SIERRA LEONE CIVIL AVIATION AUTHORITY

ADVISORY CIRCULAR

SLCAA-AC-AGA016-Rev.01

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Guidance on Aeronautical Study and Safety Assessment

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1 GENERAL

The Sierra Leone Civil Aviation Authority's Advisory Circulars contains information about standards, practices and procedures that the Authority has found to be an Acceptable Means of Compliance (AMC) with the associated Regulations.

An AMC is not intended to be the only means of compliance with a Regulation, and consideration will be given to other methods of compliance that may be presented to the Authority

Information considered directive in nature is described in this AC in terms such as "shall" and "must", indicating the actions are mandatory. Guidance information is described in terms such as "should" and "may" indicating the actions are desirable or permissive, but not mandatory.

1.1 Purpose

This AC provides guidance on assessing the impact of a safety concern such as a deviation from the aerodrome standards specified in the SLCAR Part 14 or a design change, and identifying alternative means of ensuring the safety of aircraft operations at an aerodrome.

1.2 Applicability

This AC applies to aerodrome operators, service providers at aerodromes and applicants for an aerodrome certificate in accordance with the SLCAR Part 14C.

1.3 Description of Changes

This is the second AC to be issued on this subject

1.4 References

a) SLCAR's Part 14A - Aerodromes Design and Operations
b) SLCAR's Part 14C - Certification of Aerodromes
c) SLCAA-AC-AGA001-Rev.00 - Certification of Aerodromes
d) SLCAA-AC-AGA017 Rev00 - Safety Management System

1.5 Cancelled Documents

This document repeals and replaces the previous guidance prescribed in **SLCAA-AC-AATNS016 - AERONAUTICAL STUDIES.**

1.6 Definitions

Aeronautical Study: An aeronautical study is a study of an aeronautical problem, to identify possible solutions and select a solution that is acceptable without degrading safety.

Hazard: A condition or an object with the potential to cause or contribute to an aircraft incident or accident.

Safety Risk: The predicted probability and severity of the consequences or outcomes of a hazard.

Safety Risk management: the process that enables the identification, analysis and mitigation of risks identified to an acceptable level.

Routine tasks: can be described as the actions related to an activity or service that are detailed in formal procedures, which are subject to periodic review, and for which the personnel in charge are adequately trained. These tasks may include movement area inspections, grass cutting on runway strips, sweeping of apron areas, regular and minor maintenance of runways, taxiways, visual aids, radio navigation and electrical systems**.**

Safety Assessment: A safety assessment is an element of the risk management process of a Safety Management System (SMS) that is used to assess safety concerns arising from, inter alia, deviations from standards and applicable regulations, identified changes or when any other safety concerns arise.

1.7 Abbreviations

AC	-	Advisory Circular
ALOS	-	Acceptable Level of Safety
ATS	-	Air Traffic Service
FAF	-	Final Approach Fix
NPA	-	Non-Precision Approach
SLCAR's	-	Sierra Leone Civil Aviation Regulations
VSS	-	Visual Segment Surface
VPA	-	Vertical Path Angle

2 INTRODUCTION

A comprehensive aeronautical study allows both the aerodrome operator and the Authority to be convinced that the safety and regularity of operations of aircraft at an aerodrome are not compromised in any way. It is most frequently undertaken during the planning of a new airport or new airport facility, or during the certification of an existing aerodrome or subsequently, when the aerodrome operator applies for an exemption, as a result of development, or a change in the aerodrome's operational conditions from specific Standards contained in the SLCAR's Part 14A.

Aerodrome operators should consult stakeholders and affected parties prior to the conduct of an aeronautical study. These consultations would allow the proposed deviation to be viewed from different perspectives and the different parties involved would be aware of the proposed deviation. The aeronautical study should also be approved by the accountable manager of the organization, before it is submitted to the Authority for consideration or acceptance.

Safety assessment(s) forms part of an operator/service provider's SMS used to assess the impact of implementation, change or removal of any equipment, facility, service, and procedure/process which could give rise to a safety concern, e.g. a design change or deviation in operational procedure. A safety assessment is also used to identify an alternative means of compliance, when the service provider is unable to meet a particular standard.

The SLCAR's part 14C and Part 22, allows in certain cases, for the use of Aeronautical Studies and Safety Assessments as a means to identify alternative means to achieve an equivalent level of safety by means other than full compliance with a specific requirement. However, it is important to note that the preferred option must always be to seek compliance with the standards. In order to achieve an equivalent level of safety by other means, one must implement effective mitigating measures to ensure an ALOS is maintained at all times.

Note - the Authority may choose to participate in the conduct of an aeronautical study as an observer where appropriate.

3 AERONAUTICAL STUDY

3.1 Purpose of an Aeronautical Study

(a) An aeronautical study is conducted to; assess the impact of deviations from the SLCAR's Part 14 and to present alternative means of ensuring the safety of aircraft operations, to estimate the effectiveness of each alternative and to recommend procedures to compensate for the deviation.

