

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 1 of 13</p>

1. PURPOSE

This Advisory circular (AC) provides guidance to 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. Although this AC 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.

2. REFERENCE

- 2.1 Manual of Aerodrome Standards, 4th edition, December 2016
- 2.2 Manual of Aerodromes Certification Procedures
- 2.3 Civil Aviation (Aerodromes) Regulations, 2017

3. BACKGROUND

3.1 The Tanzania Civil Aviation (Aerodromes) Regulations, as amended contains basic provisions on the use of Aeronautical Studies as a means to identify alternative ways to achieve an equivalent level of safety 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.

4. DEFINITION

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.”

This is a controlled document	Issued February 2017
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	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 2 of 13</p>

5. RESPONSIBILITY OF CONDUCTING AERONAUTICAL STUDY

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

6. PARTICIPANTS IN THE AERONAUTICAL STUDY

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

7. AERONAUTICAL STUDY CONSIDERATIONS

After receiving such notice, the Director will conduct an Aeronautical Study to determine the effect of the intended proposal on the safe and efficient use of airspace, by aircraft, and on the safety of persons and property on the ground.

Some of the factors considered in the Study are:

- a) the impact on existing or anticipated traffic circuits of neighboring aerodromes or heliports;
- b) the impact on existing and projected airspace use;
- c) the impact on safety of persons and property within the affected area;
- d) impact of existing or proposed man-made objects;
- e) natural objects and features within the affected area;
- f) the adjustment of other aviation requirements that may be needed to accommodate the proposal; and
- g) Wildlife hazard management and the impact associated with wildlife.
- h) Bird attractants.
- i) possible revisions of the proposal that may be necessary to eliminate a hazardous or inefficient use of airspace

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 3 of 13</p>

8. MATTERS THAT CAN NOT BE CONSIDERED

The Aeronautical Study is focused solely on matters that affect the safety and efficiency of airspace use and the safety of persons and property on the ground. It is not the role of the Tanzania Civil Aviation Authority to deal with matters relating to noise or other environmental issues, the effect on lifestyle or property values, or the effect on other services in the area such as roads, railways etc.

9. ITEMS TO BE CONSIDERED IN AERONAUTICAL STUDIES FOR NEW OBJECTS AT EXISTING AERODROMES

a. Consideration of non-normal operations.

The PANS-OPS obstacle clearance surfaces (OCS) cater for normal operations. The margin between these and the Annex 14 obstacle limitation surfaces (OLS) is the only airspace available to contain maneuvers associated with non-normal operations. These include such events as uncontained engine failures after takeoff, maneuvering in marginal visibility, operator's contingency procedures, emergencies, flight management system faults, and human errors. While rare or extremely rare, such events do occur, and their probability has to be balanced against the consequences when they relate to a dispensation granted by an aeronautical study.

b. Risk calculations for OLS penetrations

A number of statistical studies have been made on runway end safety areas and on the risk to individuals in airport planning. However, any calculation of risk to aircraft as a function of degree or number of OLS penetrations is fraught with problems and is probably intractable. Firstly, non normal operations need not be confined to the orientation of the runway(s). Secondly, there is at present no objective method of determining a maximum or acceptable obstacle penetration and density. Finally, when preparing for low-probability risks, it is a mistake to gear the protection to the perceived likelihood of occurrence, rather than the severity of the consequences.

c. Consequences of an accident involving an aeronautical study

Accidents involving loss of lives near aerodromes can result in public enquiries or the equivalent legal processes. These as are normally conducted by a judge or magistrate, and being a legal process are more far reaching than the normal investigation carried out by the State accident investigation body. Such enquiries can and have resulted in significant financial, legal and operational consequences to the aerodrome. Where the accident involves a dispensation from Standards and Recommended practices, the logic

This is a controlled document	Issued February 2017
-------------------------------	----------------------

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 4 of 13</p>

associated with that departure becomes a critical issue. Thus the remote probability associated with such events has to be balanced against the more serious consequences.

d. New objects at existing aerodromes

The view of many States regarding penetration of the obstacle limitation surfaces is that no new objects or extensions of existing objects are acceptable for existing aerodromes. Possible concessions are the temporary use of cranes in construction projects or equipment necessary for navigation or operational purposes. The clause of the Annex allowing dispensations at existing aerodromes via aeronautical studies is under review by the relevant ICAO Technical Panels.

e. Establishment of a precedent

One of the most important objections to allowing dispensation via an aeronautical study is that it establishes a precedent. Once a dispensation has been granted, it becomes very difficult to resist the next request for a similar dispensation. This applies not only at that particular aerodrome, but at other aerodromes and at aerodromes in other States. It also becomes a lever for commercial and political pressures.

f. Effect on navigational aids and radar

Sometimes forgotten is the effect of new obstacles on VOR and radar facilities. Annex 10 Part I Attachment C contains guidance for VOR, but radars are equipment specific. If a check of the clearance angle reveals problems, the next step is a proper evaluation by an expert, so this eventuality should be included in the aeronautical study budget.

g. Mitigating circumstances.

It is for the agency requesting a dispensation via an aeronautical study under Regulation 61,65, 66 and 132, to propose any associated mitigating circumstances, rather than for the aerodrome or aviation authority to justify the need for protecting the surfaces. However, the applicant must always be given the opportunity to state any considerations he may have and they must be covered in the report.

