Advisory Circular

CAA-AC-AGA021C

June, 2024

GUIDANCE MATERIAL ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT.

1.0 PURPOSE

1.1 This Advisory Circular (AC) provides guidance to aerodrome operators on the conduct of Aeronautical Study and risk assessment where the aerodrome is unable to meet requirements and need to identify alternative means to achieve an equivalent level of safety.

1.2 Although this guidance material relates to aerodromes, the principles contained in it may be applied more widely in circumstances where requirements cannot be met and an alternative means of compliance is proposed. It provides guidance on what is acceptable to the Authority to demonstrate compliance with the requirements of the Civil Aviation Regulations.

1.3 It is important to note that this circular on its own does not change, create, amend or permit deviations from regulatory requirements nor does it establish minimum standards.

1.4 This **AC** supersedes **CAA-AC-AGA021B** issued in **March 2021**.

1.5 This AC is effective on 1st June, 2024.

2.0 REFERENCE

2.1 Civil Aviation Act (amended);

2.2 Civil Aviation (Aerodromes) Regulations, 2013;

2.3 Civil Aviation (Certification, Licensing and Registration of Aerodromes) Regulations, 2018;

2.4 Civil Aviation (Safety Management) Regulations, 2018.

3.0 INTRODUCTION

3.1 Civil Aviation (Aerodromes) Regulations, 2013 and (Certification, Licensing and Registration of Aerodromes) Regulations, 2018 contain basic provisions on the use of Aeronautical Studies as a means to identify alternative means to achieve an equivalent level of safety by means other than full compliance with a specific requirement.

3.2 It is acknowledged that there could be some other cases where full compliance with requirements cannot be achieved, and for which a deviation from a regulatory requirement will have to be sought. A safety case based on the same principles as an Aeronautical Study should accompany any application for a deviation.

3.3 It is important to note that the preferred option must always be to seek compliance with the requirements. In order to achieve an equivalent level of safety by other means, one must usually establish mitigating measures that affect the efficiency and usability of the aerodrome.

3.4 An aeronautical study is a study of an aeronautical problem to identify possible solutions and select a solution that is acceptable without degrading safety. A comprehensive aeronautical study allows the aerodrome operator/applicant and the authority to be convinced that safety and regularity of operations of aircraft is not compromised in any way. It is mostly undertaken during the planning of a new airport, new airport facility, new proposed development/ structure or during the certification of an existing aerodrome. This circular provides guidance for conduct of Aeronautical study/ safety assessment during any of these phases.

3.5 Each study is specific to a particular deviation or change; hence, caution should be exercised in considering applicability to other situations and locations. The outcome of the studies remains the ultimate responsibility of the State in accordance with the Convention on International Civil Aviation.

3.6 Aerodrome operators/applicants should consult the stakeholders, senior management and affected departments in their organizations prior to the conduct of an aeronautical study. These consultations allow the proposed deviation to be viewed from different perspectives and the different parties involved would be aware of the proposed deviation. The senior management of the organization should also approve the aeronautical study before it is submitted to the authority for acceptance.

3.7 The Authority reserves the right to accept or reject the results of the Aeronautical Study. Such acceptance or rejection shall be based on a critical review of the study and ensuring that aviation safety and security are preserved at all times.

3.8 The Authority, where satisfied with the results of the aeronautical study, equivalent level of safety and mitigating measures provided, may offer an exemption to the compliance with the provision of the regulations.

4.0 DEFINITION

4.1 ICAO Doc 9774 defines an aeronautical study as:
"a study of an aeronautical problem to identify possible solutions and select a solution that is acceptable without degrading safety."

5.0 RESPONSIBILITY OF CONDUCTING AERONAUTICAL STUDY

5.1 If the aerodrome cannot meet the requirements, the aerodrome operator needs to propose, and have accepted, an alternative means of compliance or a deviation from the requirement.

5.2 Consequently, the burden of justifying an application by means of an Aeronautical Study rests with the aerodrome operator.

6.0 OBJECTIVES

6.1 The objectives of an aeronautical study are:

6.1.1 To study the impact of deviations from the SARPs;

6.1.2 To present alternative solutions to ensure the level of safety remains acceptable;
6.1.3 To estimate the effectiveness of each alternative; and
6.1.4 To recommend operating procedures/restrictions or other measures to compensate for the deviation.

