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ALBANIAN CIVIL AVIATION AUTHORITY

WILDLIFE HAZARD MANAGEMENT GUIDANCE MATERIAL

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0.1 Record of Amendments

The table below describes the dates and reason for the different amendments of the current Guidance Material.

A vertical black line on the left-hand side of the page identify the changes with the previous version.

Issue No.	Revision No.	Date	Amended by	Reason
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0.3 Revision table

Page #	Issue No.	Revision No.	Date	Edited by

0.4 Distribution List

Control #	Responsible Person	Type of Document
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Note: In case of interested party involved in ACAA activities, access rights shall be given on case by case basis by the concerned Directorate/ Sector (s).

0.5 Definitions & Acronyms

Term	Definition
Aerodrome	A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.
ATIS	A continuous broadcast of recorded aeronautical information for aerodromes and their immediate surroundings.
Distress Call	A unique call only given by certain bird species when they have been caught by a predator.
Habitat	Any kind of distinguishable feature within the environment, such as an open meadow, a stand of trees or a water body
Hazard	A condition or an object with the potential to cause or contribute to an aircraft incident or accident.
Near Miss	The potential of a wildlife strike.
NOTAM	A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.
Predator	An animal that naturally preys on others.
Repellent	A substance/technique/equipment that deters birds, insects or other pests from approaching or settling.
Risk Assessment	A systematic process of evaluating the potential risks that may be involved in a projected activity or undertaking.
Risk Mitigation	The process of incorporating defences, preventive controls or recovery measures to lower the severity and/or likelihood of a hazard's projected consequence.

Safety Data	<p>A defined set of facts or set of safety values collected from various aviation-related sources, which is used to maintain or improve safety.</p> <p>Note. — Such safety data is collected from proactive or reactive safety-related activities, including but not limited to:</p> <ul style="list-style-type: none"> a) accident or incident investigations; b) safety reporting; c) continuing airworthiness reporting; d) operational performance monitoring; e) inspections, audits, surveys; or f) safety studies and reviews.
Safety Information	<p>Safety data processed, organized or analysed in a given context so as to make it useful for safety management purposes.</p>
Safety Management System	<p>A systematic approach to managing safety, including the necessary organizational structures, accountability, responsibilities, policies and procedures.</p>
Safety Risk	<p>The predicted probability and severity of the consequences or outcomes of a hazard.</p>
Strike	<p>A collision between wildlife and aircraft.</p>
Wildlife Hazard	<p>The presence of wildlife (i.e. birds and other animals, both wild and domestic) that could result in damage to aircraft.</p>
Wildlife Management	<p>Manipulating an animal's behaviour or its habitat in order to achieve a specific goal with regards to an animal's behaviour, population, or geographic distribution.</p>
Wildlife Survey	<p>A valuable tool for aerodromes to ensure their wildlife management and habitat plans are effective,, meet all regulations and standards required.</p>

0.6 Abbreviations and Acronyms

Abbreviation or Acronym	Meaning
ACAA	Albanian Civil Aviation Authority
AIP	Aeronautical Information Publication
ANSP	Air Navigation Service Provider
AO	Aerodrome Operator
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATS	Air Traffic Service
FOD	Foreign Object Debris
GIS	Geographical Information System
IBIS	ICAO Bird Strike Information System
ICAO	International Civil Aviation Organization
LRAD	Long Range Acoustic Device
MO	Minister's Order
MRO	Maintenance, Repair and Overhaul
NGO	Non-Governmental Organization
NOTAM	Notice to Airmen
RA	Risk Assessment
RADAR	Radio Detection and Ranging
RPAS	Remotely Piloted Aircraft System
SARPs	Standards and Recommended Practices
SMS	Safety Management System
WHMP	Wildlife Hazard Management Programme

1. INTRODUCTION

1.1 Objective

The objective of this guidance material is to provide instructions to Aerodrome Operators for the development of a Wildlife Hazard Management System, to minimize the hazard to aircraft operations created by the presence of birds and/or animals in the aerodrome, or in the vicinity of the aerodrome.

This guidance material will assist Aerodrome Operators to manage wildlife hazards around the aerodrome by describing the responsibilities of the operator, guidelines for conducting a Risk Assessment and the creation of a Wildlife Hazard Management Programme (WHMP), operational practices for Wildlife Hazard Management, training curriculum, and how to evaluate the efficacy of the WHMP.

1.2 Regulatory Framework

- Law No. 96/2020 “Air Code of the Republic of Albania”;
- Law No. 53/2022 “For the organisation and administration of the Civil Aviation Authority”;
- Minister’s Order No. 58/2024 “Regulation for certification, registration of aerodromes and operation obligations and responsibilities falling on aerodrome operators, transposing Annex 14, Vol I of ICAO”;
- Minister’s Order No. 170/2022 “Regulation for determining the requirements and administrative procedures related to the aerodromes in the Republic of Albania” transposing Commission Regulation (EU) No. 139/2014 “Laying down requirements and administrative procedures related to aerodromes pursuant to Regulation (EC) No. 216/2008 of the European Parliament and of the Council”;
- ICAO Doc 9137 “Airport Services Manual”, Part 3 – Wildlife Control and Reduction;
- PANS-Aerodromes (Doc 9981), Part II, Chapter 1 and 6.