An aeronautical study may be undertaken in respect of specific areas (but not limited to); taxiway minimum separation distances, penetration of the obstacle limitation surfaces by existing objects, descend gradients for NPA with FAF, Noise abatement, VSS penetrations, NPA steep angle approaches etc.

(b) An aeronautical study may be used to identify and evaluate aerodrome service options, including service increases or decreases, or the introduction or termination of services (such as the introduction of a rapid exit taxiway or removal of a grass runway). The study can be undertaken in a variety of ways using different analytical methods and various safety management tools that are appropriate to each specific aeronautical study requirement.

(c) An aeronautical study may contain many elements; however, hazard identification, risk assessment, risk mitigation and risk elimination are the key components. The goal of risk management in an aeronautical study is to identify hazards and assess risks, then to take appropriate action to minimize such risk as much as is reasonably practicable to achieve the ALOS, as if the full compliance were in place.

3.2 Applicability of an Aeronautical Study

An aeronautical study should be carried out when aerodrome standards cannot be met. Such a study is most frequently undertaken during the planning of a new airport or during the certification of an existing aerodrome.

The SLCAR's Part 14A and 14B specifically provides for aeronautical studies to be conducted in respect of:

(a) Radio Altimeter Operating Area (SLCAR's Part 14A, section 3.8.3);
(b) Taxiway minimum separation distances (SLCAR's Part 14A, section 3.9.7);
(c) OLS requirements (SLCAR's Part 14A, sections 4.2.4, 4.2.5, 4.2.11, 4.2.12, 4.2.20, 4.2.21, 4.2.27, 4.3.1, 4.3.2, 4.4.2)
(d) Visual Aids for Navigation (SLCAR's Part 14A, sections 5.3.5.23, 5.3.5.40, 5.3.5.40, 5.3.5.46 and 5.4.3.11);
(e) Visual Aids for Denoting Obstacles (SLCAR's Part 14A, sections 6.1.1.4, 6.1.1.6, 6.1.1.7, 6.1.1.9, 6.1.1.10, 6.1.2.2, 6.1.2.3, 6.2.3.28, 6.4.2, 6.2.4.3, 6.2.4.5 and 6.2.5.8);
(f) Heliport safety areas, approach/take-off climb surface, OLS and touchdown position marking (SLCAR's Part 14B sections 3.1.23, 4.2.4, 4.2.5, 4.2.6, 4.2.7, 4.2.10, 5.2.10.3, 5.2.10.4, 5.3.6.25 and 5.3.6.26), and.
(g) Descend gradients for NPA with FAF, Noise abatement, VSS penetrations, NPA steep angle approaches and VPA (ICAO Doc 8168 para 5.2.2.3, 2.3, 5.4.6.4, 1.2 and 4.2.1.3)

Note 1 - The Authority does not encourage the submission of aeronautical studies in cases of deviations from the standards that have not been specifically recommended in the SLCAR's Part 14. However, for existing aerodromes where physical constraints make it impossible for the aerodrome operator to meet the standards and implementation of mitigations is beyond the capability of the aerodrome operator, an aeronautical study should be conducted and submitted to the Authority, to support the request for an exemption from the SLCAR's.

3.3 Objective of an Aeronautical Study

The objectives of an aeronautical study are as follows:

(a) To study the impact of any deviations from the SLCAR's Part 14.
(b) To present alternative solutions to ensure the level of safety remains acceptable;
(c) To estimate the effectiveness of each alternative; and

(d) To recommend operating procedures, restrictions or alternative measures to compensate for the deviation.

3.4 Responsibility for and Participants in an Aeronautical Study

(a) If the aerodrome operator or other service provider cannot meet the requirements, it needs to propose and have accepted an alternative means of compliance or a deviation from the requirement, the burden of justifying an application by means of an Aeronautical Study rests solely with the aerodrome operator or service provider.

(b) An aeronautical study may be initiated by the Authority, an aerodrome operator or another interested party, such as an ATS provider or air operators. Depending on the area and complexity of the issue, aerodrome and flight operational expertise will be needed and in some cases ATS and/or PANS-OPS expertise. It is also recommended that Safety and Risk specialists in risk analysis be brought in to assess the degree of risk resulting from the aeronautical study and to propose acceptable mitigation measures.

(c) Consultation with as wide a range of stakeholders as possible is essential when conducting the aeronautical study. The following may be included as applicable:

(i) Aerodrome operator;
(ii) Aerodrome users;
(iii) Airspace user groups;
(iv) Aircraft operators and operator groups;
(v) Pilot organisations;
(vi) ATS providers; and
(vii) The Sierra Leone Civil Aviation Authority.