7.0 AERONAUTICAL STUDY CONSIDERATIONS

7.1 After receiving such notice, the Authority will review the aeronautical study to determine the effect of the intended proposal on the safe operation of aircraft.

7.2 Some of the factors considered in the studies are:

7.2.1 the impact on existing or anticipated traffic circuits of neighboring aerodromes or heliports;
7.2.2 the impact on existing and projected airspace use;
7.2.3 the impact on safety of persons and property within the affected area;
7.2.4 impact of existing or proposed man-made objects;
7.2.5 natural objects and features within the affected area;
7.2.6 the adjustment of other aviation requirements that may be needed to accommodate the proposal
7.2.7 Wildlife hazard management and the impact associated with wildlife.
7.2.8 Bird attractants.
7.2.9 possible revisions of the proposal that may be necessary to eliminate a hazardous or inefficient use of airspace

8.0 PARTICIPANTS IN THE AERONAUTICAL STUDY

8.1 Both aerodrome and flight operational expertise is needed. In some cases, ATS and/or PANS - OPS expertise must be involved.

8.2 Finally, depending on the complexity of the issue, specialists on risk analysis may have to be brought in to assess the degree of risk resulting from the aeronautical study and proposed deviances.

9.0 STEPS/FRAMEWORK OF AN AERONAUTICAL STUDY

9.1 An Aeronautical Study implies a systematic and documented approach to a problem. Thus it consists of certain steps, notably:

9.1.1 Aim of the Study;
9.1.2 Background;
9.1.3 A description of problems and objectives;
9.1.4 Selection of procedures, methods and data sources;
9.1.5 Safety assessment;
9.1.6 Presentation of results;
9.1.7 Outcome of the Aeronautical Study/ Safety Assessment;
9.1.8 Conclusion of the Study;
9.1.9 Evaluation of the Proposal for Grant of Permission; and
9.1.10 Monitoring of the deviation.

9.2 Aim of the Study

9.2.1 The aim of the study should be explicitly stated. It should address the safety concerns; identify safety measures to be put in place to ensure safe aircraft operations in an aerodrome and refer to the specific Standards, which the study is meant to address.

9.3 Background

9.3.1 Information on the current situation 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:

9.3.2 what is the current situation?

9.3.3 Where are the areas that will be affected by the proposed deviation?

9.3.4 When will the applicant be able to comply with the specific standard

9.3.5 if it is due to development of the aerodrome?

9.3.6 Why is there a need to review the current processes and procedures?

9.3.7 How will the proposed deviation affect the operation of aircraft at the aerodrome?

9.4 A description of problems and objectives

9.4.1 The first step of any risk analysis is to define the problem and the objective of the exercise. The problem will be to identify the safety implications of not complying (in full) with a certain requirement or requirements.

9.4.2 The objective will be to identify suitable mitigating measures, which will mitigate these safety implications. Thus, it is important to understand which hazards and scenarios the requirement(s) in question are designed to protect against.

9.5 Procedures, methods and data sources

9.5.1 The main issue is whether the study shall follow a quantitative or qualitative approach. The answer will to a large extent be dependent upon the data-sources available.

9.5.2 A qualitative approach based on common sense and qualified expert opinion will probably, in many cases, yield results that are far better than nothing, and better than a quantitative approach based on a limited set of unrepresentative or unreliable data.

9.5.3 Even if it is possible to carry out a quantitative approach, qualified expert opinion is necessary, particularly in the conduct of hazard identification and risk analysis.

9.6 Safety Assessment

9.6.1 A safety assessment usually consists of the following:

9.6.1.1 Identification of hazards and consequences; and

9.6.1.2 Risk management.

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

9.6.2.1 Aerodrome layout

9.6.2.2 Types of aircraft intended to operate at the aerodrome

9.6.2.3 Traffic density and distribution

9.6.2.4 Aerodrome ground services

9.6.2.5 Air ground communications

9.6.2.6 Type and capabilities of surveillance systems

9.6.2.7 Flight instrument procedures and related aerodrome equipment
9.6.2.8 Complex operational procedures – (including A-CDM)
9.6.2.9 Aerodrome technical installation -A-SMGC
9.6.2.10 Obstacles or hazardous activities at or in the vicinity of the aerodrome
9.6.2.11 Planned construction or maintenance
9.6.2.12 Any local or regional MET conditions
9.6.2.13 Airspace complexity and operating restrictions
9.6.2.14 Management and Technical personnel requirements

9.6.3 **Identification of hazards**

9.6.3.1 Hazards are any situation or condition that has the potential to cause damage or harm. The basic question one must ask is: what can go wrong, and where?

