NAMIBIA CIVIL AVIATION AUTHORITY

Advisory Pamphlet (AP)

AGA-AP139/01

CONDUCT OF AERONAUTICAL STUDIES

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Reinhard Gärtner

Interim Executive Director of Civil Aviation

CONDUCT OF AERONAUTICAL STUDIES

1. PURPOSE

This Advisory Pamphlet (AP) provides guidance to Aerodrome Operators on the conduct of aeronautical studies to meet the requirements of the NAMCAR, Part 139 and the associated technical standards.

2. BACKGROUND

(a) NAMCAR Part 139 requires an aerodrome operator to conduct an aeronautical study and to establish an alternative level of compliance whenever there is a deviation from any standards and procedures published for the design and operation of an aerodrome.

(b) NAMCAR Part 139 states that the Executive Director may require an operator of an aerodrome to conduct an aeronautical study for any significant change or changes that may affect the safety of the aerodrome operations.

(c) NAMCAR Part 139 further states that the Executive Director may grant an exemption where the results of an aeronautical study conducted indicates that an alternative level of compliance may be established without compromising safety.

(d) Below are the extracts from the Civil Aviation Regulations Part 139 – Aerodromes, to which this Advisory Pamphlet apply.

3. EXTRACTS FROM NAM-CAR, PART 139 – AERODROMES

139.01.9 Deviations

(1) An aerodrome operator must publish in the aerodrome manual, any deviation from the requirements stipulated in this Part, or from any standards and procedures published for the design and operation of an aerodrome.

(2) Any deviations in terms of sub-regulation (1) must be approved by the Executive Director where the results of an aeronautical study conducted in accordance with regulation 139.01.35, indicates that an alternative level of compliance may be established without compromising safety.

139.01.35 Aeronautical studies

(1) An operator of an aerodrome must monitor its operations for any significant change or changes that may affect the safety of aerodrome operations.

(2) Notwithstanding sub-regulation (1), the Executive Director may require an operator of an aerodrome to conduct an aeronautical study for any significant change or changes that may affect the safety of aerodrome operations.

139.01.43 Exemptions

(1) The Executive Director may in accordance with Section 46 of the Civil Aviation Act, grant an aerodrome operator, an exemption from specific provisions of these regulations taking into account all safety-related aspects of the aerodrome.

(2) Any exemptions in terms of these regulations may be approved by the Executive Director where the results of an aeronautical study conducted in accordance with regulation 139.01.35, indicates that an alternative level of compliance may be established without compromising safety.

CONDUCT OF AERONAUTICAL STUDIES

1. INTRODUCTION

1.1 This Advisory Pamphlet (AP) provides information and guidance to assist aerodrome operators and any other parties when undertaking an aeronautical study.

1.2 An aeronautical study is a study of an aeronautical problem to identify possible solutions and select a solution that is acceptable without degrading safety. An aeronautical study may be conducted in cases of deviations or exemptions from the specified requirements in Part 139 and the associated technical standards.

1.3 The objectives of an aeronautical study are to;

a) study the impact of deviations from the regulatory requirements and standards;
b) present alternative solutions to ensure the level of safety remains acceptable;
c) estimate the effectiveness of each alternative solution presented; and
d) recommend operating procedures/restrictions or other measures to compensate for the deviation or exemption.

1.4 An aeronautical study may be used as a tool to review aerodrome and airspace processes and procedures to ensure that the safety criteria in place are appropriate. The study can be undertaken in a variety of ways using various analytical methods appropriate to the aeronautical study requirements.

1.5 The aeronautical study should include:

a) current status review (baseline);
b) quantifiable data analysis;
c) stakeholder interviews;
d) safety /risk matrix.

1.6 An aeronautical study provides a holistic view of an aerodrome's operational environment as opposed to a safety case study which is task specific. An aeronautical study may contain many elements; however the key components are risk assessment, risk mitigation and risk elimination. In addition, the aeronautical study may include constraints in the aviation system.

1.7 The goal of risk management in an aeronautical study is to identify risks, and take appropriate action to minimise the risk as much as is reasonably practicable. 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 significant impact on an aerodrome's operation and for an effective outcome there should be a level of consensus as to their acceptability among the key stakeholders.

1.8 This AP describes the trigger factors that may lead to an aeronautical study, the scope of an aeronautical study, the conduct of the study and the types of activities that should be included in the study. The AP also describes a generic model of an aeronautical study methodology consisting of seven (7) steps. This AP does not include a formula that is guaranteed to give the correct solution, nor does it tell the individual or organisation conducting an aeronautical study what it should value. The appropriate constraints and goals are left to the judgement of those carrying out the study.

1.9 The aeronautical study should be seen as a framework for effective decision-making, rather than as a guaranteed process to come up with the correct outcomes. The framework described in this AP proposes a systematic method, and some tools, for analysing complex risk issues so as to help the decision-maker to make decisions with confidence and, if necessary, to articulate these decisions.

