Advisory Circular

AC 139-15

Aeronautical Studies for Aerodrome Operators

Revision 1.0
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General

Civil Aviation Authority Advisory Circulars contain information about standards, practices, and procedures that the Director has found to be an **Acceptable Means of Compliance (AMC)** with the associated rule.

An AMC is not intended to be the only means of compliance with a rule, and consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate Advisory Circular.

An Advisory Circular may also include **Guidance Material (GM)** to facilitate compliance with the rule requirements. Guidance material must not be regarded as an acceptable means of compliance.

Purpose

This Advisory Circular provides information and guidance to assist aerodrome operators and other parties to undertake an aeronautical study in accordance with Civil Aviation Rule 139.107.

Related Rules

This Advisory Circular relates specifically to Civil Aviation Rule Part 139

Change Notice

~~Initial issue~~

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Chapter 1 — General

Introduction

1.1.1 In accordance with the requirements of Rule Part 139.107, the holder of an aerodrome operating certificate must monitor operations and conduct an aeronautical study and risk assessment when a significant change in aerodrome operations occurs that may affect the safety of aircraft operations. These significant changes in aerodrome operations include a change in aerodrome aircraft traffic, a change in aircraft operations type, a change in the aerodrome physical characteristics, an increase in aerodrome accidents/incidents, or a change in airspace designation.

1.1.2 This Advisory Circular details how an aeronautical study is conducted to assess the impact of changes in aerodrome operations and deviations from the aerodrome standards specified in Appendices A to H Part 139 and Volume I to Annex 14 to the Convention on International Civil Aviation to present acceptable means of compliance.

1.1.3 An aeronautical study should estimate the effectiveness of each alternative and recommends procedures to compensate for the deviations from CAR Part 139 standards and requirements for aerodromes taking into account Papua New Guinea's aviation environment.

1.1.4 Aeronautical study justification may either be quantitative or qualitative.

1.2 Applicability

1.2.1 This AC 139-15 applies to all aerodrome operators[1] certificated under Part 139 of the PNG Civil Aviation Rules.

1.2.2 For the purposes of, but not limited to Rule Part 139.17, 139.55, 139.89 and 139.119, it is recommended that this AC 139-15 provides guidance to aerodrome operators when analysing aeronautical problems.

Note — Aeronautical studies may not be conducted in cases of deviations from the standards, if not specifically recommended in Annex 14, Volume I.

1.3 Aeronautical Study

1.3.1 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."

1.3.2 An aeronautical study is a study of an aeronautical problem to identify possible solutions, and to select a solution that is acceptable without degrading safety. A comprehensive aeronautical study allows both the aerodrome operator and CASA

PNG to be convinced that safety and regularity of operations of aircraft are not compromised in any way.

1.3.3 An aeronautical study 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 operational conditions from a specific Standard or Recommended Practice (SARP) contained in CAR Part 139.

1.3.4 Aerodrome operators should consult their stakeholders, senior management and affected divisions/departments in their organisations 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 senior management of the organization before it is submitted to CASA PNG for consideration of acceptance.

1.3.5 Aerodrome operators should note that CASA PNG may choose to participate in the conduct of an aeronautical study as an observer where appropriate.

1.4 Objectives

1.4.1 The objectives of an aeronautical study are as follows:

a) To study the impact of deviations from the SARPs;

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 other measures to compensate for the deviation.

[1]Aerodrome operators include applicants applying for an aerodrome operating certificate (ADOC).

Chapter 2 — A Typical Aeronautical Study

2.1 Parts of an Aeronautical Study

2.1.1 An aeronautical study submitted to CASA PNG for determination of acceptability should comprise the following parts:

a) Aim of the Study;

b) Background;

c) Safety Assessment;

d) Recommendations;

e) Conclusion; and

f) Monitoring of the Deviation.

2.2 Aim of the Study

2.2.1 The aim of the study should be explicitly stated. It should:

a) Address the safety concerns;

b) Identify safety measures to be put in place to ensure safe aircraft operations in an aerodrome; and

c) Make reference to the specific SARP in PNG CAR Part 139 which the study is meant to address.

2.2.2 An example to illustrate this would be as follows:

"The aim of *this aeronautical study is to address the operation* of *Code D aircraft in* a *Code 3C airport, <name* of *airport> and to put in place <list* of *safety measures> necessary to ensure safe operation* of *Code D aircraft in <name* of *airport> with reference made to <reference to specific SARP> ... "*

2.3 Background

2.3.1 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 subsection.

Clear explanation should be provided, particularly on the following:

a) What is the current situation?