9.6.3.2 Examples of 'what' include, but are not limited to:

a) Aircraft colliding with terrain, aircraft, vehicles or objects.
b) Aircraft landing in front of the threshold, running off the far end of the runway or veering off the side of the runway.
c) Aircraft colliding with, or ingesting wildlife or foreign objects debris

9.6.3.3 Examples of 'where' include, but are not limited to:

a) During flight (approach, landing, balked landing, take-off, climb-out)
b) On the ground (Runway, taxiway, apron, strips, RESAs, or outside these areas)

The key is to identify hazards that the requirement in question is designed to protect against.

9.6.4 **Analysis of causal factors, severity and probability**

9.6.4.1 Causal factors

a) The basic questions are: why can it go wrong, what is the consequence if it does go wrong and how likely is it that it will go wrong?
Examples of 'why' include, but are not limited to:
i) Lack of guidance (non-visual aids, lights, markings, signs, charts)
ii) Confusing guidance (non-visual aids, lights, markings, signs, and charts).
iii) Inaccurate obstacle surveys and obstacle publications
iv) Inaccurate aeronautical data
v) Insufficient protected areas (strips and RESAs)
vi) Insufficient separation distances
vii) Insufficient surface widths
viii) Insufficient maintenance programmes
b) In some cases, these factors can contribute to an accident. In other cases, they can increase the consequences of an incident so that it becomes an accident.

9.6.4.2 Safety Risk Probability (How likely is it that it will occur?)

a) This is a probability issue. How often is it likely to occur within a certain number of movements? Table A-1 in appendix B gives the probability levels and their descriptions.

9.6.4.3 Safety Risk Severity

a) Key considerations should be the assessment of what are the (potential) consequences if it occurs? Assessment of the severity of the occurrence is better described by using the table A-2 in Appendix B

9.6.5 **Risk Assessment**

9.6.5.1 Risks are the potential adverse consequences of a hazard, and are assessed in terms of their severity and probability.

9.6.5.2 Thus, for each hazard resulting from the non-compliance, one can now describe the risk by placing the combination of severity and probability in the Risk Assessment Matrix is shown in Table A-3 and A-4 in Appendix B. If the risk comes out as medium or above, risk reduction measures must be identified.

9.6.6 **Identification of possible mitigating measures**

9.6.6.1 As can be seen from the risk classification matrix, risk reduction measures can aim towards either reducing the likelihood of an occurrence, or reducing the severity of an occurrence. Some measures could conceivably do both.

9.6.6.2 The first priority should always be to seek measures that will reduce the likelihood of an occurrence (i.e. accident prevention). When contemplating mitigating measures, it is always necessary to look to the intent of the requirement that is not (fully) complied with.

9.6.6.3 Examples of mitigating measures include, but are not limited to:

a) Publication in the AIP as a minimum. (This is a requirement in the Civil Aviation (Aeronautical Information Services) Regulations,2018 and is also necessary in order that the airlines can take their precautions, as they are obliged to do according to Civil Aviation (Aircraft Operations) Regulations,2018 .)

b) Aerodrome operational procedures are in some cases relevant. One example is to restrict traffic on a parallel taxiway if runway/taxiway or taxiway/taxiway separation distance is insufficient.

c) Infrastructure and/or additional visual and/or non-visual aids.

d) Operational restrictions that might be necessary. These may include restrictions on all-weather operations, increased spacing between aircraft (in the air or on the ground).

e) Restrictions on aircraft operators that might be necessary, such as:

i) Operations restricted to operators/crew who can demonstrate special competence.

ii) Requirements that aircraft carry special equipment or certifications

iii) Requirements that operators set special wind limits

9.6.6.4 Mitigating measures usually means reduced usability for an aerodrome. Safety and usability is a balancing act.

9.6.7 **Estimating the effect of mitigating measures**

9.6.7.1 The mitigating measures should be fed back into the consideration listed earlier in order to evaluate their relevance and effectiveness in reducing risk.

