1. PURPOSE

The purpose of this Advisory Circular (AC) is to provide guidance on the procedure for recording and reporting wildlife strikes to aircraft, the collection of information from aircraft operators, aerodrome personnel and other sources on the presence of wildlife on or around the aerodrome and an ongoing evaluation of the wildlife hazard by competent personnel.

2. REFERENCE

2.1 Civil Aviation (Aerodromes Designs and operations) Regulations 2024

2.2 Tanzania Civil Aviation Authority Manual of wildlife hazard management 3rd Edition civil aviation Authority

2.3 ICAO Doc 9137 – Part 3 Wildlife Hazard Management Fifth Edition, 2020

2.4 ICAO Doc 9332 - Manual on the ICAO Bird Strike Information System (IBIS)

3. INTRODUCTION

Regulation 251 of the Civil Aviation (Aerodromes Designs and Operations) Regulations requires the aerodrome operator to ensure information and data on wildlife strikes are recorded and reported to the Authority for appropriate safety risk management associated with the existence and migration of wildlife at aerodrome operational areas. The regulations further require that information on strikes be reported to ICAO for inclusion in the IBIS database. The intention of this AC is to provide the necessary guidance to operator in order to ensure effective implementation of these requirements.

A strike is a collision between wildlife and an aircraft; a “near miss” is the potential of a wildlife strike. To manage wildlife hazards, operator must first assess the level of risk for each species present. Recording wildlife presence (at a species level) on, and in the vicinity of, the aerodrome, wildlife strikes and near misses is therefore necessary.

The following events shall be recorded and used for assessing and mitigating the risk of wildlife hazards:

a) Any reported collision between wildlife and an aircraft for which evidence in the form of a carcass, feathers, any other remains, or damage to the aircraft is found;
b) Any reported collision between wildlife and an aircraft for which no physical evidence is found, but an indication of a collision exists (e.g. visual observation of the collision or acoustic perception of the impact);
c) Any wildlife found dead on an aerodrome without any other obvious cause of death; and
d) Incidents or observations where the presence of wildlife on or in the vicinity of the aerodrome could have an effect on a flight (e.g. missed approach, aborted take-off, etc.

4. LEGISLATIVE REQUIREMENTS

Regulation 251 of the Civil Aviation (Aerodrome Design and Operations) regulations, 2024 specifies as follows:

i. An operator shall, take all reasonable steps to minimise the risks associated with wildlife strike hazards

ii. An operator shall take practical measures to control the wildlife habitat at or around the aerodrome and to disperse birds, which are a potential hazard to aircraft operations.

iii. A wildlife strike hazard on, or in the vicinity of an aerodrome shall be assessed through
   a) The established procedure for recording and reporting wildlife strikes to aircraft
   b) The collection of information from aircraft operators, aerodrome personnel; and other sources on the presence of wildlife on, or around the aerodrome constituting a potential hazard to aircraft operations; and
   c) an on-going evaluation of the wildlife hazard by competent personnel.

iv. The aerodrome operator shall collect and forward wildlife strike reports to the Authority for submission to ICAO for inclusion in the ICAO Bird Strike Information System (IBIS) database.

v. The operator shall cause records of all aspects of wildlife hazard control to be kept and shall report all wildlife strikes to the Authority.

vi. An aerodrome operator shall take action to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.

5. COLLECTING, REPORTING AND RECORDING DATA ON WILDLIFE INCIDENTS AND OBSERVED WILDLIFE

The aerodrome operator shall have policies and procedures in place on how to obtain data related to hazardous wildlife species and their use of the aerodrome and its vicinity, to further assess such related hazards to aviation. For best results, data collection shall begin at the planning and design phase of an aerodrome and continue throughout its lifecycle.

This data will mainly contain records of:

a) wildlife observed at the aerodrome and its vicinity;
b) wildlife control activities;
c) Incidents with wildlife;
d) wildlife strikes and near misses;
e) areas of high wildlife activity on the aerodrome and in its surroundings; and
f) wildlife observations or surveys from the aerodrome's vicinity taken periodically, at least seasonally and noting migratory activities.

5.1 Wildlife observations and control activities records

A record of all observed wildlife activity on an aerodrome and in its vicinity shall be maintained. Aerodrome personnel involved in wildlife control shall record these observations and include, at a minimum

a) the type of wildlife activity and movements (for example: direction and altitude);
b) control action taken and effect;
c) the preferred areas frequented by wildlife; and
d) the frequency of presence of hazardous species detected.