Article 10 “Wildlife hazard management” of of Minister’s Order No. 170/2022 specifies that:

1. Member States shall ensure that wildlife strike hazards are assessed through:
 - a) the establishment of a national 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 constituting a potential hazard to aircraft operations; and
 - c) an ongoing evaluation of the wildlife hazard by competent personnel.
2. Member States shall ensure that wildlife strike reports are collected and forwarded to ICAO for inclusion in the ICAO Bird Strike Information System (IBIS) database.

ADR.OPS. B.020 “Wildlife strike hazard reduction” specified that the aerodrome operator shall:

- a) assess the wildlife hazard on, and in the surrounding, of the aerodrome;
- b) establish means and procedures to minimise the risk of collisions between wildlife and aircraft, at the aerodrome; and
- c) notify the appropriate authority if a wildlife assessment indicates conditions in the surroundings

of the aerodrome are conducive to a wildlife hazard problem.

Also, AMC1.ADR.OPS.B.020 “Wildlife strike hazard reduction” specified that the aerodrome operator should:

- a) participate in the national wildlife strike hazard reduction programme;
- b) establish procedures to record and report to the appropriate authority wildlife strikes to aircraft occurred at the aerodrome, in close cooperation with organisations operating, or providing services at the aerodrome;
- c) ensure that wildlife hazard assessments are made by competent personnel; and
- d) establish, implement and maintain a wildlife risk management programme.

Chapter 9.4 “Wildlife strike hazard reduction” of Minister’s Order No. 58/2024 specifies that:

9.4.1 The wildlife strike hazard on, or in the vicinity of, an aerodrome shall be assessed through:

- a) the establishment of a national 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 ongoing evaluation of the wildlife hazard by competent personnel.

9.4.2 Wildlife strike reports shall be collected and forwarded to ICAO for inclusion in the ICAO Bird Strike Information System (IBIS) database.

The IBIS is designed to collect and disseminate information on wildlife strikes to aircraft. Information on the system is included in the Manual on the ICAO Bird Strike Information System (IBIS) (Doc 9332).

9.4.3 Action shall be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.

Procedures on the management of wildlife hazards on and in the vicinity of an aerodrome, including the establishment of a wildlife hazard management programme (WHMP), wildlife risk assessment, land-use management and personnel training, are specified in the PANS-Aerodromes (Doc 9981), Part II, Chapters 1 and 6. Further guidance is given in the Airport Services Manual (Doc 9137), Part 3.

9.4.4 The appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem. Where the elimination of existing sites is not possible, the appropriate authority shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.

9.4.5 States should give due consideration to aviation safety concerns related to land developments in the vicinity of the aerodrome that may attract wildlife.

1.3 Requirements

The criteria in this guidance material are applied to all aerodromes in the Republic of Albania certified in accordance with the requirements of Minister's Order No. 58/2024, transposition of Annex 14, Volume I of ICAO, as well as to aerodromes certified according to the requirements of Minister's Order No. 170/2022, transposing Commission Regulation (EU) No. 139/2014.

This guidance material addresses the following issues:

1. General information regarding wildlife hazard;
2. Stakeholders within the aerodrome and external stakeholders in the community;
3. Methods of communication;
4. The local aerodrome wildlife committee;
5. Establishment of a national committee or forum;
6. Aerodrome Wildlife Safety Risk Assessment;
7. Habitat management, on-aerodrome management and off-aerodrome management;
8. Management of hazardous wildlife;
9. Recording and reporting;
10. Advancement in technology;
11. Training;
12. Operational notifications;
13. Wildlife Hazard Management Programme (WHMP) and WHMP Evaluation;
14. Management of conflict between aerodrome safety and environmental requirements.

1.4 Ethical responsibility

Wildlife management at aerodromes is a critical part of safe aircraft operations. Furthermore, aerodrome operators have an ethical responsibility to contribute to the conservation of wildlife and biodiversity. Some of the species that present a high risk to aviation safety might be critically endangered or threatened. It is the responsibility of the aerodrome operator to deliver solutions that maintain aviation safety whilst conserving the species in question.

Wildlife management is a complicated practice that involves thorough understanding of animal biology and behaviour, including the ways in which they fulfil their basic requirements. Aerodrome operators will generally achieve the greatest level of safety if they invest in a dedicated Wildlife Hazard Management Programme (WHMP).

Each aerodrome will have a different set of challenges associated with wildlife, but the fundamentals of wildlife management apply to all of them.

Aerodrome operators must work with an animal's behaviour, and not against it, if they are to successfully maintain aviation safety.

2. GENERAL

2.1 What is a wildlife hazard?

A wildlife hazard is the presence of wildlife (i.e. birds and other animals, both wild and domestic) that could result in damage to aircraft.

The risk of a wildlife hazard depends on the size, behavior and number of wildlife and their proximity to aircraft during different phases of flight. Wildlife hazards on the aerodrome or while passing through critical airspace are likely to increase the probability of negative effects.

Wildlife hazards, just as any other hazards to aviation safety, should be identified, assessed and managed in order to reduce the risk, through a Safety Management System (SMS). The first step is hazard identification, involving species present in and around the aerodrome, and how much damage each species could cause to an aircraft if struck (**Hazard Level**). This is followed by a review of past wildlife strikes in order to identify which species are likeliest to be involved in a collision (**Probability of a Strike**). The product of these factors gives the risk for that species, and can be shown in a risk assessment matrix (*this process is thoroughly explained in Chapter 4*). An assessment of habitats in and around the aerodrome that have the potential to attract wildlife is also to be completed, so that the habitat can be managed to reduce the presence of species identified as constituting a risk to flight safety.