9.6.8 **Choice of mitigating measures**

9.6.8.1 If one or more measures enable the risk to be sufficiently reduced, one can recommend a choice, bearing in mind that the preferred option should be accident prevention, and prepare the final report. Thus the final description should recommend mitigating actions and list the consequences and their probabilities when these are taken into account. A Safety assessment flow chart is given in Appendix B.

9.7 Presentation of results

9.7.1 The work shall be documented in such a way that it is possible to see what has been done. The steps referred to above should be identifiable.

9.7.2 Other key issues to consider include:

9.7.2.1 What essential assumptions, presuppositions and simplifications have been made?

9.7.2.2 Any uncertainty about the results due to the choice of and availability of methods, procedures and data sources should be discussed.

9.7.3 The results of the study should emphasize which undesired event contributes the most to risk, and factors influencing these undesired events. Recommendations for measures to mitigate risk, their character and their estimated effect shall be stated.

9.8 Outcome of the Aeronautical Study/ Safety Assessment

9.8.1 It demonstrates to Authority 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 aerodrome operator/applicant should estimate the effectiveness (through trials, surveys, simulations etc.) of each recommendation listed so as to identify the best means to address the proposed deviation.

9.8.2 Every airport operator should create a baseline or an initial hazard- log. Hazard identification then becomes an ongoing activity and hazard logs be continuously reviewed and updated. The hazard/ risk outcome of every aeronautical study/safety assessment should also be included in the log.

9.8.3 The aerodrome operator/applicant should also ensure that the affected stakeholders are informed of such changes. The notification procedure including process flow, time frame and different means of notification such the Aeronautical Information Publication (AIP) and Notice to Airmen (NOTAM) should be included in the study.

9.9 Conclusion of the Study

9.9.1 The aerodrome operator/applicant after taking into account all the necessary considerations listed above, should be able to summarize and conclude the results of the aeronautical study/ safety assessment, and come to a decision on any safety measures that should be adopted. The aerodrome 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/ safety assessment.

9.9.2 ***Appendix A*** to this circular contains a suggested checklist with the requirements to be included in an aeronautical study. The checklist can be used by the applicant as a guide to ascertain that all of the requirements have been taken into consideration and documented in the aeronautical study.

9.10 Evaluation of the Proposal for Grant of Permission

9.10.1 The documentation prepared and submitted after undergoing the above process shall be submitted to Authority for technical assessment before acceptance or denial.

9.10.2 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.

9.10.3 In conducting a technical analysis, inspectors will draw upon their practical experience and specialized knowledge. They may also consult other specialists in relevant areas. The Authority will analyze the safety assessment and verify that:

9.10.3.1 appropriate coordination has been performed between the concerned stakeholders;

9.10.3.2 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);

9.10.3.3 the proposed mitigation measures adequately address the risk; and

9.10.3.4 the time frames for planned implementation are acceptable.

9.10.4 The checklist in ***Appendix A*** is an example of a checklist that may be used by the aerodrome inspector to ascertain that all of the requirements have been taken into consideration and documented in the aeronautical study/safety assessment.

9.10.5 The applicant shall submit separate application for each non-compliance in the prescribed format for seeking exemption. (Refer to Exemption request form in CAA-O-GEN015A). The application for exemption shall be made through the submission of a comprehensive safety risk assessment report, supported with the reasons for non-compliance, means of mitigation and indication as to when compliance can be achieved. Furthermore, the following points should be considered while requesting the exemption for non-compliances:

a) Ensure that the exemption application is given proper consideration;

b) Ensure that an exemption is absolutely necessary rather than a convenient method of circumventing the requirements;

c) Detailed reasons why the applicant needs the exemption.

d) If the application is for a renewal of an existing exemption, the application need not contain information which has been previously supplied. However, the application must include reasons why a renewed exemption is required; and

e) Considerable research and investigation

9.10.6 An exemption granted pursuant to the requirements of the Civil Aviation (Aerodromes) Regulations, 2013 shall cease

a) At the end of the date specified in the exemption application/request form or

b) If no date is specified for that purpose in the exemption application/request form, one (1) year after the commencement of the exemption.

10.0 MONITORING/ MANAGEMENT AND CONTROL OF THE DEVIATION

10.1 The alternative measures, operational procedures and operating restrictions developed from safety assessments or aeronautical studies should be reviewed periodically to assess their continued validity.

