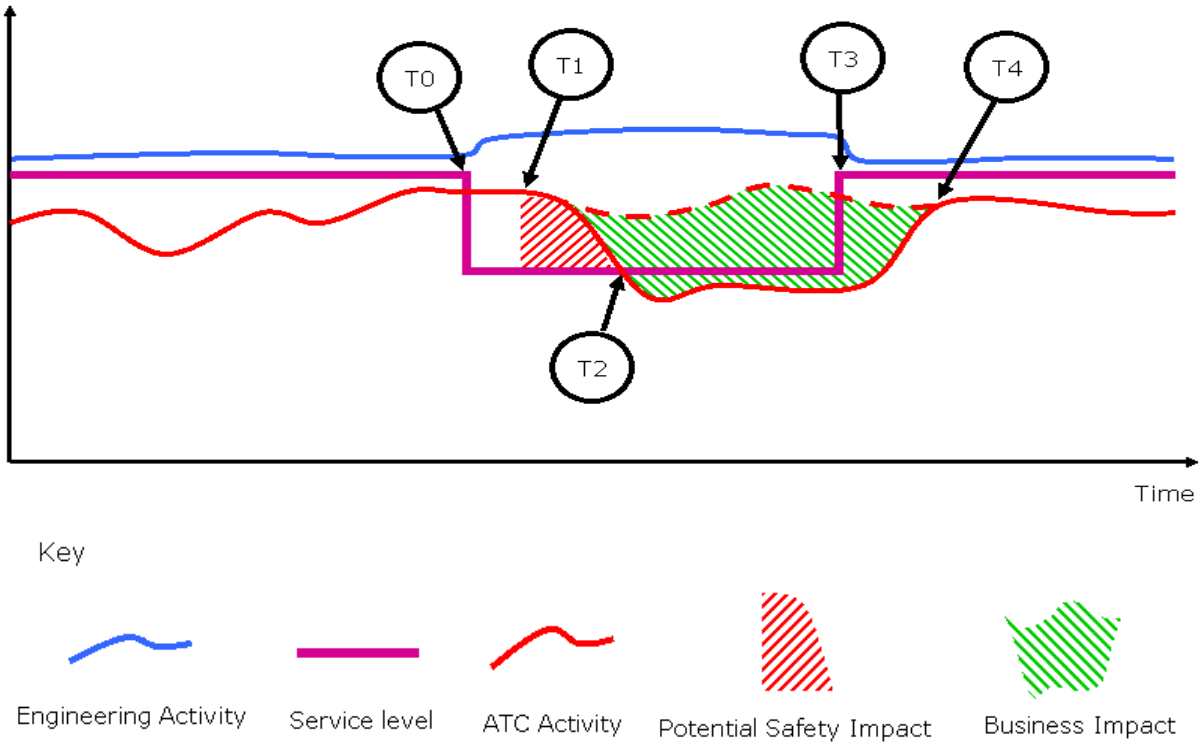
- <u>Steady state of the technical system (no failure)</u>

  The chart below illustrates a steady state where the ATM system delivers all operational functions as expected.



- <u>ATM-specific technical event with a potential or real operational impact</u>

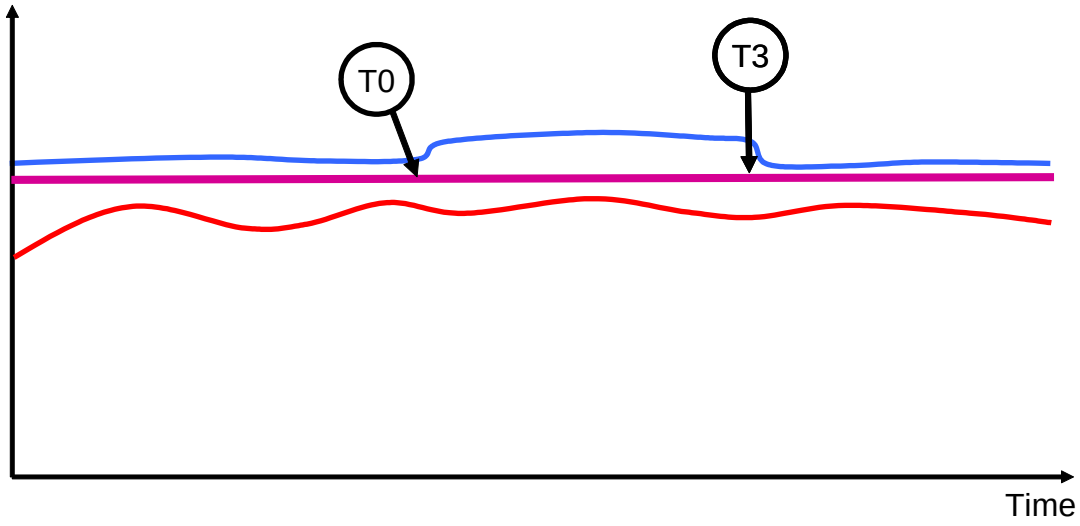
  The chart below provides the occurrence timeline in case of a total failure of an operational function. In the given example the failure has an operational impact on the ability to provide ATM services (this could be the case in a total failure of the air-ground communication function, total failure of surveillance function; see examples 1 and 3 below).