Following a Risk Assessment (RA), aerodrome operators must develop a Wildlife Hazard Management Plan (WHMP). The WHMP sets out the actions required to reduce wildlife hazards in and around critical aircraft operating areas, and decrease the risk of a strike.

An aerodrome WHMP should include an evaluation system to assess the success of the WHMP and its actions. This involves maintaining records of wildlife populations in and around the aerodrome, collecting data on actions, and detailing the response of wildlife to management actions. Detailed records of wildlife strikes should be maintained as part of the evaluation system.

Wildlife risks fluctuate with the daily and seasonal cycles of wildlife activity. The species and number of wildlife at and around aerodromes may vary over the years due to land use and environmental changes (e.g. agricultural practices, urbanization, conservation and climate change). Aerodromes have site-specific characteristics regarding their habitat, climate and surroundings that should be reflected in their respective WHMPs.

Increased air traffic and the development of quieter aircraft engines may increase the likelihood of a wildlife strike. Wildlife hazard management methods and techniques should therefore be reviewed annually and updated regularly to ensure that effective control methods are implemented.

2.2 Historical Background

Many wildlife incidents and accidents have occurred since the dawn of aviation. While piloting his airplane on 7 September 1905, Orville Wright had what is believed to be the first collision between an aircraft and a bird, an event now known as a bird strike. Less than seven years later, on 3 April 1912, in Long Beach, California, Calbraith Perry Rodgers, the first man to make a transcontinental flight across the United States, became the first person to die as the result of a bird strike. His Wright Flyer flew into a flock of gulls that jammed the aircraft's controls, causing it to plunge out of control into the ocean.

The frail structures of early aircraft made them susceptible to wildlife strike damage. However, their slow speed gave pilots and wildlife more time to take evasive action. The development of aircraft over the past 100 years has progressed to produce aircraft that are more resistant to wildlife strikes. Nevertheless, significant strikes continue to occur regularly worldwide.

The deadliest bird strike to date occurred on 4 October 1960 at the Boston Logan International Airport, when a Lockheed Electra L188 struck a flock of European starlings (*Sturnus vulgaris*) just as it became airborne. The birds were ingested into three of the aircraft's four engines, causing the aircraft to lose power, stall and crash into the harbor. Sixty-two people died out of the seventy-two passengers and crew members on board.

Wildlife strikes have also impacted changes to aircraft design. On 23 November 1962, a Vickers Viscount struck a flock of whistling swans (*Cygnus columbianus*) over the State of Maryland in the United States while flying at 6 000 ft. One of the horizontal stabilizers was penetrated by a swan, weakening the structure and causing it to separate from the aircraft which subsequently crashed and killed all crew members and passengers on board. This crash resulted in the design criteria for horizontal stabilizers being raised to withstand eight pounds (3.6 kg).

Perhaps the most famous bird strike in recent years took place on 15 January 2009, when an Airbus A320 hit a flock of Canada geese (*Branta canadensis*) just after taking off from LaGuardia Airport, New York City. The ingestion of multiple geese into both engines resulted in a forced emergency landing on the Hudson River. All 150 passengers and five crew members survived.

A more recent wildlife strike resulting in fatality was on 28 September 2012, when a Dornier Do-228 with sixteen passengers and three crew members was on initial climb out of Kathmandu Airport. The crew reported a bird strike, resulting in a fatal crash that killed all on board. The bird was identified as a black kite (*Milvus migrans*).

Although the majority of wildlife strikes involve birds, those involving other animals may also have a severe outcome. For example, on 4 December 2015, a SpiceJet landing at Jabalpur Airport collided with a herd of wild boars that were crossing the runway. The aircraft went off the runway and the left main and nose gear of the aircraft collapsed. No passenger or crew member was injured.

2.3 Fundamentals of Wildlife Hazard Management

The objective of wildlife hazard management at aerodromes is to reduce the risk of a wildlife strike by implementing appropriate mitigation measures.

A strike is a collision between wildlife and an aircraft; a “near miss” is the potential of a wildlife strike. To manage wildlife hazards, one 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 should 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.).

Measures to manage wildlife hazards at aerodromes may include, but are not limited to: manipulating habitats (see *Chapter 5, Habitat management*), harassment and repellent techniques and removal of wildlife (see *Chapter 6, Management of hazardous wildlife*). Emerging technology such as bird detection RADAR or remotely piloted aircraft systems (RPAS), may also enhance the detection, monitoring and control of hazardous wildlife (see *Chapter 7, Advancements in technology*).

In addition to managing the land use on aerodrome property, off-site land use in its vicinity must also be assessed and mitigated, as it can affect wildlife presence or activity. Land use suggestions can be offered to owners around aerodrome property to aid in wildlife management.

The strategy for assessing wildlife at aerodromes and the control measures for reducing wildlife risk should be outlined in the aerodrome’s WHMP.