3.5 Aspects of the Study

(a) The initial baseline study will be followed by a review of operational issues; this will typically involve an in-depth safety analysis based on quantifiable data where available, and extensive consultation with aerodrome users and stakeholders using various interview and data gathering processes, including a hazard identification workshop. This study may identify any changes that are required to ensure the safe, orderly, and efficient operation of the aerodrome.

(b) The study will normally cover phases such as; requirements definition, design evaluation, introduction to service, and routine operation. The aeronautical study can be presented in parts corresponding to these developing phases as information becomes available, but the Authority can only determine the acceptability of a study when it is complete.

(c) Decisions made in respect of risks must balance the technical aspects of risk with the social and moral considerations that often accompany such issues. These decisions may have a significant impact on an aerodrome's operation. Therefore, for an effective outcome, there should be appropriate involvement, consultation and a level of consensus as to their acceptability among all key stakeholders.

(d) A technical analysis will provide justification for a deviation, on the grounds that an equivalent level of safety can be attained by other means. It is generally applicable in situations where the cost of correcting a problem that violates a standard is excessive

but where the unsafe effects of the problem can be overcome by some procedural means which offers both practical and reasonable solutions. In conducting a technical analysis, the operator should draw upon its own practical experience and specialized knowledge and consult other specialists in relevant areas. When considering alternative procedures in the deviation approval process, it is essential to bear in mind the safety objective of the applicable standards so that the intent of the regulations/standards is not circumvented.

3.6 Example of an Aeronautical Study

(a) Taxiway Minimum separation distances. It may be permissible to operate with lower separation distances at an existing aerodrome, if an aeronautical study indicates that such lower separation distances would not adversely affect the safety or significantly affect the regularity of operations of aeroplane.

(b) Hazard identification and analysis of potential hazards associated with runway and parallel taxiway separation distances are:

(i) risk of collision between an aircraft in flight and an object(fixed or mobile) on the aerodrome;
(ii) risk of collision between an aeroplane leaving the runway and an object on the aerodrome or the risk of collision of an aircraft that runs off the taxiway into the runway strip
(iii) ILS signal interference due to a taxiing or stopped aeroplane.

The first two hazards are potentially catastrophic and the third one is potentially major.

(c) Main causes and accident factor:

i) human factors
ii) weather conditions
iii) aircraft mechanical failure
iv) runway surface conditions
v) lateral veer off distance
vi) aeroplane size and characteristics (wing span)

(d) Risk Assessment and possible mitigation measures;

Collision between an aircraft veering off the runway and an object (fixed or mobile) on the aerodrome. the following options may be considered:

(i) place a restriction on the wingspan of aircraft using the parallel taxiway if continued unrestricted runway operation is desired;
(ii) conduct a local study to determine the impact on ILS signals; and
(iii) in deciding whether to approve unrestricted operations, consider the expected frequency of potentially limiting the operation of new large aircrafts
(iv) A review of present taxi procedures and guidance technologies may be needed. Mitigating measures may require some surface movement restrictions, alternative operational procedures or additional guidance systems.

4 CONTENTS OF AN AERONAUTICAL STUDY

4.1 Overview

(a) The Authority will review submitted studies on a case by case basis and determine their acceptability.

(b) An aeronautical study submitted to the Authority for determination of acceptability should demonstrate that the objectives in section 3.3 above, have been fully met and must contain a recommendation for the acceptance or rejection of the study. The report structure should comprise of the following parts:

(i) Aim of the study;
(ii) Background including system description;
(iii) Hazard identification and safety assessment;
(iv) Recommendations;
(v) Conclusion; and
(vi) Monitoring of the deviation.

4.2 Aim of the Study

(a) The aim of the study should be explicitly stated. It should:

(i) resolve the safety concerns;
(ii) identify safety measures to be put in place to ensure safe aircraft operations in an aerodrome;
(iii) make reference to the specific regulations which the study is meant to address; and
(iv) Indicate how the ALOS will be achieved and maintained.

(b) An example to illustrate this would be as follow:

"The aim of this aeronautical study is to address the operation of (name of aerodrome) with high ground on its north side that infringes the inner horizontal surface and to put in place (list of safety measures) necessary to ensure safe operation of all aircraft at (name of aerodrome) with reference made to (reference to specific regulation)"

4.3 Background

(a) Information on the current situations faced by the aerodrome operator, current procedures that have been put in place and other relevant details should be clearly stated and explained in this sub-section. Clear explanation should be provided, particularly on the following:

(i) What is the current situation? i.e. a system description
(ii) Where are the areas that will be affected by the proposed deviation?
(iii) When will the aerodrome operator be able to comply with the specific standard if it is due to development of the aerodrome?
(iv) Why is there a need to review the current processes and procedures?
(v) How will the proposed deviation affect the operation of aircraft at the aerodrome?