T0	ATM-specific technical event commences.
T0 to T1	ATM-specific technical event has no operational impact as the ATC maintain desired traffic level.
T1	ATM-specific technical event triggers operational consequences on ATC controller or pilot.
T1 to T2	Potential safety impact on ATC or pilot.
T3	The ATM-specific technical event finishes.
T1 to T4	Business effect on ATC or Pilot, e.g. regulations applied.
T4	ATC returns to the desired traffic levels.

- <u>Redundancy reduction</u>

The chart below illustrates the occurrence timeline in the case of a redundancy reduction with no operational impact (duration is less than T1). This case could be applied in the Example 2 from section C, the failure on day D.



T0	ATM-specific technical event commences.
T1	Does not take place.
T2	Does not take place.
T0 to T3	ATM-specific technical event has no impact. ATC maintain desired traffic level.
T3	ATM-specific technical event finishes.
T4	Does not take place.

B. Look-up table

Following the selection of criteria options described in this AMC 9 SKPI, the severity for an ATM-specific occurrence may be determined by identifying the appropriate combination in the look-up table presented in Appendix 1 to GM 11 SKPI — Look-up Table for Severity Classification of ATM-specific occurrences and retrieve the predetermined severity in column 'Severity'.

The look-up table contains all the realistic combination of the criteria described in this GM. An occurrence code is uniquely assigned to each combination.

It is to be noted that in case of combination of criteria that are not realistic the severity is marked 'X' in the look-up table. In such case the severity cannot be determined (category D). Therefore, the user should try to map a given failure to the credible combination available in the look-up table.

A severity is predefined for each of the identified realistic combinations. A sample of a section of this look-up table is given below:

Code	Service Affected	Services	Operational functions	Type of Failure	Extension	Scope	uratio	T1	Severity
AR-AGC/000	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	Unit	All	> T1		AA
AR-AGC/001	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	Unit	Some	> T1		AA
AR-AGC/002	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	Unit	One	> T1		A
AR-AGC/010	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	Multiple Suites	All	> T1		AA
AR-AGC/011	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	Multiple Suites	Some	> T1		A
AR-AGC/012	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	Multiple Suites	One	> T1		A
AR-AGC/020	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	Sector Suite	All	> T1		X
AR-AGC/021	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	Sector Suite	Some	> T1		X
AR-AGC/022	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	Sector Suite	One	> T1		B
AR-AGC/030	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	CWP	All	> T1		X
AR-AGC/031	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	CWP	Some	> T1		B
AR-AGC/032	Area control services	Communication	Air/Ground Communication	Undetected Corruption of function	CWP	One	> T1		B
AR-AGC/100	Area control services	Communication	Air/Ground Communication	Total Loss of function	Unit	All	> T1		AA
AR-AGC/101	Area control services	Communication	Air/Ground Communication	Total Loss of function	Unit	Some	> T1		AA
AR-AGC/102	Area control services	Communication	Air/Ground Communication	Total Loss of function	Unit	One	> T1		A
AR-AGC/110	Area control services	Communication	Air/Ground Communication	Total Loss of function	Multiple Suites	All	> T1		AA
AR-AGC/111	Area control services	Communication	Air/Ground Communication	Total Loss of function	Multiple Suites	Some	> T1		A
AR-AGC/112	Area control services	Communication	Air/Ground Communication	Total Loss of function	Multiple Suites	One	> T1		A
AR-AGC/120	Area control services	Communication	Air/Ground Communication	Total Loss of function	Sector Suite	All	> T1		A
AR-AGC/121	Area control services	Communication	Air/Ground Communication	Total Loss of function	Sector Suite	Some	> T1		A
AR-AGC/122	Area control services	Communication	Air/Ground Communication	Total Loss of function	Sector Suite	One	> T1		A
AR-AGC/130	Area control services	Communication	Air/Ground Communication	Total Loss of function	CWP	All	> T1		B
AR-AGC/131	Area control services	Communication	Air/Ground Communication	Total Loss of function	CWP	Some	> T1		B
AR-AGC/132	Area control services	Communication	Air/Ground Communication	Total Loss of function	CWP	One	> T1		B
AR-AGC/200	Area control services	Communication	Air/Ground Communication	Partial Loss of function	Unit	All	> T1		C
AR-AGC/201	Area control services	Communication	Air/Ground Communication	Partial Loss of function	Unit	Some	> T1		C
AR-AGC/202	Area control services	Communication	Air/Ground Communication	Partial Loss of function	Unit	One	> T1		C