This guidance material applies to both existing and new aerodromes, including expansion projects. More information can be found in the *Airport Planning Manual, Part 1 — Master Planning* and *Part 2 — Land Use and Environmental Management (Doc 9184)*. State authorities should analyze and approve the location of new aerodromes, to ensure that issues with high potential for wildlife attraction are considered and mitigated where necessary.

2.4 What is wildlife management?

Wildlife management involves manipulating an animal's behaviour or its habitat in order to achieve a specific goal with regards to an animal's behaviour, population, or geographic distribution. At aerodromes, the goal of wildlife management is to change the behaviour of animals so that they do not occupy critical safety zones where aircraft operate. The key to managing wildlife at aerodromes is to understand the animals' basic requirements and how their behaviour can lead to an aviation safety hazard. Essentially, it is imperative to know why animals behave the way they do.

2.5 Animal needs and habitats

All animals have basic requirements for survival and reproduction and these requirements dictate how they will behave. They need energy and nutrients, including water, to survive and thrive. They must maintain the core temperature of their bodies, they must avoid being eaten by other animals, and they must reproduce. All of the behaviour can be traced to these basic requirements. Different species have different behaviours and some of these can lead to high-risk situations at aerodromes. Once the aerodrome operator understands the needs of the animal that lead to its high-risk behaviour, they can begin to take steps to change that behaviour.

An animal meets its basic requirements by utilizing habitats within the environment. A habitat is any kind of distinguishable feature within the environment, such as an open meadow, a stand of trees or a water body. Different animals use different habitats to meet their requirements, and some vary the types of habitats they use at different times of the year, depending on the specific requirement they are fulfilling.

2.6 Manipulating habitats

With an understanding of how animals behave and use different habitats to meet their requirements, aerodrome operators can begin to manage them. Around the aerodrome, this usually means manipulating habitats, especially around the critical safety zones, so that animals are not able to fulfil their requirements there. This kind of manipulation varies depending on the animals involved and the requirements they need to fulfil.

For example, a drainage ditch full of water will provide ducks with a safe place to bathe and feed. If the ditch is directly adjacent to a runway, there may be a risk of ducks being struck by aircraft as they move to and from the ditch habitat. When the drainage ditch is enclosed with a culvert, the habitat that the duck requires is gone. The duck is no longer able to fulfil its requirements in that location, and will have to find another suitable habitat. As a result, there will be fewer ducks in a critical safety zone for aircraft, and, therefore, a reduced risk to aviation safety.

2.7 Active management

Sometimes nothing can be done to change a habitat on an aerodrome, so active management might be necessary to manipulate wildlife behaviour directly.

For example, concrete tarmacs commonly required for aircraft operations, can provide a habitat attractive to wildlife. In cold weather, the concrete can warm faster than its surroundings and become the warmest habitat available attracting congregations of birds. To change the behaviour might need an intervention involving stimulating the animal in a way that it perceives a danger that outweighs the gains it will receive by not changing its behaviour. In the case of birds warming themselves on concrete tarmac, a loud noise from a pyrotechnic explosive, rifle shot or air siren can provide enough stimulus to make the animals fear for their safety and leave.

2.8 Removal

In some cases, it may be not feasible to manipulate the habitat or change wildlife behaviour permanently. Removal of an animal or a group of animals may be the only option. This can involve trapping and releasing them in a new location, or in extreme cases killing them. Aerodrome operators must ensure that they are compliant with all regulations regarding the wildlife species in question, and that they carry out removals in a manner as humane as possible.

3. STAKEHOLDERS

3.1 Introduction

A variety of stakeholders should contribute to wildlife hazard management at the aerodrome. These include, but are not limited to, the aerodrome operator (AO), airside personnel, air navigation services providers (ANSPs), pilots, airlines, environmental authorities, local and regional authorities, civil aviation authorities (CAAs), security forces, police, local community groups, the air force and wildlife experts and scientific and academic communities.

The aerodrome operator is the primary stakeholder and the common link among all other stakeholders at the aerodrome. The safety management system (SMS) of the aerodrome should be coordinated with those of other stakeholders, where applicable, to be successful in wildlife risk management. Aerodrome operators should also have an open line of communication between various stakeholders, for example with the formation of a local aerodrome wildlife committee.

3.2 Aerodrome Operators

3.2.1 General

The primary responsibility of the aerodrome operator is to maintain aerodrome safety and ensure that action is taken to reduce the risk of wildlife strikes.

To achieve this goal, each aerodrome operator should develop, implement and demonstrate an effective WHMP. This programme should represent the size and level of complexity of the aerodrome, taking into consideration hazardous species, the level of risk associated with them and the volume of flight operations. The aerodrome operator should ensure that all wildlife hazard control personnel and managers demonstrate competency, are adequately trained and are provided with the appropriate resources and equipment to carry out their tasks.

The aerodrome operator should provide pilots and aircraft operators with recurrent wildlife behavior and habits that may impact aircraft safety.

The aerodrome operator should ensure that, where applicable, agreements with tenants of leased land contain specific wildlife hazard management control information. The aerodrome operator may choose to include enforcement language within their leases or concession agreements.