(b) An example to illustrate this would be as follows:

"All aerodromes are required by the regulation to comply with specific obstacle limitation surfaces according to the operation of the aerodrome. Due to high ground to the north of (name of aerodrome), this study is undertaken to ensure the safe and efficient operation of (name of aerodrome) by identifying the hazards of the high ground, assessing the safety risks and determining appropriate actions and procedures…"

4.4 Safety assessment

Safety assessment 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.

A safety assessment must be conducted as per the methodology described in section 5.5.

4.5 Recommendations

(a) To allow the relevant stakeholders and the Authority to be convinced and assured that the proposed deviation will not pose a drop in the level of safety, the aerodrome operator should recommend operating procedures/restrictions or other measures that will address any safety concerns. In addition, the operator should estimate the effectiveness (through trials, surveys, simulations, etc.) of each recommendation listed, to identify the best means to address the proposed deviation.

(b) The operator should also ensure that the affected parties are well informed of such changes. The notification procedure including process flow, time frame, and different means of notification such as; the Aeronautical Information Publication (AIP) are in accordance with the AIRAC cycle if applicable, and Notice to Airmen (NOTAM) should be included in the study. An example to illustrate this would be as follows:

"The following are some of the operating procedures/restrictions, or other measures as well as their measured effectiveness, which could be adopted to ensure safe aircraft operations in (name of aerodrome):

(Name of the operating procedures/restrictions or other measures and their corresponding measured effectiveness)

The notification procedure to the affected parties is as follow:

(Description of the notification procedure including process flow, time frame and different means of notification)

4.6 Conclusion

The operator after taking into account all necessary considerations listed above, should be able to summarise and conclude the results of the aeronautical study, and come to a decision on any safety measures that should be adopted. The operator should also specify a date to put in place all the necessary safety measures and show how they maintain the same level of safety with the recommended safety measures mentioned in the aeronautical study, as well as stating the interim measures until all such safety measures are implemented. An example to illustrate this would be as follows:

"The results of this aeronautical study have concluded that (obstacle in the inner horizontal surface) would have posed a reduction in the level of safety. However, by adopting prohibition of flight on that side of the aerodrome, this reduction in the level of safety can be safely addressed. These safety measures will be put in place on (proposed date) to address the proposed deviation. With these safety measures put in place, the same level of safety can be achieved as if the (cause of the study) had not occurred due to segregation of the hazard from the operation."

4.7 Monitoring of the Deviation

(a) After the completion of the aeronautical study, the operator should monitor the status of the deviation and ensure that the implemented recommendations have been effectively carried out, and that the level of safety is not compromised at any time. This assessment is to allow feedback into the safety assessment process, if required. An example to illustrate this would be as follows:

"The aerodrome operator will monitor the deviation's status and ensure the safety measure has been effectively carried out and the level of safety is not compromised at any time. The aerodrome operator will review the safety assessment process, if required. Any inadvertent flight on the north side of the aerodrome shall be investigated and reported to the Authority, together with any necessary enhancement of procedures to avoid any repetition."

(b) For temporary deviations, the operator shall notify the Authority as soon as the deviation has been corrected.

5 METHODOLOGY TO CONDUCT SAFETY ASSESSMENTS AT AERODROMES

5.1 Overview

(a) The primary objective of a safety assessment is to assess the impact of implementation, change or removal of any equipment, facility, service, and procedure/process which could give rise to a safety concern. e.g. a design change or deviation in operational procedure.

(b) Such a safety concern can often impact multiple stakeholders; therefore, safety assessments will usually need to be carried out in a cross-organizational manner, involving experts from all the involved stakeholders. Prior to the assessment, a preliminary identification of the required tasks and the organizations to be involved in the process is conducted.

(c) Safety assessments are part of the aerodrome's SMS. A certified aerodrome operator implements an SMS acceptable to the Authority that, as a minimum;

(i) identifies safety hazards;
(ii) ensures that remedial action necessary to maintain safety is implemented;
(iii) provides for continuous monitoring and regular assessment of the achieved safety; and
(iv) aims to make continuous improvement to the overall safety of the aerodrome.

(d) An operator's SMS should enable the operator to manage the safety risks it is exposed to, as a consequence of the hazards it must face during operations. The Authority may accept a deviation from the standards on the basis of an acceptable safety assessment and implementation of the appropriate mitigating actions /limitations.

5.2 Basic Considerations

(a) When a safety concern, change or a deviation has an impact on several stakeholders, consideration shall be given to the involvement of all stakeholders affected in the safety assessment process. In some cases, the stakeholders impacted by the change will need to conduct a separate safety assessment themselves in order to fulfil the requirements of their SMS's and co-ordinate with other relevant stakeholders. When a change has an impact on multiple stakeholders, a collaborative safety assessment should be conducted to ensure compatibility of the final solutions.