1.10 Aerodrome operators should also undertake aeronautical studies when the aerodrome operating environment changes. These changes are normally precipitated by a trigger event such as a change, or a proposed change in; airspace design, aircraft operations, aerodrome infrastructure or the provision of an air traffic service. In all cases the aeronautical study should document and demonstrate the site-specific need and rationale for the level of service, procedure design or operational requirements.

2. FACTORS THAT MAY TRIGGER AN AERONAUTICAL STUDY

2.1 An aeronautical study is a tool for the aerodrome management to use as part of its operations and strategic planning and is an integral part of the aerodrome's Quality Assurance and Safety Management Systems.

2.2 One of the purposes of the aeronautical study is to determine levels of operational safety, service or procedures that should apply at a particular location. The decision to undertake this type of study may be triggered by any one or more of a wide range of factors, including:

a) the number of aircraft movements;
b) the peak traffic periods;
c) the ratio of instrument flight rules (IFR) to visual flight rules (VFR) traffic;
d) the type of operations - scheduled, general Aviation (GA), training, etc;
e) the types, and variety of types, of aircraft using the aerodrome (jet, turbo-prop, rotary, etc);
f) aerodrome layout;
g) aerodrome management structure;
h) runway or taxiway and associated manoeuvring areas;
i) operations of a neighbouring aerodrome or adjacent airspace.

2.3 Feedback about any changes should be sought from aviation stakeholders including pilots, individuals and other representative groups as part of the study.

2.4 An aeronautical study may be initiated by the Executive Director NCAA, an aerodrome operator or another interested party, such as an air traffic service provider or air operators.

2.5 The NCAA can assist in identifying whether an aeronautical study is required and the appropriate methodology for the aeronautical study and in reviewing the aeronautical study.

3. SCOPE OF AERONAUTICAL STUDY

3.1 An aeronautical study can be undertaken at any time. It is constructed to consider all relevant factors, including traffic volume, mix and distribution, weather, aerodrome role, aerodrome and airspace configuration, surface activity and the efficiency requirements of operators using the service. The scope of studies can range from minor adjustments to aerodrome configuration, e.g. from the widening of a taxiway to a complete review of aerodrome airspace with the introduction of a new runway.

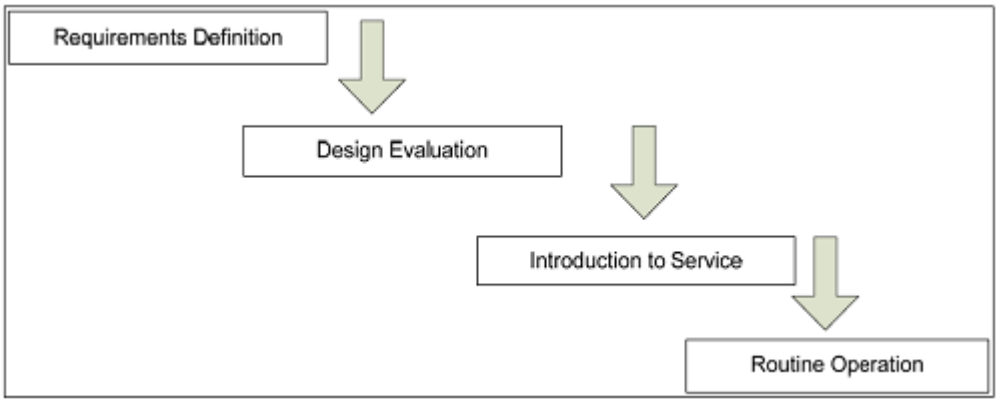
3.2 The scope of an aeronautical study usually reflects one of three situations–

a) the existing operation, e.g. the aerodrome, airspace or ATS (or sometimes just a particular part of the operation);
b) a change to the existing operation;
c) a new operation.

3.3 Where the aeronautical study is used to consider a change to existing operations or a new operation, it may not initially be possible to provide all the safety assessment and evidence required. An aeronautical study can 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).

3.4 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 and extensive consultation with customers and stakeholders using various interview and data gathering processes. This may identify any changes that are required to ensure the safe, orderly and efficient operation of the aerodrome.

3.5 Larger projects may have distinct phases such as requirements definition, design evaluation, introduction to service and routine operation. In this case, the aeronautical study can be presented in parts corresponding to these phases as information becomes available; this is illustrated in the flow chart below:



4. AERONAUTICAL STUDY PROCESS

4.1 The study content

4.1.1 There will be a number of hazards in any aerodrome environment. These must be identified so that the risks associated with each hazard can be determined. It important to start the process by identifying a number of key events and then deciding what hazards and threats can lead to those events and their possible consequences.