Figure 6 — Extract of look-up table in Appendix 1 to GM 10 SKPI

C. Examples for ATM-specific occurrences

Example 1

All communications with aircraft were lost in the sector South in the ACC X. The failure lasted 1 min 12 sec.

The service provided was 'Communication'. As the communication was lost with the aircraft, the operational function affected is 'Air-Ground Communication'.

No communication with the aircraft in the sector was possible during that time; therefore the type of failure is 'Total loss of function'. Service affected is 'Area Control Centre'. The sector

South was only ACC sector affected by the failure. As such, the extension is 'Sector Suite'. In this case the communication with all aircraft in the sector was lost and therefore the scope is 'All'.

In the ACC x, the T1 is predefined for Total loss of Air-Ground communication function as being T1 = 20 seconds.

As the total duration of failure is 1 min 12 sec, the duration is higher than T1 and therefore the RAT look-up table may be used.

For these selected options the corresponding combination in the look-up table is:

Code	Service Affected	Services	Operational functions	Type of failure	Extension	Scope	Duration	T1	Severity
AR-AGC/120	Area control services	Communication	Air/Ground communication	Total loss of function	Sector suite	All	> T1	~20s	A

Therefore, the Severity for the failure in Example 1 is 'A — Serious inability to provide safe ATM services'.

Example 2

Due to telecom failure there is loss of redundancy of some frequencies affecting several sectors in APP Z. There were two such occurrences at APP Z: one on day D which lasted 5 minutes and the other on day D+2 which lasted two hours.

The service provided was 'Communication'. As the redundancy is for radio communication with the aircraft, the operational function affected is 'Air-Ground Communication'.

The type of failure is 'Redundancy reduction' and affects several sectors and several frequencies; therefore, the extension is 'Multiple Suites' and scope 'Some'.

In the APP Z, the local procedure requires that in case of loss of back-up frequencies (i.e. redundancies), capacity limitations are put in place after 30 minutes, which is our T1.

Therefore, duration of the failure on day D is less than T1 and the severity is directly classified as 'E — No effect on ATM services' and there is no need to use the look-up table.

For the failure on day D+2 the duration is greater than or equal to T1 and therefore the look-up table might be used and the corresponding combination is:

Code	Service Affected	Services	Operational functions	Type of failure	Extension	Scope	Duration	T1	Severity
AR-AGC/120	Area control services	Communication	Air/Ground communication	Total loss of function	Sector suite	All	> T1	~20s	A

Therefore the Severity for the failure in Example 2 on day D+2 is 'C — Ability to provide safe but degraded ATM services'.

Example 3

Total failure of the radar data processing system (normal and back-up) in an ACC (duration 2 minutes).

Service affected = Area control services

The service is 'Surveillance' and the operational function is 'Air Surveillance in the Area control services'. It is a total loss of function which extends to the whole unit and affects all targets.