(b) A safety assessment considers the impact of the safety concern on all relevant factors determined to be safety-significant. The list below provides a number of items that may need to be considered when conducting a safety assessment. The items in this list are not exhaustive and in no particular order:

(i) aerodrome layout, including runway configurations; runway length; taxiway, taxilane and apron configurations; gates; jet bridges; visual aids; and the RFF services infrastructure and capabilities;
(ii) types of aircraft, and their dimensions and performance characteristics, intended to operate at the aerodrome;
(iii) traffic density and distribution;
(iv) aerodrome ground services;
(v) air-ground communications and time parameters for voice and data link communications;
(vi) type and capabilities of surveillance systems and the availability of systems providing controller support and alert functions;
(vii) flight instrument procedures and related aerodrome equipment;
(viii) complex operational procedures, such as collaborative decision-making (CDM);
(ix) aerodrome technical installations, such as advanced surface movement guidance and control systems (A-SMGCS) or other air navigation aids;
(x) obstacles or hazardous activities at or in the vicinity of the aerodrome;
(xi) planned construction or maintenance works at or in the vicinity of the aerodrome;
(xii) any local or regional hazardous meteorological conditions (such as wind shear); and
(xiii) Airspace complexity, ATS route structure and classification of the airspace, which may change the pattern of operations or the capacity of the same airspace.

(c) Subsequent to the completion of the safety assessment, the operator is responsible for implementing and periodically monitoring the effectiveness of the identified mitigation measures. The Authority reviews the safety assessment provided by the operator and its identified mitigation measures, operational procedures and operating restrictions as required, and is responsible for the subsequent regulatory oversight of their application.

Note - changes on an aerodrome or in operations can include changes to procedures, equipment, infrastructures, safety works, special operations, standards, organization, etc.

5.3 Management of Change

(a) As part of their SMS, aerodrome operators should have in place procedures to identify changes and to examine the impact of those changes on operations.

(b) A safety assessment will be carried out to identify hazards and propose mitigation actions for all changes that are found to have an impact on operations.

Note - Depending on the scope of the envisaged change as well as the level of the impact on operations, the methodology and level of detail required to carry out the required safety assessment may vary.

5.4 Need for a Safety Assessment According to the Category of Changes

(a) **Routine tasks** - Changes related to routine tasks do not have to be assessed using the safety assessment methodology because these tasks are established and managed through specific procedures, training, feedback and reviews. The actions resulting from the regular assessment, feedback and review process related to these tasks should ensure that any changes related to them are managed, thus ensuring the safety of the specific task. However, a change related to a routine task for which feedback is not yet sufficient cannot be considered as sufficiently mature. Therefore, a safety assessment should be carried out.

(b) **Specific changes** - Impact on the safety of aerodrome operations may result from:

i) changes in the characteristics of infrastructures or the equipment;
ii) changes in the characteristics of the facilities and systems located in the movement area;
iii) changes in runway operations (e.g. type of approach, runway infrastructure, holding positions);
iv) changes to the aerodrome networks (e.g. electrical and telecommunication);
v) changes that affect conditions as specified in the aerodrome's certificate;
vi) long-term changes related to contracted third parties;
vii) changes to the organizational structure of the aerodrome; and
viii) changes to the operating procedures of the aerodrome.

Note - When the change involves an aeroplane type/model new to the aerodrome, a compatibility study, as specified in the SLCAA-AC-AGA035-Rev.00 should be conducted.

For any change in aerodrome operations as defined above, a safety assessment should be conducted. 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.

5.5 Safety Assessment Process

A safety assessment is initially composed of four basic steps:

(a) definition of a safety concern and identification of the regulatory compliance;
(b) hazard identification and analysis;
(c) risk assessment and development of mitigation measures; and
(d) Development of an implementation plan for the mitigation measures and conclusion of the assessment.

5.5.1 Definition of a Safety Concern and Identification of the Regulatory Compliance

Any perceived safety concerns are to be described in details, including timescales, projected phases, location, stakeholders involved or affected, as well as their potential influence on specific processes, procedures, systems and operations. The perceived safety concern is first analysed 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. The corresponding areas of concern are identified before proceeding with the remaining steps of the safety assessment, with all relevant stakeholders.

If a safety assessment was conducted previously for similar cases in the same context at an aerodrome where similar characteristics and procedures exist, the aerodrome operator may use some elements from that assessment as a basis for the assessment to be conducted. Nevertheless, as each assessment is specific to a particular safety concern at a given aerodrome, the suitability for reusing specific elements of an existing assessment is to be carefully evaluated.

5.5.2 Hazard Identification

(a) Hazards related to infrastructure, systems or operational procedures are initially identified using methods such as brain-storming sessions, expert opinions, industry knowledge, experience and operational judgement. The identification of hazards is conducted by considering:
    (i) accident causal factors and critical events based on a simple casual analysis of available accident and incident databases;
    (ii) events that may have occurred in similar circumstances or that are subsequent to the resolution of a similar safety concern; and
    (iii) potential new hazards that may emerge during or after implementation of the planned changes.

