Safety assessments for Aerodromes

(PANS-Aerodromes)

ICAO ESAF Workshop on Aerodrome Certification

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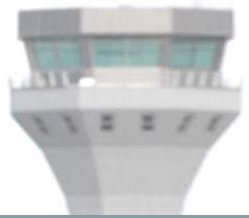
Methodologies and Procedures to be followed when undertaking safety assessments at Aerodromes

PANS –Aerodromes outlines the methodologies and procedures, including a list of topics to be followed when undertaking a safety assessment in the specific domain of aerodromes.

It also includes references to and complements Annex 19 and Doc 9859, *Safety Management Manual (SMM)* which, respectively, provide the high-level safety management responsibilities and processes, and generic safety management guidance



Safety assessments for Aerodromes

1. **Introduction**
2. **Scope and applicability**
3. **Basic considerations**
4. **Safety assessment process**
5. **Approval or acceptance of a safety assessment**
6. **Promulgation of safety information**

Attachment A — **Safety assessment flow chart**
Attachment B — **Safety assessment methodologies for aerodromes**

3.1 INTRODUCTION

3.1.1 A certified aerodrome operator implements an SMS acceptable to the State that as a minimum:

a) identifies safety hazards;
b) ensures that remedial action necessary to maintain safety is implemented;
c) provides for continuous monitoring and regular assessment of the achieved safety; and
d) aims to make continuous improvement to the overall safety of the aerodrome.

Annex 19, standard in 4.1.8 states: *"The SMS of an operator of a certified aerodrome in accordance with Annex 14, Volume I shall be made acceptable to the State responsible for aerodrome certification".*

Note: Where alternative measures , operational procedures and operating restrictions have been developed arising from safety assessments, these should be reviewed periodically to assess their continued validity.

Basic considerations

Safety Assessment - An element of the risk management process of an SMS that is used to assess safety concerns arising from, inter alia, deviations from standards and applicable regulations, identified changes at an aerodrome or when any other safety concerns arise.

Primary Objective of a safety assessment – to assess the impact of a safety concern such as a design change or deviation in operational procedures at an existing aerodrome.

"Safety Assessment" Vs. "Aeronautical study" and "compatibility study"
Aeronautical study - A study of an aeronautical problem to identify possible solutions and select a solution that is acceptable without degrading safety (doc 9774, 9734 Part A).

Compatibility study - A study undertaken by the aerodrome operator to address the impact of introducing an aeroplane type/model new to the aerodrome. A compatibility study may include one or several safety assessments.

Basic considerations (cont'd)

Upon completion of a safety assessment:

State reviews the safety assessment provided by the aerodrome operator and its identified mitigation measures, operational procedures and operating restrictions and is responsible for the subsequent regulatory oversight of their application;

Aerodrome operator responsible for implementing and periodically monitoring the effectiveness of the identified mitigation measures.

Items that may need to be considered when conducting a safety assessment:

- Aerodrome layout
- Types of aircraft intended to operate at the aerodrome
- Traffic density and distribution
- Aerodrome ground services
- Air ground communications
- Type and capabilities of surveillance systems
- Flight instrument procedures and related aerodrome equipment

Items that may need to be considered when conducting a safety assessment (cont'd):

- Complex operational procedures
- Aerodrome technical installation
- Obstacles or hazardous activities at or in the vicinity of the aerodrome
- Planned construction or maintenance;
- Any local or regional MET conditions
- Airspace complexity.