These records shall be written using the standardized templates prepared by the aerodrome and made available to wildlife control personnel. It is recommended that the records be accompanied by maps of the aerodrome, indicating the location of observations or control activities. These observations shall be followed up by periodic surveys and/or studies.

5.2 Periodic wildlife surveys

Appropriate data on the presence and behaviour of wildlife on, and in the vicinity of, the aerodrome may also be obtained by means of periodic surveys. Wildlife surveys shall cover the entire year to account for seasonal changes and shall also consider different phases of the day. The survey shall also consider aircraft movements, runways in use and wildlife behaviour. The greater the presence of hazardous wildlife, the greater the need to conduct surveys to gather information.

The sampling method shall be consistent, systematic and replicable, for the data to be comparable over time. This sampling method shall also be aligned with the data collected in observation records.

The possibility of using different data sources and methodologies to carry out the surveys will depend on the material and human resources of the aerodrome.
The periodic surveys shall be carried out by personnel with the knowledge and experience of studying wildlife.

There are many methods to conduct wildlife surveys. For example, wildlife observation points can be used to record the species seen and their behaviour during a clearly defined period of time. There are also sampling methods using paths of a specific length in which the wildlife observed along a route is recorded (referred to as transects), carried out on foot or by vehicle.

5.3 Wildlife incidents records and reporting

5.3.1 All stakeholders must report wildlife-related incidents defined in section 3 to the aerodrome operator

The aerodrome operator shall have well-defined reporting procedures in place for wildlife-related incidents with different stakeholders and shall ensure the appropriate and meaningful review of data, while considering all circumstances. All stakeholders shall be made aware of the procedures described in the aerodrome manual or any associated aerodrome documentation.

A wildlife incident reporting form shall be included in the procedure and made available to all stakeholders. The forms to be used by the aerodrome operator or other stakeholders at the aerodrome shall contain, at minimum, the following:

a) operator involved;
b) aircraft make/model;
c) engine make/model;
d) aircraft registration;
e) date (dd/mm/yyyy);
f) local time;
g) dawn/day/dusk/night;
h) aerodrome name;
i) runway used;
j) location if en route;
k) height above ground level in ft;

l) speed indicated airspeed in kt;

m) phase of flight:

n) part(s) of aircraft struck or damaged:

o) effect on flight:

i. none;

ii. aborted take-off;

iii. precautionary landing;

iv. engines shut down;

p) sky condition:

i. no cloud;

ii. some cloud;

iii. overcast;

q) precipitation:

i. fog;

ii. rain;

iii. snow;

r) wildlife species;

s) number of wildlife:

1. seen;
2. struck:

t) size of wildlife:

1. small;
2. medium;

3. large;

u) pilot warned of wildlife: yes/no;

v) remarks (description of damage, injuries and other pertinent information);

w) reporting person/organization;

x) address and/or instructions for returning the form to the competent authority; and

y) address within the State to which any wildlife remains, including feather fragments, shall be sent.

5.3.2 The aerodrome operator shall report wildlife incidents to the Authority in accordance with national regulations on incident reporting.

All incidents, regardless of damage or evidence, shall be collected and reported to the Authority though the attached IBIS report form for submission to ICAO for inclusion in the ICAO bird strike information system database.

Wildlife species identification shall be as accurate as possible. It is therefore essential for wildlife personnel to be adequately trained. The aerodrome operator shall have a procedure in place for the collection, management, conservation and identification of animal remains to identify a species after a strike as well as any remaining organic material using DNA analysis.

5.4 Inventory of attractive areas for wildlife

The aerodrome shall keep a record of areas with wildlife attraction or concentration in the aerodrome and its vicinity. This inventory shall lead to an analysis of the existing habitat and

include reasons why wildlife species may be attracted. Certain habitats attract species for food, water or shelter.

6.0 AERODROME WILDLIFE SAFETY RISK ASSESSMENT

6.1 INTRODUCTION TO SAFETY RISK MANAGEMENT

Aerodrome operators shall conduct a specific safety risk assessment of the wildlife situation and use the results to help target wildlife management measures and monitor their effectiveness. Safety risk assessments should be updated and repeated at regular intervals, commensurate with assessed risks.

The aerodrome operator's wildlife safety risk assessment should, as a minimum:

a) define the area for the safety risk assessment, which would, in most cases, be the entire aerodrome but may also include the vicinity of the aerodrome;
b) rate the strike probability using strike data from reports for each species, information on the presence of species, and the number of individuals and their biology, and update the data and probabilities regularly;
c) rate the severity of damage arising from those strikes for each species;
d) determine the risk for each species; and
e) identify the causes (attractants, migration routes) of each wildlife hazard.