For the combination above the T1 is set to ~ 40s, therefore Duration is > T1 and therefore the look-up table might be used and the corresponding combination is:

Code	Service affected	Services	Operational functions	Type of failure	Extension	Scope	Duration	T1	Severity
AP-AGC/311	Approach control services	Communi-cation	Air/Ground communi-cation	Redundancy reduction	Multiple suites	Some	> T1	1800 s	C

Therefore the Severity for the failure in Example 3 is 'A — Serious inability to provide safe ATM services'.

AMC 8 SKPI RAT methodology — Monitoring mechanism

The Member States' points of contact established in accordance with Directive 2003/42/EC and Commission Regulation (EC) No 1330/2007, should collect verified information regarding the application of severity classification using the Risk Analysis Tool (RAT) methodology for the reported occurrences within the scope of the performance scheme Regulation.

When the Member States report on the monitoring of the performance plans and targets in accordance with the performance scheme Regulation they should report the percentage of occurrences that been evaluated by the use of the severity classification using the RAT methodology.

For the application of the severity classification on an individual basis for all occurrences within the scope of the regulation Member States should provide the data by making use of existing safety data reporting mechanisms, that is, either the European Central Repository and/or the Annual Summary Template Mechanism, with enhancements where needed.

IV Just culture

GM 12 SKPI Just culture — General

The Just Culture KPI aims at measuring the level of presence and corresponding level of absence of just culture at State and at ANSP level. The metrics have been constructed to respond to the criteria of: clearly defined, auditable, verifiable, repeatable and indicative of the level of just culture being implemented. The just culture KPI consists of metrics in the areas of policy and its implementation, legal/judiciary and occurrence reporting and investigation.

The main aim of the indicator and of the questionnaires is to identify possible obstacles and impediments to the application of the just culture (JC).

Reference is made to the 'State level' instead of 'NSA level' because, although a large number of questions refer to the existing situation in the national authority, a limited number of others deal with elements which go beyond the field of competence of the authority and may have to be addressed at the level of other State entities.

The questionnaires identify several elements related to an effective just culture, each element in turn with a number of sub-elements. These sub-elements are binary, i.e. the answer can only be 'yes' or 'no'. The States and ANSPs may qualify the 'no' answers in their respective

completed questionnaire (column 'Justification and remarks') by indicating the related obstacles.

A positive reply gives an indication of a just culture context while a negative reply indicates a potential deficit/obstacles in just culture implementation. However, it is not expected that all replies should be positive but the identification of negative elements would give indication of possible areas of improvement and could be considered as incentives for improving the just culture in a particular State/organisation. State/ANSP may be asked to provide evidence for justification of the answers supported by written documents such as arrangements, procedures, correspondence or other documents.

AMC 9 SKPI Just culture — Reporting at State level

A. Reporting

The just culture indicator should be reported by verified responses to a questionnaire at State level. The questionnaire which should be answered by the Member State/competent authority is indicated in Appendix 1 to AMC 9 SKPI — Just Culture Questionnaire — State level (questions P.1 to P.9, L.1 to L.7, and O.1 to O.2). The questions should be answered with 'yes' or 'no'. For each question, the State should provide information and evidence to justify the answers and may add any applicable explanatory remarks.

B. Verification

Questionnaires should be dispatched together with those for the Effectiveness of Safety Management (EoSM) indicator following the same verification process.

The verification mechanism for JC measurement should be the same as in AMC 2 SKPI, section C.

GM 13 SKPI Just culture — Reporting and Verification at State level

Some examples of the possible justification material which support the verification of completed JC questionnaire at State level are provided in Appendix 1 to GM 13 SKPI — Just Culture — State level — possible evidence. This appendix consists of the State-level JC questions with an additional column providing possible evidence and some explanatory notes where considered necessary.

In addition to the filled-in questionnaire, the State may report on the just culture indicator using the following format, including an indication of possible areas for improvement.

No of questions answered with:	**Yes**	**No**
Policy and its implementation		
Legal/Judiciary		
Occurrence reporting and investigation		
Identification of possible areas of improvement		
Policy and its implementation		
… …		
Legal/Judiciary		
… …		
Occurrence reporting and investigation		
… …		

AMC 10 SKPI Just culture — Reporting at ANSP level

A. Reporting

The just culture indicator should be reported by verified responses to a questionnaire at ANSP level. The questionnaire which should be answered by the Air Navigation Service Providers is indicated in Appendix 1 to AMC 10 SKPI — Just Culture Questionnaire — ANSP level (questions P.1 to P.13, L.1 to L.3, and O.1 to O.8). The questions should be answered with 'yes' or 'no'.