Note. Advisory Pamphlet AGA-AP139/03 Aerodromes SMS provides guidance on hazard identification.

4.1.2 The class of airspace or type of air traffic service required is primarily determined by the level of risk at the aerodrome and in its immediate airspace. The next stage is to assess the risk levels. The relative risk levels can then be used to identify the threats that have the highest risk, after which it will be possible to determine what, if any, controls can be put in place to reduce the risks. While this type of study is aimed at determining the appropriate airspace environment at and around an aerodrome, these tools may highlight other risk areas.

4.2 Estimating risk levels

4.2.1 There are several tools that can be used to estimate the risks at an aerodrome. This AP discusses the Collision Risk Model and Aerodrome Complexity Model.

Collision Risk Model (CRM)

4.2.2 A widely-used tool for aeronautical studies is the collision risk model (CRM). This tool is normally used by airspace designers, air navigation service providers or specialist consultants.

4.2.3 The basic output of the CRM is the relative risk of collision between two aircraft (or an aircraft and a parachute) whose intended tracks would bring them into a collision zone. Such pairs are referred to as “conflict pairs”. The relative risk is affected by the environment (type of airspace, service, aircraft) but not by the number of movements. Multiplying the relative risk of collision by the annual number of conflict pairs gives an annual collision risk, which can then be compared to some measure of acceptable risk.

4.2.4 The CRM estimates the risk of collision from failure to take considered action (failure of the control) and failure to take evasive action (failure of the mitigation). As its name suggests, the pilot has some time to initiate a considered action, which is generally the result of information received by radio. A problem close to the collision zone is generally detected visually and requires evasive action. An action initiated within a few seconds of the collision zone is typically too late to alter the flight path sufficiently, so whether a collision takes place or not is a matter of chance.

4.2.5 The model considers the various factors that can lead to the need for considered action and to evasive action, and arranges them in a tree leading to the collision zone. The linking of the branches of the tree is by arithmetical ‘AND’ and ‘OR’ operators. Thus to reach the collision zone, both considered action and evasive action must fail. If one aircraft has no radio or is on the wrong frequency, then radio communication fails.

4.2.6 A numerical risk is assigned to each contributory factor, and thus the risk of reaching the collision zone can be calculated. Whether the aircraft will actually collide in the collision zone depends on the collision geometry and a collision geometry factor is applied to allow for this.

4.2.7 For a collision to take place, the two aircraft must initially be on a collision course, at least to the extent that, uncorrected, they will occupy the collision zone at the same time. These pairs are termed “conflict pairs”. The total number of pairs that may become conflict pairs can be calculated from traffic data.

Aerodrome Complexity Model

4.2.8 This model assumes that the complexity of operating at, and in the environment of, an aerodrome bears a relationship to pilot workload and hence to the risk of accident. The model therefore identifies a number of complexity factors and scores these according to the relative influence that they are deemed to have. The number of movements and the VFR/IFR (visual flight rules/instrument flight rules) mix are then taken into account and an overall complexity score calculated.

4.2.9 Typical complexity factors include the number and disposition of runways and taxiways, the types of operation, the topography and extreme weather conditions that may be expected.

4.2.10 This tool allows an aerodrome operator, for example, not only to determine a score that may be compared against some criterion, but also interactively to identify those areas of aerodrome planning where complexity may be reduced.

4.3 Consultation

4.3.1 It is essential that, in conducting the aeronautical study, there is consultation with as wide a range of aerodrome users and other stakeholders as possible. Different users have different views of hazards and the corresponding threats, controls, mitigations and consequences.

4.3.2 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 allow the proposed deviation or exemption 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 aerodrome senior management before it is submitted to the NCAA for consideration and acceptance.

4.3.3 The following should be included in the consultation:

a) Aerodrome operators of adjacent affected aerodromes;
b) Aerodrome users;
c) Airspace user groups;
d) Aircraft operators and operator groups;
e) Pilot organisations;
f) Air traffic service providers

4.3.4 Consultation undertaken in open meetings, where ideas can be exchanged and debated, generally results in consensus being achieved. Individual consultation, on the other hand, tends to result in dissatisfaction for those whose proposals or viewpoints are not eventually accommodated.

Note. An example of an aeronautical study methodology consisting of seven (7) steps is provided as Appendix 1 to this AP.

5. CONTENTS OF AN AERONAUTICAL STUDY REPORT

5.1 An aeronautical study report submitted to the NCAA 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.

5.2 Aim of the study

5.1.1 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 Part 139 requirement or standard which the study is meant to address.

5.1.2 An example to illustrate this would be as follows:

"The aim of this aeronautical study is to address the operation of Code F aircraft in a Code 4E aerodrome, (name of aerodrome) and to put in place (list of safety measures) necessary to ensure safe operation of Code F aircraft in (name of aerodrome) with reference made to (reference to specific Part 139 requirement or standard)…"

5.2 Background

5.2.1 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:

a) What is the current situation?
b) Where are the areas that will be affected by the proposed deviation?
c) When will the applicant be able to comply with the specific standard if it is due to a significant change at 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?