3.2.2 Senior Manager

The aerodrome operator has a responsibility to provide a safe operating environment for aircraft operators, air transport users and neighboring communities. Accordingly, a Senior Manager should be

identified who has overall responsibility for wildlife control. This maybe be a dedicated role or included in the responsibilities of the Safety Manager. The role should involve tasks and responsibilities that include:

- Ensuring that the WHMP is developed and implemented;
- Ensuring that the WHMP is referred to and becomes part of both the aerodrome Safety Management System (SMS) and the operational and safety culture of the aerodrome;
- Ensuring sufficient financial and human resources, including initial and on-going training are provided to enable implementation of the WHMP;
- Participating on the Aerodrome Wildlife Committee;
- Working with external parties such as local, regional and national governments in order to avoid or mitigate regulation that might impinge on the safe operation of aerodromes.

Specific responsibilities arising from items that should be included in the WHMP will include the following:

- Ensuring that the protected species register is included in the WHMP and that proper safeguards for these species are in place;
- Ensuring that required reports are submitted (usually monthly) to the national aviation authority;
- Ensuring that, where appropriate, habitats and land uses identified in the WHMP, especially those that will require capital development expenditure, are included in the Aerodrome Masterplan.

Further information can be found in ICAO Airport Service Manual, part 3, Wildlife control and reduction, 3.3 Role of the airport operator.

3.3.1 Because of the importance of bird/wildlife control, each airport operator has the responsibility to develop, implement and demonstrate an effective bird/wildlife strike and wildlife control programme at the aerodrome, and this should be tailored to and commensurate with the size and level of complexity of the aerodrome, taking account of the identification of the bird hazard and the risk assessment of that hazard.

3.3.2 Aerodrome operators, where practicable, should implement a programme tailored to local conditions, with assistance from the national committee or other outside agencies, as required. Where practicable, the aerodrome operator should appoint an aerodrome bird/wildlife control coordinator who is responsible and accountable for the aerodrome's bird/wildlife hazard control policy and the personnel engaged in bird/wildlife hazard control. This may include the formation of a local aerodrome bird/wildlife committee that will develop and implement the specific programme. It is imperative that personnel responsible for these tasks are able to demonstrate competence, are trained by qualified personnel and are provided with the appropriate resources and equipment to carry out their tasks.

3.2.3 Aerodrome wildlife coordinator

The aerodrome operator should appoint a wildlife coordinator or manager who is responsible and accountable for wildlife hazard management and personnel engaged in wildlife hazard control.

The aerodrome wildlife coordinator will undertake day-to-day management and efficient implementation of the WHMP. The person might be a technical specialist, such as a biologist, or such expertise might be out-sourced. In more detail, this role will involve key duties such as the following:

- Advising the Senior Manager on all matters relating to wildlife hazard prevention, and to assist with the production and development of the WHMP;
- Planning and organizing wildlife control operations in accordance with the WHMP;
- Supervising and monitoring wildlife control operations to ensure that WHMP is implemented correctly;
- Supervising wildlife control record keeping (log, bird counts, wildlife strike recording and reporting, bird dispersal, culling and habitat management diaries, etc.);
- Providing technical supervision of Wildlife Control Operators, intelligence gathering, and planning;
- Facilitating active surveillance, wildlife dispersal, culling and other field tasks;
- Ensuring that all necessary passes and permits are current;
- Ensuring the supply, safe keeping and correct maintenance of wildlife control equipment and consumables;
- Coordinating with operation and/or grounds maintenance to ensure that habitat is managed according to the WHMP; and
- Providing a communications channel between the aerodrome policy makers/providers, wildlife control operators and other interested parties, such as airline operators and air traffic control.

Further information can be found in ICAO Airport Service Manual, part 3, 3.4 Role of bird/ wildlife strike control coordinator.

3.4.2 The aerodrome bird/wildlife strike control coordinator (or equivalent) should coordinate the activities of the wildlife control programme with air traffic control (ATC) and other stakeholders. The coordinator's responsibilities should allow for the time required to be involved with observations, control and reporting. The wildlife coordinator at the site should also review strike reports, monitor daily activity records and maintenance reports to determine the requirements for short- and long-term management programmes, and this information should be passed to managers accountable for safety on a regular basis (recommended at least monthly).

3.2.4 Aerodrome wildlife control operator

A wildlife control operator performs the front line role and may be any suitably trained and qualified member of aerodrome staff. This role will involve key duties such as, but not limited to:

- maintaining surveillance of wildlife activity on, and in the vicinity of, an aerodrome;
- implementing active wildlife control measures and interventions in accordance with the WHMP to counter any detected wildlife hazards;
- providing, where applicable, the details of potential wildlife hazards to ATS units;
- recording all wildlife observed (on- and off-site);
- recording wildlife control activity and the effect of the control actions;
- recording actual, potential or suspected wildlife strikes;
- advising senior personnel on improvements to the wildlife control tasks or WHMP; and
- assisting with surveys.

3.2.5 Collecting, reporting and recording data on wildlife incidents and observed wildlife

The aerodrome operator should 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 should begin at the planning and design phase of an aerodrome and continue throughout its lifecycle.

This data will mainly contain records of:

- wildlife observed at the aerodrome and its vicinity;
- wildlife control activities;
- incidents with wildlife;
- wildlife strikes and near misses;
- areas of high wildlife activity on the aerodrome and in its surroundings; and
- wildlife observations or surveys from the aerodrome's vicinity taken periodically, at least seasonally and noting migratory activities.

Note. — *Procedures for the establishment of a wildlife log are described in the PANS-Aerodromes (Doc 9981).*

Wildlife observations and control activities records

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

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

These records should 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 should be followed up by periodic surveys and/or studies.