For each question, the ANSP should provide to the NSA information and evidence to justify its answers and may add any applicable explanatory remarks.

B. Verification

Questionnaires should be dispatched together with those for the Effectiveness of Safety Management indicator following the same verification process.

The verification mechanism for JC measurement at ANSP level should be the same as in AMC 3 SKPI, section D.

GM14 SKPI Just culture — Reporting and Verification at ANSP level

Some examples of the possible justification material which support the verification of completed JC questionnaire at ANSP level are provided in Appendix 1 to GM 14 SKPI — Just Culture — ANSP level — possible evidence. This appendix consists of the ANSP level JC questions with an additional column providing possible evidence and some explanatory notes where considered necessary.

In addition to the filled-in questionnaire, the ANSP may report on the just culture indicator using the following presentation format, including a self-assessment of possible areas for improvement.

No of questions answered with:	**Yes**	**No**
Policy and its implementation		
Legal/Judiciary		
Occurrence reporting and investigation		
Identification of possible areas of improvement		
Policy and its implementation		
… …		
Legal/Judiciary		
… …		
Occurrence reporting and investigation		
… …		

GM15 SKPI Interdependencies - evaluation of the impact on safety of the performance plan

Purpose

The purpose of this guidance material is to describe a possible process to be applied when describing consideration of the interdependencies between key performance areas in the performance plan, including an evaluation of the impact on safety in the performance plan when complying with the performance scheme Regulation.

Description of a possible process to be applied when identifying interdependencies and impact on safety

The ATM performance plan includes identifying interdependencies between cost, environment, capacity and safety. The competent authority should be considered as an integral part of the interdependencies because of the competent authorities' responsibilities in relation to certification and oversight. Planned actions to achieve the targets in the performance areas of environment, capacity and cost-efficiency most likely will bring changes in the functional systems, as defined in Commission Implementing Regulation (EU) 1035/2011[6] (common requirements Regulation), of the ANS providers and their competent authorities (NSAs).

The performance scheme Regulation establishes provisions[7] for an evaluation of the impact on safety of the performance plan. This is valid for all entities which contribute to the performance plans, including the competent authorities (NSAs).

All entities contributing to the improvement of the performance at local level should make an analysis of impact on their functional systems by the changes which will be introduced by the improvements in the other performance areas foreseen to be implemented within the reference period. Assessment of the identified changes to the functional systems should be done at the time of performance planning and the relevant possible mitigating actions should be identified. Description of the changes with potential effect on safety and the mitigations identified should be included in the interdependencies analyses of the performance plan.

In instances where changes to functional systems are scheduled for medium to long-term future implementation, safety mitigations for safety assurance should be included in the performance plan as far as practicable. If the assessment of planned changes (e.g. by using Safety scanning) shows no effect on safety they should be referenced in the interdependencies analyses of the performance plan as having no safety impact. However, the Member States may also include a high level description of some changes in the other performance areas which will not affect their functional systems. The process for the assessment of changes and their insertion in the performance plan are provided in the diagram (Figure 7).

When describing the consideration of the interdependencies between safety performance area and the rest of the performance areas in the performance plan, Member States should, at a minimum, include in the performance plan:

- Performance area and the target which' achievement will introduce the change to the functional system;
- Functional systems affected; and
- Description of:
    - affected elements of the functional system and the changes introduced in each of them;
    - general description of planned mitigations and activities for safety assurance and other relevant information.

[6] Article 2 (3) of Commission Implementing Regulation (EU) 1035/2011 - 'functional system' means a combination of systems, procedures and human resources organised to perform a function within the context of ATM.

[7] Article 11, 3 (e) and Annex II, 3.3 of Commission Implementing Regulation (EU) No 390/2013 (performance scheme Regulation).