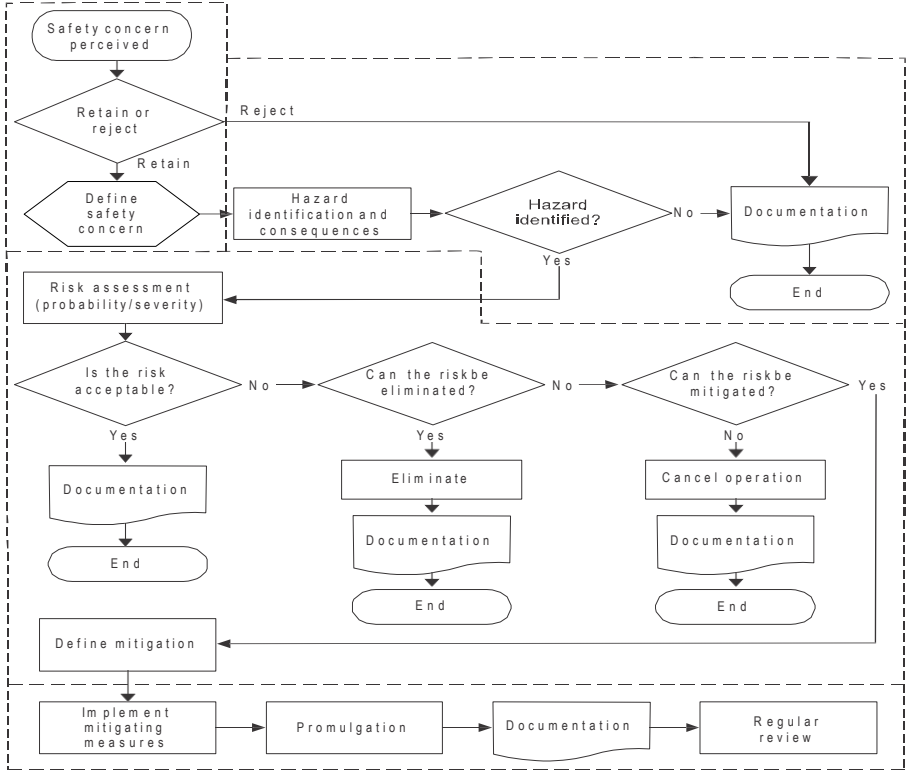
Safety assessment process

Composed of four basic steps:

- Definition of a safety concern and identification of the regulatory compliance;
- Hazard identification and analysis;
- Risk assessment and development of mitigation measures; and
- Development of an implementation plan for the mitigation measures and conclusion of the assessment.

A safety assessment process flow chart applicable for aerodrome operations is available in Attachment A to Chapter 3 of Doc 9981; a generic safety risk management process can be found in Doc 9859.

Attachment A to Chapter 3 – Safety assessment flow chart



Definition of a safety concern and identification of the regulatory compliance

- Any perceived safety concerns are to be described in detail, including timescales, location, stakeholders involved or affected as well as their potential influence on specific processes, procedures, systems and operations.
- Analyze the safety concern to determine whether it is retained or rejected. If rejected, the justification for rejecting the safety concern is to be provided and documented.
- An initial evaluation of compliance with the appropriate provisions in the regulations applicable to the aerodrome is conducted and documented.
- Identify the areas of concern before proceeding with the remaining steps of the safety assessment, with all relevant stakeholders.

Each assessment is specific to a particular safety concern at a given aerodrome.

Hazard identification

Identify Hazards related to infrastructure, systems or operational procedures using methods such as brain-storming sessions, expert opinions, industry knowledge, experience and operational judgment. The identification of hazards is conducted by considering:

a) accident causal factors and critical events based on a simple causal analysis of available accident and incident databases;

b) events that may have occurred in similar circumstances or that are subsequent to the resolution of a similar safety concern; and

c) potential new hazards that may emerge during or after implementation of the planned changes.

Hazard identification (cont'd)

Identify all potential outcomes or consequences for each identified hazard;
Define and detail the appropriate safety objective for each type of hazard.
This can be done through:

a) reference to recognized standards and/or codes of practices;
b) reference to the safety performance of the existing system;
c) reference to the acceptance of a similar system elsewhere; and
d) application of explicit safety risk levels

Safety objectives are specified in either quantitative terms (e.g. identification of a numerical probability) or qualitative terms (e.g. comparison with an existing situation). The selection of the safety objective is made according to the aerodrome operator's policy with respect to safety improvement and is justified for the specific hazard.