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 should cover the entire year to account for seasonal changes and should also consider different phases of the day. The survey should 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 should be consistent, systematic and replicable, for the data to be comparable over time. This sampling method should 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 should 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.

Wildlife incidents records and reporting

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

A wildlife incident reporting form should be included in the procedure and made available to all stakeholders. The forms used by the aerodrome operator or other stakeholders at the aerodrome should contain, at minimum, the information in the PANS-Aerodromes, Part II, Chapter 6, Appendix 2. More detailed information results in a more accurate risk assessment of wildlife data.

The aerodrome operator should report wildlife incidents to the CAA in accordance with national regulations on incident reporting (*See chapter 6.5.3 Reporting to CAA*).

All incidents, regardless of damage or evidence, should be reported, collected and entered into a database as mentioned in the PANS-Aerodromes, Part II, Chapter 6.

Wildlife species identification should be as accurate as possible. It is therefore essential for wildlife personnel to be adequately trained.

The aerodrome operator should 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.

Inventory of attractive areas for wildlife

The aerodrome should keep a record of areas with wildlife attraction or concentration in the aerodrome and its vicinity. This inventory should 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. Examples include: fruits on aerodrome property that attract small flocking birds; large bodies of water that attract shorebirds and waterfowl; and forests that attract large birds of prey and mammals.

3.3 Stakeholders within the aerodrome

3.3.1 Airside personnel

The aerodrome operator's reporting system should ensure that there is a requirement for all relevant third parties and all aerodrome personnel to report wildlife incidents, wildlife remains and any other relevant identified hazards, to the aerodrome operator.

Aerodrome personnel not directly involved in wildlife control measures should be made aware of hazardous wildlife attractants and understand the importance of both not creating foreign object debris (FOD) but also picking up or reporting FOD that could attract wildlife. The aerodrome operator should ensure this detail is included in information briefings and during airside induction and familiarization programmes.

3.3.2 Air traffic control (ATC)

ATC is the link between the airside personnel on the ground and pilots; they provide pilots with updated information concerning observations of wildlife activity on or near the aerodrome.

ATC should report all aerodrome wildlife incidents through the established procedures. In addition, ATC should maintain a continuous liaison with the aerodrome wildlife hazard control personnel.

Depending on the circumstances, ATC may take action or advise in response to potential wildlife strike hazards not limited to: take-off delay, use of alternative runways for landing and take-off, or different routes and altitudes according to established procedures.

ATC should attend and participate in both local aerodrome and national wildlife committees.

3.3.3 Pilots

All pilots should report wildlife strikes through the established procedures. They should also report wildlife activity or remains near or on the movement areas to ATC to advise other pilots and so the wildlife control unit can assess the situation and take action if necessary.

If hazardous wildlife is observed prior to take-off or landing, pilots may choose to delay the departure or to initiate a missed approach.

The attendance of pilots in local aerodrome wildlife committees is highly recommended since due to their unique vantage point, they can provide pertinent information regarding wildlife movements and activity during approach, landing and take-off operations.

3.3.4 Aircraft operators

The aircraft operator should report all wildlife strikes to the aerodrome operator. Wildlife hazards observed (both in the air and on the ground) by the aircraft operator should also be reported. The aircraft operator may investigate a high strike frequency at a certain aerodrome; this may be done in conjunction with the aerodrome operator.

As part of the risk assessment or airfield audit of an aerodrome, the aircraft operator may request the WHMP for assessment, and provide input to the aerodrome operator.

The aircraft operator should provide training on wildlife hazards in relation to flight operations reporting requirements to pilots and ground personnel.

3.3.5 Others

Other stakeholders may include: aircraft manufacturers aiming to improve materials, airframe and engine resistance to bird impact; or aeronautical authorities with tasks such as developing protective legislation, exchanging information and knowledge, disseminating best practices, keeping a wildlife strike database, etc.

3.4 Identifying external stakeholders in the community

3.4.1 The importance of identifying external stakeholders

Different habitats, land uses and human activities developed near an aerodrome can shelter and attract wildlife that is hazardous to aircraft. Since these areas are owned or managed by external stakeholders to the aerodrome, they should be made aware of the potential hazard and briefed on how, due to their activities or land uses, they can contribute to minimizing the attraction of wildlife.

A good working relationship with neighbouring stakeholders is an essential first step in protecting the interests of an aerodrome and its clients, since many community land use planners are unfamiliar with the potential impact of off-aerodrome land use activities on aircraft safety. Awareness programmes for key community stakeholders are particularly effective as they highlight the potential flight-safety issues associated with different land uses.

3.4.2 Land owners

The aerodrome does not have the authority to directly manage habitats outside of the aerodrome. Therefore, it is necessary to develop good relationships with the landowners in the vicinity. Landowners should be aware of the possible attractants of the land use activities on their grounds and the construction of their buildings. Aerodromes have the best understanding of the impact of wildlife on aviation safety and should initiate conversations and working groups with land owners who may not otherwise be aware

of the risks. *Land uses that should be considered by aerodrome operators are outlined in Chapter 5, Habitat management.*

3.4.3 State authorities

State authorities and other public bodies responsible for territorial planning should collaborate with one another. For example, laying down restrictive legal requirements (establishing safeguarding areas) or, at least, raising awareness about what land uses or human activities should not be developed within the 13-km circle in the vicinity of the aerodromes because they may be attractive for wildlife, may be a helpful starting point.