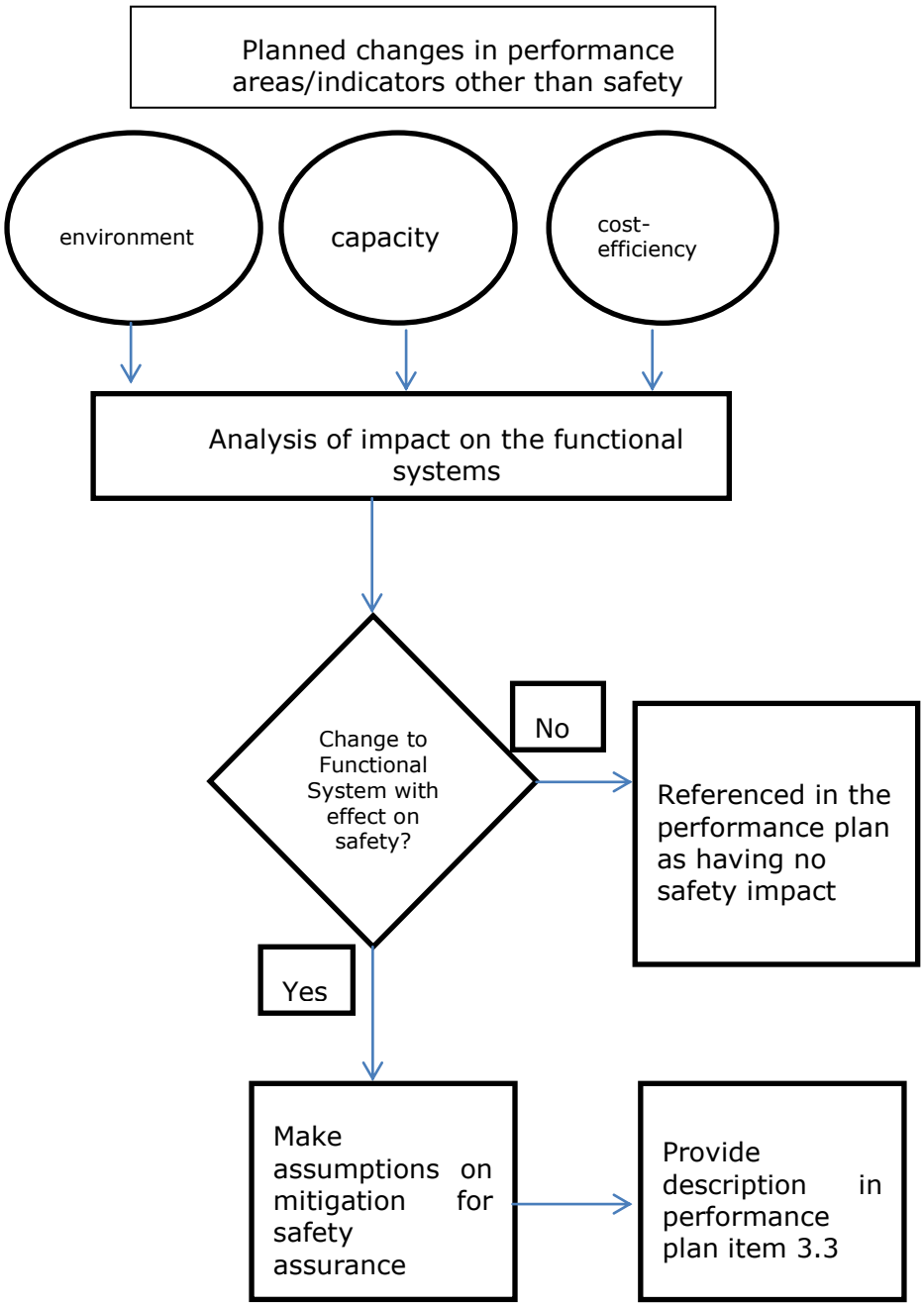


Figure 7 Interdependencies evaluation

Examples of changes that may have an effect on safety and how the relevant interdependencies may be described in the performance plan item 3.3Examples of changes for ANS providers driven by improvement in performance areas which have effect on safety				
Performance area/reason for change	**Functional system affected/ Change description**	**Potential changes to the elements of functional system and possible mitigation measures**		**Remarks**
Cost-efficiency driven change (reduce cost for personnel)	ANSP xxx, ACCs yyy, zzz etc. Removal of assistant position (tasks go to ATCO and/or automation)	Human resources	Reduction in operational personnel; ATCO additional training for new role; Training for technical personnel.	The change is planned for the beginning of 2019 and will support achieving the cost-efficiency target by reducing the unit rate with 1.06 %. In order for the ATCO to take over the role of the assistant then, it is likely that the information used by the assistant will have to be presented to the ATCO. Moreover, in order to avoid overload, the information used by the assistant and the information used by the ATCO will have to be presented in a different, more user friendly, form. It may also be necessary to provide additional automation to perform some assistant's tasks. This certainly implies changes to the equipment at the ATCO's working position and very probably implies changes to the functions providing information to those working positions.
		Procedures	Change to operational and maintenance procedures.	
		Systems	Change to operator interface likely change to functions for the manipulation and visibility of surveillance and flight data information and management; Possibly the addition of new flight lists in CWP of planning and executive controllers.	
		Architecture	Removal of assistant position and likely changes to the way information is managed and distributed within the system; Redistribution of function/ responsibility between	

			human – automation.	
		Environment	Possible change to sector shape/organisation to limit ATCO workload	
Capacity driven change - increase in traffic in airspace	ANSP A and B Change the organisation of the upper airspace and introduction of new technology	Human resources	Training for new procedures, airspace organisation and equipment; Possible increase in personnel ; Working hours/shift patterns (fatigue and the associated increased risk of human errors)	The change is a deliberate attempt by the provider of ATS to increase the capacity as indicated in the performance plan from 2017. Daily and seasonal fluctuations in traffic are not considered to be a change. The change is actually a change in the environment of operation that would require a change in the functional system in order to make the operation acceptably safe. Changes are required to the surveillance or communications systems already present. The changes may involve the operational use of new or modified information that is already within the current system. Such use could involve an architectural change to make the information available to the changed components.