(b) Following the previous steps, all potential outcomes or consequences for each identified hazard are identified. The appropriate safety objective for each type of hazard should be defined and detailed. This can be done through:

    (i) reference to recognized standards and/or codes of practices;
    (ii) reference to the safety performance of the existing system;
    (iii) reference to the acceptance of a similar system elsewhere; and
    (iv) application of explicit safety risk levels.

(c) 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.

5.5.3 Risk Assessment and Development of Mitigation Measures

(a) The level of risk of each identified potential consequence is estimated by conducting a risk assessment. This risk assessment will determine the severity of a consequence (effect on the safety of the considered operations) and the probability of the consequence occurring and will be based on experience as well as on any available data (e.g. accident database, occurrence reports).

(b) 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 strongly 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.

Note - A risk categorization tool in the form of a safety risk (index) assessment matrix is available in Appendix 3 of this AC.

(c) Once each hazard has been identified and 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. An initial identification of existing mitigation measures must be conducted prior to the development of any additional measures.

(d) All risk mitigation measures, whether currently being applied or still under development, are evaluated for the effectiveness of their risk management capabilities. In some cases, a quantitative approach may be possible, and numerical safety objectives can be used. In other instances such as changes to the operational environment or procedures, a qualitative analysis may be more relevant. In some cases, the result of the risk assessment may be that the safety objectives will be met without any additional specific mitigation measures.

NOTE - Appendix 2 provides aerodrome operators with the risk assessment form template to be used during an aeronautical study/safety assessment. Aerodrome operators must use this form as a guide to formulate his/her own log. This form should be constantly updated throughout the aeronautical study life-cycle.

5.5.4 Development of an Implementation Plan and Conclusion of the Assessment

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

(b) 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.

6 ACCEPTANCE OF AERONAUTICAL STUDY/ SAFETY ASSESSMENT

6.1 Acceptance by the Authority

(a) Once submitted, the Authority will analyse the aeronautical study/safety assessment to verify that:

(i) Appropriate coordination has been performed between the concerned stakeholders;

(ii) The risks have been properly identified and assessed based on documented arguments (e.g. physical or human factors studies, analysis of previous incidents and accidents);
(iii) The proposed mitigation measures adequately addresses the risks; and
(iv) The timeframe for planned implementation are acceptable.

(b) The right to accept or reject the results of the Aeronautical Study/Safety assessment rests fully with the Authority. On completion of the analysis of the safety assessment, the Authority:

(i) either gives formal acceptance of the aeronautical study/safety assessment to the operator; or
(ii) if some risks have been underestimated or have not been identified, co-ordinates with the operator to reach an agreement on safety acceptance; or
(iii) if no agreement can be reached, rejects the proposal for possible resubmission by the operator; or
(iv) may choose to impose conditional measures to ensure safety.

(c) In some instances, the only reasonable means of providing an equivalent level of safety is to adopt suitable procedures and to require as a condition of certification, that cautionary advice be published in the appropriate AIS publications. The determination to require caution will be primarily dependent on two considerations:

(i) a pilot's need to be made aware of potentially hazardous conditions; and
(ii) the responsibility of the Authority and the operator to publish deviations from standards that would otherwise be assumed under certificate status.

(d) The Authority shall ensure that the mitigation or conditional measures are properly implemented and that they fulfil their purpose. The Authority will regularly review the mitigation measures or exemptions granted to assess their continued validity.

7 PROMULGATION OF SAFETY INFORMATION

(a) 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.
(b) In order to ensure adequate dissemination of information to interested parties, information that affects the current AIP or other relevant safety information is:

(i) promulgated in the relevant section of the AIP or automatic terminal information service (ATIS); and
(ii) published in the relevant aerodrome information communications through appropriate means.