10.2 The aerodrome operator/ applicant should monitor the status of the deviation and conduct annual review to ascertain that the mitigation measures are in place 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 to be documented in a report to be submitted to the Authority

10.3 The authority shall review the status of exemptions at the time of renewal of certificate, the aerodrome operator/ applicant shall submit the details of progress made during the currency of certificate regarding compliance of such requirements and adequacy of mitigation measures employed to ensure safety and regularity of aircraft operations.

10.4 For temporary deviations, the aerodrome operator/applicant should also notify the authority after the deviation has been corrected.

11.0 Publication of the concluded aeronautical studies/risk assessment outcome in the aeronautical information publication (AIP)

11.1 Upon satisfactory completion and submission of the aeronautical study/ risk assessment to the Authority by the aerodrome operator/applicant, the Authority will conduct a technical assessment to justify the deviation with the objective of granting or refusing an exemption. If the exemption is granted, the Authority shall provide this information including alternative means of compliance with the standards to Aeronautical Information Services (AIS) units for publication in the Aeronautical Information Publication (AIP)

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Civil Aviation Authority

APPENDIX A

CHECKLIST FOR AERONAUTICAL STUDY/ SAFETY ASSESSMENT

This appendix provides aerodrome operators with a suggested checklist for reviewing of an aeronautical study. An aerodrome operator may use this checklist as a guide for developing an aeronautical study tailored to its individual situation.

The suggested checklist for reviewing of an aeronautical study is as shown below:

REVIEW ITEM	YES	NO	REMARKS
1. Aim of the study including (a) address safety concerns, (b) identify safety measures, and (c) make reference to specific standards in the regulations;			
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 the standard, 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. Recommendations (including operating procedures, restrictions or other measures to address safety concern) of the aeronautical study.			
9. How the proposed deviation will not pose a drop in the level of safety; details			
10. Estimation of the effectiveness of each recommendation listed in the aeronautical study;			
11. Notification procedure including process flow, time frame and the publication used to promulgate the deviation;			
12. Conclusion of the study;			
13. Monitoring of the deviation; and			
14. Notification to the authority once the temporary deviation has been corrected.			

APPENDIX B

RISK PROBABILITY & SEVERITY, RISK ASSESSMENT MATRIX, RISK TOLERABILITY AND SAFETY ASSESSMENT FLOW CHART

This appendix provides aerodrome operators with a suggested risk probability & severity and risk assessment matrix to be included in an aeronautical study. Aerodrome operators may use this as a guide for developing their own risk probability & severity and risk assessment matrix tailored to their situation.

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Table A-1 Risk Probability

PROBABILITY OF OCCURRENCE		
LIKELIHOOD	**MEANING**	**VALUE**
Frequent	Likely to occur many times (has occurred frequently)	**5**
Occasional	Likely to occur sometimes (has occurred infrequently)	**4**
Remote	Unlikely to occur, but possible (has occurred rarely)	**3**
Improbable	Very unlikely to occur (not known to have occurred)	**2**
Extremely Improbable	Almost inconceivable that the event will occur	**1**

Table A-2 Risk Severity

SEVERITY OF OCCURRENCE		
SEVERITY	**MEANING**	**VALUE**
Catastrophic	— Equipment/facilities destroyed — Multiple deaths	**A**
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**
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**
Minor	— Nuisance — Operating limitations — Use of emergency procedures — Minor incident	**D**

Negligible	— Few consequences	**E**

Table A-3 Risk Assessment Matrix

Risk probability		**RISK SEVERITY**				
		Catastrophic A	**Hazardous B**	**Major C**	**Minor D**	**Negligible 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 A-4 Risk Tolerability

RISK INDEX	**TOLERABILITY**	**SUGGESTED CRITERIA**
3A, 4A, 4B, 5A,5B, 5C	**Intolerable**	Unacceptable under the existing circumstances.
1A, 2A, 2B, 2C,3B, 3C, 3D, 4C,4D, 4E, 5D, 5E	**Tolerable**	Acceptable based on risk mitigation. It may require management decision.
1B, 1C, 1D, 1E,2D, 2E, 3E	**Acceptable**	Acceptable as is. No risk mitigation required.

Safety Assessment Flow Chart