The collaboration among different State authorities (e.g. aviation-environmental) may lead to the development of environmental legislation or regulation that promotes the control of, or even the elimination of, wildlife attraction areas located near aircraft flight routes.

State authorities should publish information that ensures landowners in the vicinity of the aerodrome are aware of the laws and regulations that apply to their lands. These laws and regulations may impact building design and land use (e.g. crop choices and harvesting methods).

3.4.4 Environmental authorities

Since environmental authorities may be responsible for protected and non-protected areas, they can collaborate with other stakeholders by facilitating procedures, authorization or permission necessary for the management or capture of hazardous wildlife species, especially those protected by environmental legislation.

Environmental authorities may develop legislation that requires an environmental impact assessment of certain projects (e.g. new aerodromes or facilities and infrastructures to be built near aerodromes). Wildlife hazards should be adequately evaluated and monitored. Consequently, environmental impact statements issued by these authorities should avoid promoting environmental restoration projects that may attract wildlife near aerodromes.

Coordination and collaboration between environmental authorities, the aerodrome operator and CAAs include the sharing of information related to wildlife species, population trends, habitats and wildlife concentration areas, biological characteristics, human-wildlife conflict management procedures, etc.

Environmental authorities can also collaborate by implementing plans for newly protected areas, or by appropriately managing the existing ones, to ensure their compatibility with the aeronautical operations on the nearby aerodromes.

3.4.5 Local and regional authorities

Depending on the scope of their competences, local and regional authorities should collaborate with other stakeholders on territorial planning issues. If the authorities have decision-making capacity, they can assess the types of land uses or activities to be developed in the vicinity of an aerodrome and decide whether to authorize them or not. For this purpose, local and regional authorities can use easement regulations, safeguarding areas, wildlife hazard risk assessments, etc.

Although it depends on the State, the authorities are usually responsible for some facilities or activities known to be wildlife attractants, such as landfills. In this case, they can collaborate by properly managing the sites, minimizing as much as possible the wildlife presence and attraction.

In the case that an aerodrome lies close to an international border, aerodrome operators may need to reach out to local authorities in neighbouring countries to ensure that wildlife risks are considered.

3.4.6 Security forces and police

Security forces or police competences may vary depending on the State. Normally, they can contribute to the detection and even the prohibition of certain human activities that may involve wildlife hazards in the vicinity of the aerodrome, especially if those activities are illegal (e.g. inappropriate use of laser beam, unauthorized (or furtive) pigeon racing or training, etc.).

3.4.7 Local community groups and aerodrome neighbour organizations

When referring to local community groups or aerodrome neighbour organizations, farmers, land owners, hunter associations, pigeon racing associations, etc. should be included.

The activities of these groups may have negative effects on aerodrome safety. Proper coordination between the aerodrome operator and members of these groups is therefore essential. If these groups or organizations are adequately informed and made aware of the hazards caused by the presence of wildlife in the vicinity of the aerodrome, collaborative efforts may proceed more effectively and easily.

Good collaboration amongst local community groups may have the following effects:

- Farmers may try to choose crops less attractive for wildlife (especially birds) and may adapt or modify the growing cycle, harvesting techniques, harvesting period, etc. to attract less wildlife.
- Hunters can coordinate with the aerodrome operator concerning how and when they may conduct hunting, so as not to accidentally move animals towards the aerodrome. They can also be asked to assist in decreasing the population of hazardous wildlife.
- Pigeon racing organizations may control the locations of pigeon lofts and pigeon release areas; they may also coordinate pigeon release schedules together with the aerodrome operator.
- Agreements with farmers or shepherds may be reached, in terms of collaboration in vegetation management, animal care and property maintenance.
- Fishing groups and organizations may change the time they handle fish so as not to attract birds.

3.4.8 The Air Forces (military)

Although military operations are quite different from those of civil operations, there are still opportunities for the exchange of information and knowledge between them.

Some States have joint-use civil-military aerodromes, at which both military and civilian aircraft have shared use of the airfield. In these cases, there must be coordination between civil and military aviation authorities, and the aerodrome operator. It is recommended to have a coordination procedure for wildlife hazard management.

3.4.9 Industry

The aviation industry dedicates time and effort to the research of new technologies and materials for airframes and engines to better withstand wildlife strikes.

The wildlife control industry is constantly investigating and adapting new technologies for innovative wildlife, rodent, invertebrate and vegetation control measures and equipment.

3.4.10 Wildlife subject matter experts and the scientific and academic community

Wildlife experts, through bird strike committees, associations, wildlife management companies, government agencies, etc., often exchange knowledge on how to manage wildlife. They can also collaborate by disseminating the issue of wildlife risk for aviation, raising awareness among other stakeholders, etc.

Scientists and universities may conduct research regarding wildlife hazard management, wildlife attractants, and the new technologies that can improve wildlife knowledge. This can be useful for other stakeholders to ultimately improve aviation safety.

3.4.11 Environmental non-governmental organizations (NGOs) and ecological associations

Environmental NGOs and ecological associations should work with aerodromes and wildlife specialists to reduce the attractiveness of habitats to hazardous species on or near the aerodrome. Aerodromes should engage with these groups to raise awareness and understanding of the impacts of wildlife on aviation safety. Environmental associations may also have useful information about the biology and ecology of wildlife populations that may be used.