5.2.2 An example to illustrate this would be as follows:

"Currently, (name of aerodrome) is Code 4E aerodrome with some Code 4F capabilities. These Code 4F capabilities includes (list of the Code 4F capabilities)... (Name of aerodrome) is required to handle Code F 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 aerodrome) will be upgraded to a Code 4F aerodrome.

Upgrading (name of aerodrome) from Code 4E to Code 4Faerodrome 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 aerodrome) will be affected in the following ways…"

5.3 Safety Assessment

5.3.1 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 aerodrome operator/ applicant – a key aerodrome certification requirement. A safety assessment usually consists of the following:

a) Identification of hazards and consequences; and
b) Risk management.

5.3.2 The safety assessment methodology described in Advisory Pamphlet *AGA-AP139/03 Aerodromes SMS,* should be used by aerodrome operators and other parties to conduct hazard identification and risk management when conducting an aeronautical study.

5.3.3 Hazards and its consequences should be identified and recorded in a hazard log. The aerodrome operator has 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 consequence.

5.3.4 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.

Note. A sample hazard log is provided as Appendix 3 to this AP to assist the aerodrome operator in formulating its own hazard log to suit the aeronautical study.

5.3.5 The aerodrome operator should develop risk control measures in accordance with the guidelines in Advisory Pamphlet *AGA-AP139/03 Aerodromes SMS.*

5.4 Recommendations

5.4.1 To allow the aerodrome operator and the NCAA to be convinced and assured that the proposed change (development, deviation or exemption) will not pose a threat to 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 safety concerns arising from the proposed change, deviation or exemption.

5.4.2 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.

5.4.3 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 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)

5.5 Conclusion

5.5.1 The aerodrome operator, after taking into account all the necessary considerations listed above, should be able to summarize 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.

5.5.2 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)..."

5.6 Monitoring of the Deviation

5.6.1 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.

5.6.2 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…"

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

6. SUBMISSION OF THE REPORT TO THE NCAA

6.1 An aerodrome operator should ensure that any aeronautical study submitted to NCAA for consideration of acceptance is properly conducted and is appropriately documented.

6.2 A sample checklist is provided as Appendix 2 to this AP to assist the aerodrome operator to review the aeronautical study and the report before submitting to the NCAA for acceptance.

APPENDIX 1 EXAMPLE OF AN AERONAUTICAL STUDY METHODOLOGY

A generic model of an aeronautical study methodology consists of seven (7) steps as follows:

STEP 1: Initiation
STEP 2: Preliminary Analysis
STEPS 3 and 4: Risk Estimation
STEP 5: Risk Evaluation
STEP 6: Risk Control
STEP 7: Action/Monitoring

STEP 1: Initiation

This step consists of defining the opportunity or problem and the associated risk issues; setting up the risk management team; and identifying potential users who may be affected by any change.

STEP 2: Preliminary Analysis

The second step consists of defining the basic dimensions of the risk problem and undertaking an initial identification, analysis and evaluation of potential risks. This preliminary evaluation will help determine:

a) whether a situation exists that requires immediate action;
b) whether the matter requires further study prior to any action being taken; or,
c) whether the analysis should be ended as the risk problem is determined not to be an issue.

STEPS 3 and 4: Risk Estimation

These steps estimate the degree of risk. Step 3 estimates the severity of the consequences and step 4 estimates the probability of their occurrence.

STEP 5: Risk Evaluation

The benefits and operational costs of the activity are integrated into the analysis and the risk is evaluated in terms of the safety implications of the activity and of the needs, issues, and concerns of affected users.

STEP 6: Risk Control

This step identifies feasible risk controls and mitigations which will act to reduce either the probability of the event or the consequence of the event should it occur.

STEP 7: Action/Monitoring

This step entails implementing the chosen risk control options, evaluating the effectiveness of the risk management decision process, and implementing an ongoing monitoring program.

APPENDIX 2 SAMPLE CHECKLIST FOR AERONAUTICAL STUDY

	STUDY CONTENT	YES	NO	REMARKS
1.	Aim of the study including –			
	(a) Address safety concerns;			
	(b) Identify safety measures; and			
	(c) Make reference to specific Part 139 requirement			
2.	Consultation with stakeholders, senior management team and divisions/departments affected			
3.	The study is approved by a senior executive of the Organisation			
4.	Background information on the current situation			
5.	Proposed date for complying with the Part 139 requirements, 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			
13.	Notification to NCAA once the temporary deviation has been corrected			

APPENDIX 3 SAMPLE HAZARD LOG

S/N	*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*
1	Aircraft operation	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	