Safety risk assessment and development of mitigation measures

- Estimate the level of risk of each identified potential consequence by conducting a risk assessment and determine the severity of a consequence and probability of the consequence occurring.
- Understanding the risks is the basis for the development of mitigation measures, operational procedures and operating restrictions that might be needed to ensure safe aerodrome operations.
- The method for risk evaluation is dependent on the nature of the hazards. **The risk itself is evaluated by combining the two values for severity of its consequences and probability of occurrence.**

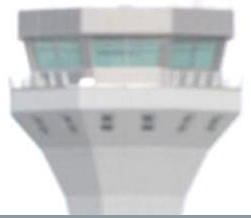
Safety risk assessment and development of mitigation measures (cont'd)

- Once each hazard has been identified, analysed in terms of causes, and assessed for severity and probability of its occurrence, it must be ascertained that all associated risks are appropriately managed.
- All risk mitigation measures, must be evaluated for the effectiveness of their risk management capabilities.
- States should provide suitable guidance on risk assessment models for aerodrome operators.
- Methodologies for risk management can be found in Attachment B to Chapter 3.

Development of an implementation plan and conclusion of the assessment

The last phase of the safety assessment process is the development of a plan for the implementation of the identified mitigation measures.

The implementation plan includes time frames, responsibilities for mitigation measures, as well as control measures that may be defined and implemented to monitor the effectiveness of the mitigation measures.



APPROVAL OR ACCEPTANCE OF A SAFETY ASSESSMENT

The State establishes the type of safety assessments that are subject to approval or acceptance and determines the process used for that approval/acceptance.

Where required, a safety assessment subject to approval or acceptance by the State shall be submitted by the aerodrome operator prior to implementation.

The State analyses the safety assessment and verifies that:

a) appropriate coordination has been performed between the concerned stakeholders;

b) the risks have been properly identified and assessed, based on documented arguments (e.g. physical or Human Factors studies, analysis of previous accidents and incidents);

c) the proposed mitigation measures adequately address the risk; and

d) the time frames for planned implementation are acceptable.

APPROVAL OR ACCEPTANCE OF A SAFETY ASSESSMENT (cont'd)

Upon completion of the analysis of the safety assessment, the State:

a) either gives formal approval or acceptance of the safety assessment to the aerodrome operator; or
b) if some risks have been underestimated or have not been identified, coordinates with the aerodrome operator to reach an agreement on safety acceptance;
c) if no agreement can be reached, rejects the proposal for possible resubmission by the aerodrome operator; or
d) may choose to impose conditional measures to ensure safety.

The State should ensure that the mitigation or conditional measures are properly implemented and that they fulfil their purpose.

PROMULGATION OF SAFETY INFORMATION

The aerodrome operator determines the most appropriate method for communicating safety information to the stakeholders and ensures that all safety-relevant conclusions of the safety assessment are adequately communicated (e.g. through AIP, ATIS (Automatic terminal information service), etc.)

Attachment B to Chapter 3 - SAFETY ASSESSMENT METHODOLOGIES FOR AERODROMES

Depending on the nature of the risk, three methodologies can be used to evaluate whether it is being appropriately managed:

a) **Method type "A".** For certain hazards, the risk assessment strongly depends on specific aeroplane and/or system performance. The risk level is dependent upon aeroplane/system performance (e.g. more accurate navigation capabilities), handling qualities and infrastructure characteristics. Risk assessment, then, can be based on aeroplane/system design and validation, certification, simulation results and accident/incident analysis.

b) **Method type "B".** For other hazards, risk assessment is not really linked with specific aeroplane and/or system performance but can be derived from existing performance measurements. Risk assessment, then, can be based on statistics (e.g. deviations) from existing operations or on accident analysis; development of generic quantitative risk models can be well adapted.

Attachment B to Chapter 3 - SAFETY ASSESSMENT METHODOLOGIES FOR AERODROMES

c) **Method type "C".** In this case, a "risk assessment study" is not needed. A simple logical argument may be sufficient to specify the infrastructure, system or procedure requirements, without waiting for additional material, e.g. certification results for newly announced aeroplanes or using statistics from existing aeroplane operations.

Risk assessment method (Attachment B)

1. The risk assessment takes into account the probability of occurrence of a hazard and the severity of its consequences; the risk is evaluated by combining the two values for severity and probability of occurrence.

2. Each identified hazard must be classified by probability of occurrence and severity of impact. This process of risk classification will allow the aerodrome to determine the level of risk posed by a particular hazard. The classification of probability and severity refers to potential events.

2. The severity classification includes five classes ranging from “catastrophic” (class A) to “not significant” (class E). The examples in Table 3-B-1, adapted from Doc 9859 with aerodrome-specific examples, serve as a guide to better understand the definition.

