REPUBLICA DE MOÇAMBIQUE

INSTITUTO DA AVIAÇÃO CIVIL DE MOÇAMBIQUE

Technical Circular CT 100-002

SUBJECT: **GUIDANCE MATERIAL ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT.**

Date: 12/09/2014

a. Authority

This technical circular is issued by the Executive Chairman of the Instituto de Aviação Civil de Moçambique (IACM) in pursuance of powers vested in him under Article 31 of Law 21/2009 of 21 September and Article 12 of Resolution 19/2011 of 30 November.

2. Purpose

This document provides guidance to operators on the conduct of Aeronautical Study and risk assessment where the operator is unable to meet MOZCAR requirements and need to identify alternative measures to achieve an equivalent or acceptable level of safety.

3. Applicability

To operators, who intend to conduct aeronautical studies and risk assessments for their equipment, infrastructure, aerodromes, systems, procedures or services.

4. References

a) ICAO Doc 9774 AN//969 Manual on Certification of Aerodromes
b) ICAO Doc 9859 AN/474 Safety Management Manual (SMM), chap 5
c) ICAO Annex 15
d) ICAO Annex 6
e) REG IS-002

5. Changes

This Technical Circular (TC) cancels the Aeronautical Information Circular AIC 23/2013 – *Guidance material on conducting aeronautical studies and risk assessment.*

6. Background

a. MOZCARs contain basic provisions on the use of Aeronautical Studies as a means to identify potential risks and measures to achieve an equivalent or acceptable level of safety by means other than full compliance with a specific requirement.

b. It is important to note that the preferred option must always be to seek

compliance with the requirements. In order to achieve an equivalent or acceptable level of safety by other means, one must usually establish mitigating measures that affect the efficiency and usability of the infrastructure, procedure or system.

c. The applicant must demonstrate evidence of a constraining physical reason for not complying with the prescribed standards. Lack of time, financing or lack of staff for example shall not be accepted as constraining reasons.

d. 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".*

7. Responsibility of Conducting Aeronautical Study

If an operator cannot meet the requirements, he needs to conduct Aeronautical studies and Risk Assessment which will address an alternative means of compliance. Consequently, the responsibility of justifying an application by means of an Aeronautical Study rests with the operator.

8. Participants in the Aeronautical Study

In most cases, specific operational expertise is needed. 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.

9. Steps 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:

A description of problems and objectives.
Selection of procedures, methods and data sources.
Identification of undesired events.
An analysis of causal factors, severity and likelihood.
A description of risk.
Identification of possible mitigating measures
An estimation of the effectiveness of mitigating measures
Choice of mitigating measures
Presentation of results.

A description of problems and objectives:

The first step of any risk analysis is to define the deviation and the objective of the exercise. The case study will be to identify the safety implications of not complying (in full) with a certain requirement or requirements. The objective will be to identify suitable mitigating measures, which will address these safety implications. Thus, it is important to understand which hazards and scenarios the requirement(s) in question are designed to protect against.

9.3 Procedures, methods and data sources:

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

9.4 Identification of hazards:

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?**

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

- Aircraft colliding with terrain, aircraft, vehicles or objects.
- Aircraft colliding with, or ingesting wildlife or foreign objects debris
- Failure or outage of a new or modified system
- Feasibility and applicability of a new procedure
- Constraints

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

- During flight (approach, landing, balked landing, take-off, climb-out)
- 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.

9.5 An analysis of causal factors, severity and probability

9.5.1 Causal Factors

The basic questions are:

- Why can it go wrong,
- How likely is it that it will go wrong, and
- What is the consequence if it does go wrong ?

Examples of 'why' include, but are not limited to:

- Lack of information
- Absence of or confusing guidance (non-visual aids, lights, markings, signs, and charts).
- Inaccurate aeronautical data
- Insufficient situation awareness
- Insufficient separation distances
- Insufficient maintenance programmes
- In some cases these factors can contribute to an accident and in other cases they

can increase the consequences of an incident so that it becomes an accident.

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

This is a probability issue. How often is it likely to occur within a certain number of movements? The Table below also extracted from ICAO doc 9859 – Safety Management Manual gives the probability levels and their descriptions.

Meaning		
Frequent	Likely to occur many times (has occurred	5
Occasional	Likely to occur sometimes (has occurred	4
Remote	Unlikely to occur, but possible (has occurred	3
Improbable	Very unlikely to occur (not known to have	2
Extremely Improbable	Almost inconceivable that the event will occur	1

9.5.3 Safety Risk Severity

What are the (potential) consequences if it occurs?
The severity of the occurrence is better described by using the table below extracted from ICAO doc 9859 – Safety Management Manual.

Severity of occurrence	Meaning	Value
Catastrophic	— Equipment 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 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	— Little consequences	**E**

9.6 Risk Assessment

1. Risks are the potential adverse consequences of a hazard, and are assessed in terms of their severity and probability.
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 shown below. If the risk comes out as medium or above, risk reduction measures must be identified.

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**

3. 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 probability of an occurrence.

4. 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.

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

a) Publication in the AIP as a minimum. (This is an ICAO Annex 15 Standard and is also necessary in order that the airlines can take their precautions, as they are obliged to do according to ICAO Annex 6.)

b) Operational restrictions that might be necessary.

c) 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;

5. Mitigating measures usually means reduced usability for an infrastructure, system or equipment. Safety and usability is a balancing act.

9.7 Estimating the effect of mitigation

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

9.8 Choice of mitigating measures

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.

9.9 Presentation of results

9.9.1 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.

Other key issues:

a) What essential assumptions, presuppositions and simplifications have been made?
b) Any uncertainty about the results due to the choice of and availability of methods, procedures and data sources should be discussed.

9.9.2 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.

10. Acceptance by the Civil Aviation Authority of the Republic Of Mozambique IACM

The Aeronautical Study and Risk assessment results need to be submitted to the IACM for review and approval.

The IACM will review the aeronautical study and, when satisfied that the required level of safety will be maintained, issue an exemption for a defined period of time, under the conditions specified and subject to periodical review. If IACM is not satisfied that the required level of safety will be maintained or that the reasons for granting an exemption are valid, it shall decline it.

The conditions under which an exemption has been granted shall be verified at regular intervals by the IACM.

Maputo, 19 September 2014

INSTITUTE OF CIVIL AVIATION OF MOZAMBIQUE

THE CHAIRMAN OF THE BOARD AND CEO

Capt João Martins de Abreu