		Procedures	New or changed procedures (including contingency measures) to handle new services and increased traffic; Changes to the ANSP organisation for delivering services	

		System/ constituents	Possibly improved surveillance, communications and/or other systems e.g. ATCO decision support tools; Changes to the display of operational data to controllers at the point of service delivery; Changes to communications systems (architecture etc.) used for the delivery of an ATS service	
		Architecture	Possibly if the surveillance and communications system changes require changes in the interfaces with equipment already present	
		Environment	Increase in traffic; Airspace change	

References

Affected CS, AMC and GM

Decision 2011/017/R of the Executive Director of the European Aviation Safety Agency of 16th December 2011 on acceptable means of compliance and guidance material to Section 2 of Annex I to Commission Regulation (EU) No 691/2010[8] laying down a performance scheme for air navigation services and network functions as amended by Commission Implementing Regulation (EU) No 1216/2011 'Acceptable Means of Compliance and Guidance Material for the implementation and measurement of safety KPIs (ATM performance IR)'.

[8] Commission Regulation (EU) No 691/2010 of 29 July 2010 laying down a performance scheme for air navigation services and network functions and amending Regulation (EC) No 2096/2005 laying down common requirements for the provisions of air navigation services (OJ L 201, 3.8.2010, p. 1). Regulation as last amended by the Commission Implementing Regulation (EU) No 1216/2011 (OJ L 310, 25.11.2011, p. 3).

1. Appendices

The below appendices will appear as separate document to this NPA.

- Appendix 1 to AMC 2 SKPI — Questionnaire for Measurement of Effectiveness of Safety Management KPI — State level
- Appendix 2 to AMC 2 SKPI — List of Weightings for Evaluation of Effectiveness of Safety Management Questionnaire — State level
- Appendix 1 to AMC 3 SKPI — Questionnaire for Measurement of Effectiveness of Safety Management KPI — ANSP level
- Appendix 2 to AMC 3 SKPI — List of Weightings for evaluation of Effectiveness of Safety Management Questionnaire — ANSP level
- Appendix 1 to AMC 9 SKPI — Just Culture Questionnaire — State level
- Appendix 1 to AMC 10 SKPI — Just Culture Questionnaire — ANSP level
- Appendix 1 to GM 4 SKPI — Verification of ANSP EoSM by NSA/competent authority
- Appendix 1 to GM 11 SKPI — Look-up Table for Severity Classification of ATM-specific occurrences
- Appendix 1 to GM 13 SKPI — Just Culture — State level — possible evidence
- Appendix 1 to GM 14 SKPI — Just Culture — ANSP level — possible evidence