Risk assessment method (cont'd)

4. The classification of the severity of an event should be based on a "credible case" but not on a "worst case" scenario. A credible case is expected to be possible under reasonable conditions (probable course of events). A worst case may be expected under extreme conditions and combinations of additional and improbable hazards. If worst cases are to be introduced implicitly, it is necessary to estimate appropriate low frequencies.

Attachment A to Chapter 3 – Safety assessment flow chart

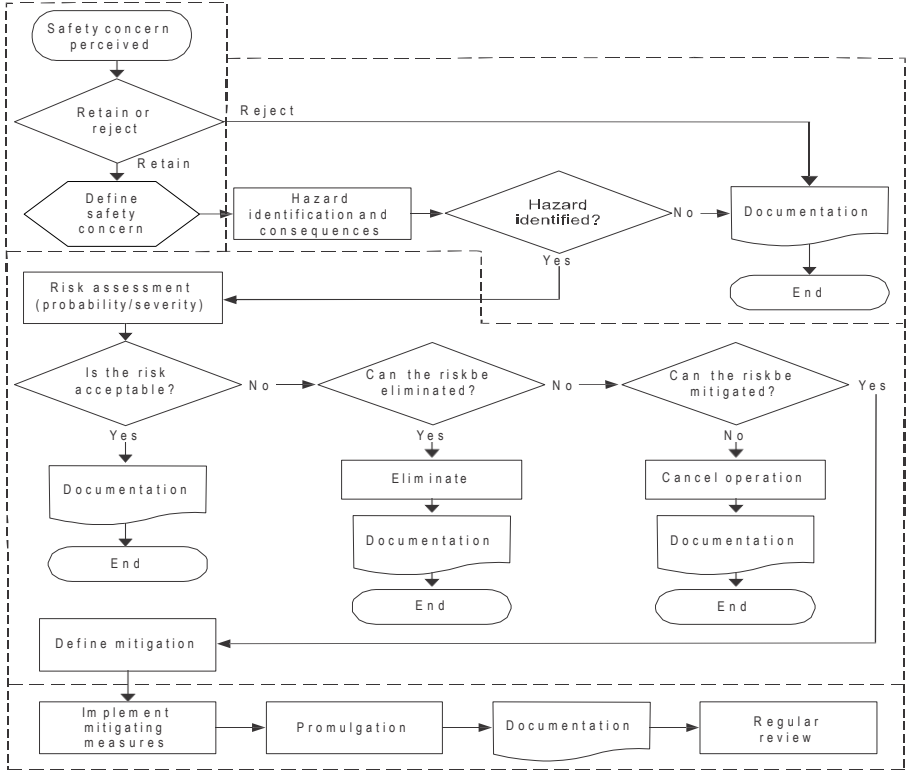


Table I-3-Att B-1. Severity classification scheme with examples

(adapted from Doc 9859 with aerodrome-specific examples)

Severity	*Meaning*	*Value*	*Example*
Catastrophic	– Equipment destroyed – Multiple deaths	A	– collision between aircraft and/or other object during take-off or landing
Hazardous…	– A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely – Serious injury – Major equipment damage	B	– runway incursion, significant potential for an accident, extreme action to avoid collision – attempted take-off or landing on a closed or engaged runway – take-off/landing incidents, such as undershooting or overrunning

… Continues with Major (C) Minor (D) Negligible (E)

Table I-3-Att B-2. Probability classification scheme

Probability class	*Meaning*
5 Frequent	Likely to occur many times (has occurred frequently)
4 Reasonably probable	Likely to occur sometimes (has occurred infrequently)
3 Remote	Unlikely to occur (has occurred rarely)
2 Extremely remote	Very unlikely to occur (not known to have occurred)
1 Extremely improbable	Almost inconceivable that the event will occur

Table I-3-Att B-3. Risk assessment matrix with prioritization classes

Risk probability		*Catastrophic* *A*	*Haza* *rdous* *B*	*Risk severit* *Major* *C*
Frequent	5	5A	5B	5C
Occasional	4	4A	4B	4C
Remote	3	3A	3B	3C
Improbable	2	2A	2B	2C
Extremely Improbable	1	1A	1B	1C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Thank You