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

c) When will the operator be able to comply with the specific standard if it is due to development of the aerodrome?

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

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

2.3.2 An example to illustrate this would be as follow:

"Currently, <name of *airport> is Code 4D airport with some Code 4E capabilities. These Code 4E capabilities includes <list of the Code 4E capabilities> ... <Name of airport> is required to handle Code E aircraft by <proposed date> and the following <list of affected areas> will be affected. Development of the <affected areas> is proposed to commence on <proposed date> and to be completed by <proposed date>. By then, <name of airport> will be upgraded to* a *Code 4E airport.*

Upgrading <name of airport> from Code 4D to Code 4E airport requires the reviewing <name of processes and procedures that need to be reviewed> to ensure safe aircraft operation.

In addition, during this development, operation of aircraft at <name of airport> will be affected in the following ways ... "

2.4 Safety Assessment

2.4.1 Safety assessment is the identification, analysis and elimination, and/or mitigation of risks to an acceptable level of safety. This should be in accordance with the aerodrome Safety Management System (SMS) that is required to be put in place by the operator - a key aerodrome certification requirement. A safety assessment usually consists of the following:

(a) Identification of hazards and consequences; and

(b) Risk management.

2.4.2 Depending on the nature of the risk, three methodologies can be used to evaluate whether it is being appropriately managed. The methodology adopted should be consistent with that established in the aerodrome operator's SMS.

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;

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.

Identification of hazards and consequences

2.4.3 Hazards and its consequences should be identified and recorded in a hazard log. Aerodrome operators have to exercise caution when identifying the hazards and their consequences as stating a hazard as its consequence would disguise the nature of the hazard and at the same time, interfere with identifying other important consequences.

2.4.4 An example would be *"Operation* of *Code* F *aircraft in* a *Code 4E airport"* and *"Wingtip collision in parking bays".* The former is a hazard whereas the latter is one of its consequences. The associated risks and control/mitigation measures should also be recorded in the hazard log when information becomes available. This log should be constantly updated throughout the aeronautical study life-cycle.

2.4.5 Appendix B of this AC contains a sample hazard log. The aerodrome operator may use this to formulate its own hazard log to suit the aeronautical study.

Risk management

2.4.6 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.

2.4.7 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.

2.4.8 The severity classification includes five classes ranging from "catastrophic" (class A) to "not significant" (class E). The examples in Table 2.4-1, adapted from Doc 9859 with aerodrome-specific examples, serve as a guide to better understand the definition.

2.4.9 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 2.4- 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
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 aircraft while passengers are on-board
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 – 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

2.4.10 The probability classification includes five classes ranging from “extremely improbable” (class 1) to “frequent” (class 5) as shown in Table 2.4-2.

2.4.11 The probability classes presented in Table 2.4-2 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 2.4- 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

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

a) many hazards at aerodromes are not directly related to aircraft movements; and

b) the assessment of hazards occurrence probabilities can be based on expert judgement without any calculations.

2.4.13 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.

2.4.14 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 2.4-3:

a) Hazards with high priority — intolerable;

b) Hazards with mean priority — tolerable;

c) Hazards with low priority — acceptable.

2.4.15 The risk assessment matrix has no fixed limits for tolerability but points to a floating assessment where risks are given risk priority defined in Table 2.4-4 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 2.4- 3. Risk assessment matrix with prioritization classes

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 2.4- 4. Risk Tolerability

Region and Risk Region Index	**Suggested Criteria**

Intolerable Region **5A, 5B, 5C, 4A,4B, 3A**	Hazards with high priority. The consequence is unacceptable under the existing circumstances.
Tolerable Region **5D, 5E, 4C, 4D, 4E, 3B, 3C, 2A, 2B, 2C**	Hazards with mean priority. Mitigating measures should be taken to reduce the probability or the severity of the consequence. This may often require senior management decision.
Acceptable Region **3D, 3E, 2D, 2E, 1A, 1B, 1C, 1D, 1E**	Hazards with low priority. The consequence is extremely improbable or not severe enough to be of concern

2.4.16 Risk control/mitigation measures should be developed to address the potential hazard or to reduce the risk probability or severity of the consequence when the risk is classified to be tolerable to a level acceptable by the aerodrome operator. There are three broad categories for risk control/mitigation and they are as follows:

(a) **Avoidance** - the operation or activity is cancelled as the risks exceed the benefits of continuing the operation or activity;

An example to illustrate this would be as follow:

"To prohibit Code F aircraft to land or take-off from <name of *airport>, which is* a *Code 4E airport with some Code 4F capabilities. "*

(b) **Reduction** - The frequency of the operation or activity is reduced, or action is taken to reduce the magnitude of the consequences of the accepted risks;

An example to illustrate this would be as follow:

"To reduce the number of *Code F aircraft to land or take-off from <name* of *airport>."*

(c) **Segregation of exposure** - Action is taken to isolate the effects of the consequences of the hazard or build-in redundancy to protect against it.