After identifying the safety aspects of an aeronautical study relating to OLS, dispensations, there is need to be aware of the ploys that are used in an attempt to justify such dispensations. Those contractors and agencies seeking dispensations frequently claim “mitigating circumstances”

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 5 of 13</p>

10. STEPS OF AN AERONAUTICAL STUDY

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

1. A description of problems and objectives.
2. Selection of procedures, methods and data sources.
3. Identification of undesired events.
4. An analysis of causal factors, severity and likelihood.
5. A description of risk.
6. Identification of possible mitigating measures
7. An estimation of the effectiveness of mitigating measures
8. Choice of mitigating measures
9. Presentation of results.

A description of problems and objectives

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. 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.

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.

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 6 of 13</p>

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 landing in front of the threshold, running off the far end of the runway or veering off the side of the runway.
- Aircraft colliding with, or ingesting wildlife or foreign objects

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

- During flight (approach, landing, bailed 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.

An analysis of causal factors, severity and probability

Causal factors

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:

- Lack of guidance (non-visual aids, lights, markings, signs, charts)
- Confusing guidance (non-visual aids, lights, markings, signs, and charts).
- Inaccurate obstacle surveys and obstacle publications
- Inaccurate aeronautical data
- Insufficient protected areas (strips and RESAs)
- Insufficient separation distances
- Insufficient surface widths
- Insufficient maintenance programmes

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

Causal factors

What are the (potential) consequences if it goes wrong?

This is a controlled document	Issued February 2017
-------------------------------	----------------------

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 7 of 13</p>

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	<ul style="list-style-type: none"> — Equipment destroyed — Multiple deaths 	A
Hazardous	<ul style="list-style-type: none"> — 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	<ul style="list-style-type: none"> — 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	<ul style="list-style-type: none"> — Nuisance — Operating limitations — Use of emergency procedures — Minor incident 	D
Negligible	<ul style="list-style-type: none"> — Little consequences 	E

Safety Risk Probability

How likely is it that it goes wrong?

This is a probability issue. How often is it likely to go wrong within a certain number of movements?

Table below also extracted from ICAO doc 9859 – Safety Management Manual gives the probability levels and their descriptions.

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 8 of 13</p>

	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

Risk Assessment

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

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.

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p style="text-align: right;">Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p style="text-align: center;">ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p style="text-align: right;">Page 9 of 13</p>

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

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.

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:

- 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.)
- 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.

This is a controlled document	Issued February 2017
-------------------------------	----------------------

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 10 of 13</p>

- Infrastructure and/or additional visual and/or non-visual aids.
- 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).
- Restrictions on aircraft operators that might be necessary, such as:
Operations restricted to operators/crew who can demonstrate special competence
- Requirements that aircraft carry special equipment or certifications
- Requirements that operators set special wind limits

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

Estimating the effect of mitigating measures

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

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

Presentation of results

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:

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

This is a controlled document	Issued February 2017
-------------------------------	----------------------

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 11 of 13</p>

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

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.

11. DETERMINATIONS

Following completion of the Study the Director General TCAA will make a determination regarding the proposal. Determinations will be one of the following:

(a) Unobjectionable when the Director is satisfied that the proposed action will not adversely affect the safe and efficient use of airspace by aircraft nor the safety of persons or property on the ground.

(b) Conditional when the study identifies objectionable aspects of a proposed action but specifies conditions which, if complied with, satisfy the Director that the proposed action will not adversely effect the safe and efficient use of airspace by aircraft, nor the safety of persons or property on the ground.

(c) Objectionable when the study identifies objectionable aspects of the proposed action. The Determination will specify the reasons for finding the proposed action objectionable.

The determination will be issued to the proponent, appropriate local authorities, and those who made submissions. The Determination will also be published on the Tanzania Civil Aviation Authority website and Aeronautical information publication.

Local Government Authorities administer the use of land under the provisions of the Land Act and it is likely that they will take due consideration of any Conditional or Objectionable Determination issued.

Effective period of the determination

Unobjectionable and Conditional Determinations shall contain a void date. The purpose of this is to allow for the orderly planning of aerodromes and to eliminate needless protection of airspace. An extension to the void date may be granted if there are valid reasons for not completing the action by the void date.

This is a controlled document	Issued February 2017
-------------------------------	----------------------

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 12 of 13</p>

Revision of the Determination

An Unobjectionable or Conditional Determination can be revised if any new facts that change the basis on which the determination was made are identified. Interested persons may, at least 14 days in advance of the void date, petition the Director to revise a determination.

12. MONITORING OF DEVIATIONS

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.

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..."

For temporary deviations, the aerodrome operator should also notify Director of Safety Regulation after the deviation has been corrected.

13. ACCEPTANCE BY THE REGULATOR

The right to accept or reject the results of the Aeronautical Study rests fully with the regulator.

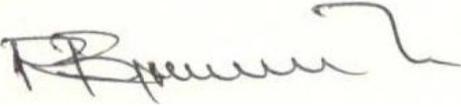
14. ISSUANCE OF EXEMPTION

The regulatory Authority, where satisfied with the results of the aeronautical study, equivalent level of safety and mitigating measures provided, may offer an exemption

This is a controlled document	Issued February 2017
-------------------------------	----------------------

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY SAFETY REGULATION</p> <p style="text-align: center;">AERODROME AND GROUND AIDS</p>	<p>Revision: 0</p>
<p>Document No. TCAA/QSP/SR/AC/AGA-023</p>	<p>ADVISORY CIRCULAR ON CONDUCTING AERONAUTICAL STUDIES AND RISK ASSESSMENT</p>	<p>Page 13 of 13</p>

to the compliance within the provision of the regulations. The exemptions may be withdrawn when the Authority is satisfied that the applicant is not inclined to resolving the non-conformances for which the exemptions were issued. Conversely, application for exemption may be disapproved by the Authority where the degree of hazard is intolerable and may significantly affect safety



Tanzania Civil Aviation Authority