Knowledge of the wildlife living in the aerodrome and its vicinity, their movements and to which areas they are attracted, is essential. This can be achieved with an adequate wildlife monitoring programme and by keeping historical records.

An important element of the safety risk assessment is understanding the definitions used for aerodrome wildlife management:

a) A hazard is a condition or object with the potential to cause or contribute to an aircraft incident or accident. In this context, a hazard is the presence of certain wildlife on or near an aerodrome; and

b) A safety risk is the predicted probability and severity of the consequences or outcomes of a hazard. In this context, safety risk is the probability of a wildlife strike by a particular species multiplied by the severity of damage to the aircraft that might reasonably occur.

Safety Risk = (Probability of a strike) × (Severity of damage caused)

Any assessment of risk needs to estimate the probability that a strike will occur and the likely level of harm that may result. Estimation of harm is relatively straightforward because the analysis of various wildlife strike databases around the world show that there is a consistent relationship between wildlife mass and the percentage of damage to aircraft. Strikes involving flocks of a given species of bird are more likely to result in damage to the aircraft than strikes with single birds of the same species. The larger the bird and the greater its tendency to be struck in groups, the greater the risk.

It is more difficult to estimate the likely strike frequency of a particular population of birds or other wildlife because their behaviour cannot be predicted with certainty. There are a number

of possible approaches to estimating strike probability which vary in sophistication, skill level, experience and input data needed to apply them.

The most common form of safety risk assessment involves the categorization of both strike probability and severity into a number of levels, usually very low, low, moderate, high and very high. These levels would apply in a double entry matrix in which wildlife species would be classified according to a determined level of risk.

The results of a risk assessment matrix should be used to prioritize wildlife management techniques and methods. These actions should be documented in the WHMP.

6.2 ESTIMATING THE PROBABILITY OF A STRIKE

The probability of a wildlife strike should be calculated using wildlife incident data and current data on the presence, location and behaviour of wildlife in the aerodrome and its vicinity. Strike records also allow the determination of daily and seasonal trends to determine the likelihood of future strike events.

Using wildlife strikes to calculate probability depends on the number of strikes and the reporting culture. Aerodromes with fewer operations may generate fewer collisions; therefore, the limited data may not allow accurate or useful predictability on strike probability.

Where good quality strike data is not available, it is important to consider the potential risk of collision determined by the existence of wildlife and their movements on and in the vicinity of the aerodrome.

Based on the above, the probability of a wildlife strike is defined for diverse variables which are not exclusive. The more knowledge about the presence and behaviour of wildlife on, and in the vicinity of, the aerodrome, the stronger the estimation of wildlife strike probability and the final safety risk assessment for each relevant species. The aerodrome should have records of wildlife incidents, as well as information about observed wildlife, its habits, preferred areas, etc. This information can provide an input for wildlife probability calculation.
Due to the differences in resources available depending on the aerodrome, the data to be used in the safety risk assessment can be quantitative and qualitative. Best practice is to use quantitative data.

Both quantitative and qualitative measurements of abundances of wildlife and number of strikes are used to rank probabilities of a species being involved in a strike at a particular aerodrome since aerodromes differ in the quality and quantity of information that they hold. This is useful to consider different levels of knowledge and available statistics for different aerodromes.

An example is shown in Table1 regarding the values of some descriptive variables of a specific species, in order to be categorized (quantitatively and qualitatively) for probability of impact:

Table 1. Example of impact probability categorization

	Probability category				
	Very High	High	Moderate	Low	Very low

QUANTITATIVE APPROACH Presence of wildlife (number of days per year a species is observed on the aerodrome and its surroundings)	> 200	100-200	50-100	50	10
QUALITATIVE APPROACH Presence of wildlife (subjective evaluation)	Permanent	Most	Some	Few	Occasional
QUANTITATIVE APPROACH Average number of strikes per year (5 years)	>10	3-10	1 - 2.9	0.3-0.9	0 - 0.2
QUALITATIVE APPROACH Strikes per year (subjective evaluation)	Very often	Often	Occasional	Some	Rare/None

Different biological and behavioural characteristics of wildlife species can help classify them in specific risk levels. For instance:

(a) species that shy away from aircraft noise or that learn to avoid aircraft could be rated as low probability;
(b) birds that flock in large numbers to certain habitats in the flight path could be rated a high or very high probability;
(c) solitary animals might be rated as moderate probability;

(d) species with low or erratic flights could be rated as high or very high probability; and

(e) species with nocturnal activity on aerodromes with nocturnal flights should have a higher probability of impact.

Other behavioural factors should also be considered. The probability might also vary with the season, age or gender of the creatures, or other conditions such as grass length or rain and other weather conditions.