An example to illustrate this would be as follow:
"To ensure <name of *airport> staff liaise with the Aeronautical Information Services (AIS) on the promulgation* of *aerodrome circulars with the necessary aerodrome information to <names* of *aircraft operators> and <names* of *other airports> <fixed period* of *time> stated in their new process and/or new procedures. "*

2.5 Recommendations

2.5.1 To allow the aerodrome operator and CASA PNG 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 aerodrome operator 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.

2.5.2 The aerodrome 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) and Notice to Airmen (NOTAM) should be included in the study.

2.5.3 An example to illustrate this would be as follow:

"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 *airport>:*

<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>*

2.6 Conclusion

2.6.1 The aerodrome operator, after taking into account all the 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 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.

2.6.2 An example to illustrate this would be as follow:

"The results of *this aeronautical study have concluded that <the proposed deviation> will indeed pose* a *drop in the level* of *safety. However, by adopting <type* of *the safety measures>, this drop 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, <to explain how to maintain the same level* of *safety> ... "*

2.7 Monitoring of the Deviation

2.7.1 After the completion of the aeronautical study, the aerodrome 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.

2.7.2 An example would be as follow:

> *"<Name* of *the aerodrome operator> will monitor the deviation's status <fixed period* of *time> and ensure the safety measures has been effectively carried out and the level* of *safety is not compromised at any time. <Name* of *the aerodrome operator> will review the safety assessment process, if required ... "*

2.7.3 For temporary deviations, the aerodrome operator should also notify CASA PNG after the deviation has been corrected.

2.8 Submission of Aeronautical Study to CASA PNG

3.1 The aerodrome operator should note the guidance provided in this AC 139-15 and use the suggested checklist provided in Appendix A to ensure that any Aeronautical study submitted to CASA PNG for consideration of acceptance is thoroughly conducted and documented.

2.9 Reference

CAR Part 139;
ICAO Annex 14, Volume I;
Doc 9981- Procedures for Air Navigation Services - Aerodromes
Doc 9774 - Manual on Certification of Aerodromes; and
Doc 9859 - Safety Management Manual.

APPENDIX A

PNG Advisory Circular AC 139-15

Appendix A - Checklist for Aeronautical Study

The purpose of this Appendix A is to provide aerodrome operators with a *suggested checklist for reviewing of an aeronautical study.*
Aerodrome operators may use this checklist as a *guide for developing an aeronautical study tailored to his individual situation.*

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

CHECKLIST FOR AERONAUTICAL STUDY	YES	NO	REMARKS
1. Aim of the study including (a) Address safety concerns, (b) Identify safety measures, and (c) Make reference to specific SARP in CAR Part 139;	❑	❑	
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 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. Recommendations (including operating procedures/ restrictions or other measures to address safety concern) of the aeronautical study and how the proposed deviation will not pose a drop in 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 CASA PNG once the temporary deviation has been corrected.	❑	❑	

APPENDIX B

Advisory Circular AC 139-15

Appendix B - Hazard Log

The purpose of *this Appendix B is to provide aerodrome operators with* a *suggested hazard log for safety* assessment of *an aeronautical study. Aerodrome operators may use this log* as a *guide to formulate his own log. This log should be constantly updated throughout the aeronautical study life-cycle.*

A sample hazard log for safety assessment of an aeronautical study is as shown below:

Type of operation or activity	Hazard and Description	Consequences Identified	Risk Index	Risk Tolerability	Risk Control/ Mitigation	Residual Risk Index	Residual Risk Tolerability	Action, if any to further reduce risk(s) and the resulting risk index and the residual risk tolerability.
Aircraft Operation	Operation of Code 4E aircraft in PMIA. Code E aircraft using runway for landing and take-off...	i. Wingtip collision at International Terminal Apron Parking bay 2 and Bay 1. ii. Loss of control of aircraft during pushback/ towing operations.	3C	Tolerable	i. Use of wingtip walkers/ ushers. ii. Aircraft to taxi at <*speed value*>. iii. Training of staff for pushback/ towing operations. iv. Restrictions on other aircraft movements within parking bay 2.	2D	Acceptable	i. Conduct trials to study the effectiveness of the implementation ii. Resulting risk: 2E iii. Residual risk tolerability: Acceptable