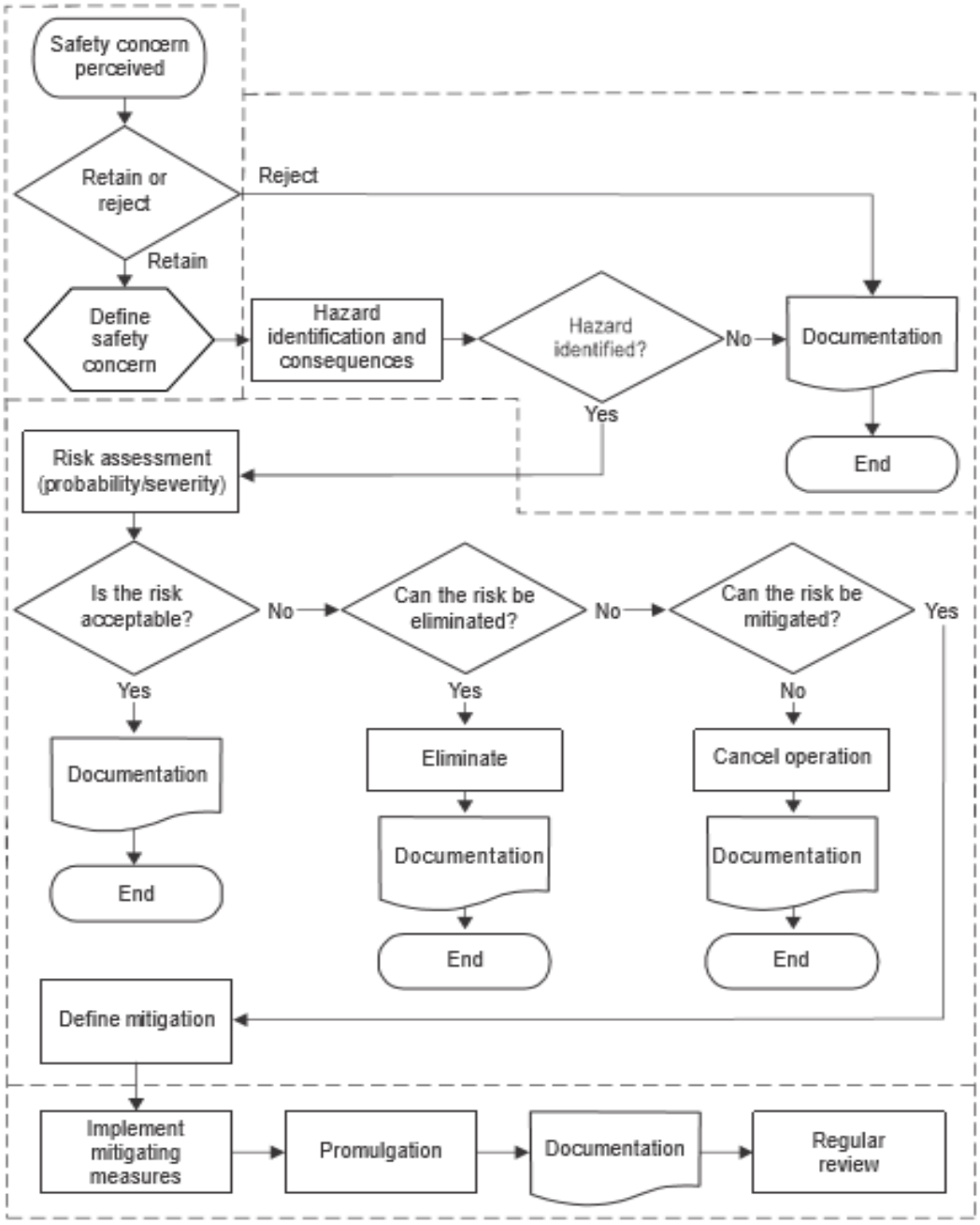

Figure 7.1: Flow chart for the conduct of a safety assessment

APPENDIX 1 - CHECKLIST FOR THE CONDUCT OF AN AERONAUTICAL STUDY.

Note - The purpose of this appendix, is to provide aerodrome operators with a sample checklist for the review of an aeronautical study. Aerodrome operators shall use this checklist as a guide for the development of an aeronautical study tailored to his individual situation.

CHECKLIST FOR AERONAUTICAL STUDY	YES	NO	REMARKS
1. Aim of the study including address of safety concerns, identify safety measures, and make reference to specific SARPs in the applicable SLCAR's Part 14	☐	☐	
2. Consultation with stakeholders, senior management team and divisions/departments affected.	☐	☐	
3. The study is approved by a senior executive of the organization.	☐	☐	
4. Background information on the current situation;	☐	☐	
5. Proposed date for complying with SARPs, if the deviation is due to development of the aerodrome;	☐	☐	
6. Safety assessment including (a) identification of hazards and consequences, and (b) risk management;	☐	☐	
7. The safety assessment used in the study (e.g. hazard log, risk probability and severity, risk assessment matrix, risk tolerability and risk control/mitigation;	☐	☐	
8. Recommendation (including operating procedures /restrictions or other measures to address safety concerns) of the aeronautical study and how the proposed deviation will not degrade the level of safety;	☐	☐	
9. Estimation of the effectiveness of each recommendation listed in the aeronautical study;	☐	☐	
10. Notification procedure including process flow, time frame and the publication used to promulgate the deviation;	☐	☐	
11. Conclusion of the study;	☐	☐	
12. Monitoring of the deviation; and	☐	☐	
13. Notification to the Authority once the temporary deviation has been corrected.	☐	☐	

APPENDIX 2 – RISK ASSESSMENT FORM

RISK ASSESSMENT FORM					
Aerodrome Name:		**Prepared By: (Name and Designation)**			
Location:					
Approved By: (Name & Designation)		**Last Review Date:**		**Next Review Date:**	