Other variables to assess the risk more accurately include: flight activity on the aerodrome (the higher number of air operations, the higher the probability of wildlife strike), the type of aircraft using the aerodrome (larger, faster aircraft are likely to increase the risk of wildlife strike). Relating the number of impacts with the number of flight operations may help better understand if an increasing frequency of impacts can be related to a greater number of operations, to a greater wildlife presence, or both.

6.3 ESTIMATING THE SEVERITY OF A STRIKE

The next step is to rank the expected severity of the impact or damage resulting from a strike event. A scale similar to the strike probability scale can be used.

Wildlife strikes have a directly associated severity, defined by the damage that the animal has caused to the aircraft after the impact. For observed wildlife, the severity scale will depend essentially on the size of the animal and its tendency to flock or congregate. Generally, heavier wildlife and greater flock size increases the probability of damaging an

aircraft and impacting its flight performance. Flocking behaviour could include multiple impacts or increase the probability of a strike.

Severity can be rated, among other approaches, in terms of aircraft damage and human casualty, wildlife strikes with a consequence of damage to the aircraft, and number of events with an adverse effect on flights (for example missed approach or aborted take-off).

Table 2 describes how to categorize, in two different approaches, the severity related to a determined species according to the damage this species has caused in the strikes recorded by an airport. In this example, the severity of the common kestrel to aviation in a theoretical airport is analysed:

Table 2. Example of severity categorization (common kestrel)

	Severity Category				
	Very High	High	Moderate	Low	Very low
Percentage of strikes with common kestrel causing damage (compared with the total amount of wildlife strikes at the airport)	>20%	10-20%	6-10%	2-6%	0-2%
Type of aircraft damage and/or human casualty (in	Catastrophic	Hazardous	Major	Minor	Negligible

strikes with common kestrel)					

6.3.1 Descriptions of damage category terms used above are shown below in Table 3.

Table 3. Example of safety risk severity

Catastrophic	— Equipment destroyed; and — multiple deaths.
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; and — major equipment damage.
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; and — injury to persons.
Minor	— Nuisance; — operating limitations; — use of emergency procedures; and — minor incident.

Negligible	— No safety consequences; — no aircraft damage; and — near miss.

6.3.2 Case of species with no Data on severity of damage

In case of species for which no data about the severity of the damage they can cause is available, the severity could be calculated by the mass multiplied by the type of flock.

To perform this calculation, previous categories of weights or sizes of wildlife, and flock sizes should be established by the aerodrome operator to fit each species within a category.

Below is an example of how to establish these categories:

Table 4. Example of wildlife categorization based on body mass

Body Mass	Examples	Body Mass Value
< 50 g	Sparrows	2
51-200 g	Starlings	4
201-1 000 g	Pigeons	8
1-5 kg	Large gulls	16
>5 kg	Big birds of prey	32

Table 5. Example of wildlife categorization based on flock size

Flock size	Examples	Flock value
Usually solitary or widely spaced	Big birds of prey, Sparrows	1
Often in loose flocks	Pigeons, Large gulls	2

Often in tight flocks	Starlings	4

It is important to note that Flock size may depend on specific aerodrome location and species involved. With the above example values given, it is possible to locate the analysed species in one of the severity ranges that could cause a collision with an aircraft.

Table 6. Example of severity categorization based on severity value

	Severity Category				
	Very high	High	Moderate	Low	Very low
Severity value (mass category value x flock category value)	32-128	16	8	4	2

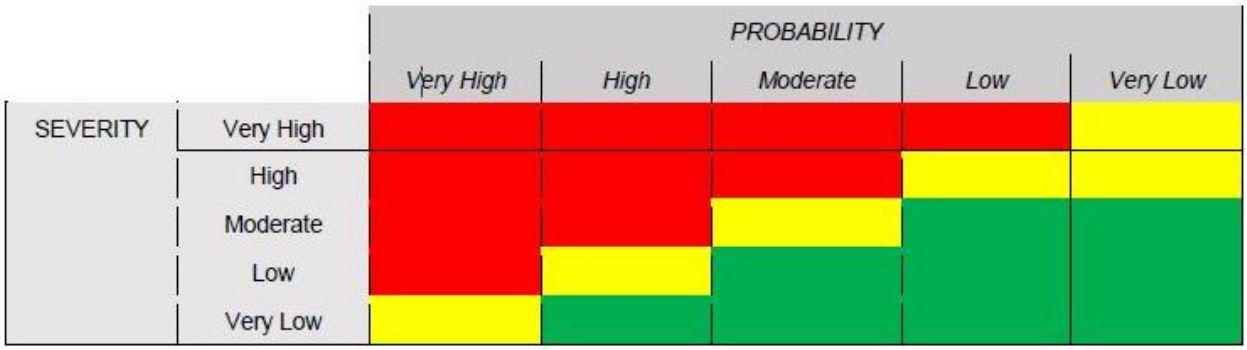
Regarding the severity categories to be established, each aerodrome should determine its own scale. Since the severity of collision also depends on the type of aircraft, the range of aircraft sizes or types of aircrafts operating at an aerodrome would also need to be taken into consideration; clearly the views of the aircraft operators should be considered.

6.4 ESTIMATING THE SAFETY RISK OF WILDLIFE SPECIES

A safety risk assessment matrix is completed by combining the probability and severity of each species to determine whether further action is required. A safety risk assessment should be reviewed at least annually or following a significant wildlife strike event and existing wildlife control measures adjusted to see if further action is required.

An example of a risk assessment matrix is shown in Table 7:

Table 7. Example of risk assessment matrix



The three risk levels are defined as follows and should be the main focus when interpreting the risk matrix:

Level 1 (Green) — Acceptable. The risk is acceptable as it is. No further action is required.

Level 2 (Yellow) — Tolerable. The risk can be tolerated based on the safety risk mitigation. Review current action undertaken, identify possible further action.

Level 3 (Red) — Intolerable. Take immediate action. Further action is required to reduce the risk.

The aerodrome operator should prioritize its wildlife management measures on those species with the highest frequency (probability) and which may create the greatest damage (severity).

6.4.1 Example of a case study

In an aerodrome, the following data of three wildlife species were collected throughout the year:

— A common resident species at the aerodrome, the common kestrel, produced nine impacts, causing minor damage to aircraft in two of them.

— The migratory barn swallow produced many impacts in spring and summer, although it was not possible to calculate the exact number of impacts. Due to the bird's size, it has never caused any damage.

— This year, griffon vultures appeared for the first time in the area for several days throughout the year. There are no historical records about the presence of vultures in the aerodrome, but due to the bird's size and possible formation of flocks, their possible hazard for operations must be considered.

According to the tables previously shown as examples of ways to categorize the probability and severity of impacts:

— For the common kestrel, its impact probability is HIGH. Its severity, considering the percentage of impacts that have caused damage, is VERY HIGH. However, knowing that the common kestrel is typically solitary, and weighs less than 300 g, its severity could be reduced to some degree, to MODERATE. This reduction would also depend on the type of damage or caused effect on flight, the type of aircraft affected, etc. As it is known from aerodrome records that the aircraft damage has always been minor, the reduction to the degree of severity is confirmed.

— For the barn swallow, which has produced several impacts, the probability is HIGH. However, it should be taken into account that its occurrence is seasonal, which concentrates its probability of impact to a few months per year. This could allow for reduction to some degree of the probability of impact. Its severity, according to the absence of damage, and with its small size (20 g), is VERY LOW.

— For griffon vultures, although there have been no impacts yet, their new and persistent presence at the aerodrome should be taken into account. Its probability would be HIGH. Its severity, considering its size (more than 7 kg) and flight form, would be VERY HIGH.

Therefore, the final risk assessment matrix in this example, after categorizing the analysed species, would be the following:

Table 8. Example of risk assessment matrix categorizing analysed species

		PROBABILITY				
		Very high	*High*	*Moderate*	*Low*	*Very low*
SEVERITY	Very High		Griffon vulture			
	High					
	Moderate		Common kestrel			
	Low					
	Very Low		Barn swallow			

This could be interpreted as:

— It is necessary to apply more mitigation measures, or improve existing ones, to control the presence of the common kestrel at the aerodrome, thus decreasing the probability of impact.

— The presence of barn swallows is acceptable, although mitigation measures that are already being applied should continue to be applied in order to minimize their presence at the aerodrome as much as possible.

— Mitigation measures must be applied on the griffon vulture to minimize or eliminate its presence at the aerodrome, before impacts occur.

7.0 DATABASE

Databases should be implemented at aerodromes in order to keep record of wildlife incidents and allow aerodrome operators to draw conclusions and trends based on these data. Database management can be as simple as using electronic spreadsheets or can be more complex with other intricate systems. Databases should be connected with reporting systems so that aerodrome personnel can input data directly into the database. Data can then be easily extracted and manipulated in order to produce reports and draw trends and conclusions about wildlife incidents. The aerodrome should ensure that these results are reflected in an updated risk assessment when necessary.

Tanzania Civil Aviation Authority