Hazard Identification				Risk Evaluation		Risk Control			
SN	**Type of operations or activity**	**Hazard Description**	**Consequences Identified**	**Risk Index**	**Risk Tolerability**	**Risk Control / Mitigation (if any)**	**Residual Risk Index**	**Residual Risk Tolerability**	**Action, if any to further reduce risk and the resulting index and the residual risk tolerability**
1	Aircraft operation	Operation of Code 4F aircraft in <name of airport>. Code F aircraft using runway for landing and take-off	• **Wing tip collision at <parking bay numbers>.** **• Loss of control of aircraft during pushback / towing operations**	**3C**	**Tolerable**	• **Use of wing walkers.** **• Aircraft to taxi at <speed value>.** **• Training of staff for pushback / towing operations.** **• Restrictions on other aircraft movements within <parking bay number>.**	**2C**	**Tolerable**	• Conduct trials to study the effectiveness of the implementation. • Resulting risk index : 1C •Residual risk tolerability : **Acceptable**
2									
3									

APPENDIX 3 - SAFETY ASSESSMENT METHODOLOGIES FOR AERODROMES

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

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

ii) *Method type "B".* For other hazards, risk assessment is not really linked with specific airplane 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;

iii) *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 airplanes or using statistics from existing airplane operations.

Risk assessment method

b) The risk assessment should take 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.

c) 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.

d) The severity classification includes five classes ranging from "catastrophic" (class A) to "not significant" (class E)

e) 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.

Table A3-1: Severity classification scheme with 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
Major	– A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency. – Serious incident. – Injury to persons.	C	– runway incursion, ample time and distance (no potential for a collision) – collision with obstacle on apron/ parking position (hard collision) – person falling down from height – missed approach with ground contact of the wing ends during the touchdown – large fuel puddle near the
Minor	– Nuisance – Operating limitations – Use of emergency procedures – Minor incident	D	– hard braking during landing or taxiing – damage due to jet blast (objects) – expendables are laying around the Stands – collision between maintenance vehicles on service road – breakage of drawbar during pushback (damage to the aircraft) – slight excess of maximum take-off weight without safety consequences

			– aircraft rolling into passenger bridge with no damage to the aircraft needing immediate repair
Severity	**Meaning**	**Value**	**Example**
			– forklift that is tilting – complex taxiing instructions/ procedures
Negligible	– Few consequences.	E	– slight increase in braking distance – temporary fencing collapsing because of strong winds – cart losing baggage.

f) The probability classification includes five classes ranging from "extremely improbable" (class 1) to "frequent" (class 5) as shown in Table A3-2.

g) The probability classes presented in Table A3-2 are defined with quantitative limits. It is not the intention to assess frequencies quantitatively; the numerical value serves only to clarify the qualitative description and support a consistent expert judgement.

Table A3-2: Probability classification scheme

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

h) The classification refers to the probability of events per a period of time. This is reasoned through the following:

i) many hazards at aerodromes are not directly related to aircraft movements; and
ii) the assessment of hazards occurrence probabilities can be based on expert judgement without any calculations.

i) The aim of the matrix is to provide a means of obtaining a safety risk index. The index can be used to determine tolerability of the risk and to enable the prioritization of relevant actions in order to decide about risk acceptance. Given that the prioritization is dependent

on both probability and severity of the events, the prioritization criteria will be two-dimensional. Three main classes of hazard mitigation priority are defined in Table A3-4:

i) hazards with high priority - intolerable;
ii) hazards with mean priority - tolerable; and
iii) hazards with low priority - acceptable.

j) The risk assessment matrix has no fixed limits for tolerability but points to a floating assessment where risks are given risk priority for their risk contribution to aircraft operations. For this reason, the priority classes are intentionally not edged along the probability and severity classes in order to take into account the imprecise assessment.

Table A3-3: Risk assessment matrix with prioritization classes

		Risk Severity				
		Catastrophic	Hazardous	Major	Minor	Negligible
Risk Probability		A	B	C	D	E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely improbable	1	1A	1B	1C	1D	1E

Table A3-4: Risk Acceptability

Safety Risk Index Range	Safety Risk Description	Acceptability/ Action Required
5A,5B,5C,4A,4B,3A	INTOLERABLE	Take immediate action to mitigate the risk or stop the activity. Perform priority safety risk mitigation to ensure additional or enhanced preventative controls are in place to bring down the safety risk index to tolerable.
5D,5E,4C,4D,4E, 3B,3C,3D 2A,2B, 2C,1A,	TOLERABLE	Can be tolerated based on the safety risk mitigation. It may require management decision to accept the risk.
3E,2D,2E, 1B 1C,1D,1E	ACCEPTABLE	Acceptable as is. No further safety risk mitigation required.