3.5 Civil Aviation Authorities (CAAs)

Minister's Order. No. 58/2024, and Minister's Order No. 170/2022 require States to certify all aerodromes used for international operations. As part of the certification process, ACAA shall ensure that aerodrome operators have developed and documented procedures relating to wildlife hazard management.

ACAA is responsible for the regulation, oversight and enforcement of the WHMP and is also an important stakeholder in supporting and facilitating engagement across all aerodrome stakeholders, external agencies and other government agencies, as applicable.

The role of the ACAA is to provide regulations, recommendations and best management practices as well as procedures for the enforcement and evaluation of compliance. ACAA may also collect data, provide outreach and information, partnerships and research opportunities.

The ACAA should ensure that:

1. wildlife strike hazards are assessed through;
 - a) reports of wildlife strikes to aircraft;
 - b) information collected from aircraft operators, aerodrome personnel and other sources documenting the presence of wildlife which pose a potential hazard to aircraft operations; and
 - c) evaluation of wildlife hazards by competent personnel;
2. aerodrome operators have developed and implemented mitigating measures to manage wildlife hazard risks and minimize the likelihood of wildlife strikes with aircraft;
3. wildlife strike reports are collected and forwarded to ICAO for inclusion in the ICAO Bird Strike Information System (IBIS) database;
4. the personnel involved in wildlife hazard oversight activities are properly trained;
5. they manage their own national reporting systems for wildlife events; and
6. that they properly plan and manage airspace to reduce interactions of wildlife with aeronautical operations.

As necessary, the ACAA may wish to engage wildlife specialists to assist in reviewing the appropriateness and effectiveness of an aerodrome operator's WHMP or other wildlife hazard management issues of concern.

The ACAA should carry out awareness-raising activities, encouraging concern and collaboration among different stakeholders with regard to wildlife hazard management.

The ACAA may also work with CAAs from other countries to exchange information and to promote a global reporting culture. State authorities may collaborate by trying to establish or modify air traffic routes over geographical areas where the risk of wildlife strike is lower (e.g. avoid flying at certain altitudes over certain geographical areas, protected areas, wildlife refuges, etc.).

3.6 Methods of communication

3.6.1 General

Proper communication and the dissemination of information between the aerodrome operator and stakeholders are essential to raise awareness about everyone's role and responsibility and ensure that

stakeholders address wildlife challenges. Such methods of communication between external stakeholders and the aerodrome could include awareness campaigns, or the dissemination of information (information leaflets or maps to be distributed to municipalities listing safety areas, land uses, etc.). This may be useful to educate external stakeholders about wildlife hazards.

Internal stakeholders can also benefit from awareness campaigns and internal information leaflets about the importance of occurrence reporting, bird identification, etc. In addition, a briefing at the beginning of each shift with the wildlife coordinator or manager is an occasion to communicate about possible hazardous wildlife activity.

3.6.2 The local aerodrome wildlife committee

The establishment of an Aerodrome Wildlife Committee is required to facilitate the communication, cooperation and coordination of hazardous wildlife management at and around the aerodrome. This committee might be included within the safety management committee. In place of a dedicated local wildlife committee, the topic may be discussed in an airside or runway safety committee.

Members of the committee may include, but are not limited to:

- a) accountable manager;
- b) senior safety or compliance manager;
- c) wildlife coordinator or manager;
- d) wildlife control operator representative;
- e) aircraft operator representative;
- f) aerodrome planning manager;
- g) aerodrome maintenance and operation manager;
- h) ATC representative;
- i) active aircrew representative familiar with the aerodrome;
- j) local runway safety team representative; and
- k) local authorities;
- l) depending on the organizational structure of the aerodrome, other representatives can also be included, such as the Fire and Rescue and Department or the Runway Control Department.

The success in the communication and coordination from a local perspective (on and in the vicinity of the aerodrome), is reliant to a large extent on the effective communication of the wildlife threat and recognized control measures adopted and agreed to by the local aerodrome wildlife committee.

Communication between internal stakeholders and users of the aerodrome should go both ways, i.e. the users should have a forum for expressing concerns, raising issues or submitting proposals. This forum may also increase the awareness of stakeholders in reporting wildlife-related incidents and convey the need to include wildlife hazard management in their SMS.

For external stakeholders, the local aerodrome wildlife committee will be mostly advisory, with the opportunity to share input, feedback, and, in some cases, take action aimed to reduce the presence of wildlife in the surroundings of the aerodrome.

The committee should inform and review the strike data collected and its observations of wildlife, assess wildlife risks and summarize any trend in order to mitigate any emerging issues. This may be as an appropriate aspect for follow-up for the implementation and maintenance of the WHMP.

Further information can be found: ICAO Airport Service Manual, part 3, 3.4 Role of bird/ wildlife strike control committee.

3.4.1 The aerodrome bird/wildlife strike committee should include those involved in bird/wildlife control, aerodrome planning, maintenance and operations. It should also include air traffic services, flight operators, rescue and firefighting services, security, duty managers, finance, etc. The committee should review strike data collected and observations of birds/wildlife, assess bird/wildlife risks and summarize trends in order to evaluate and determine what effective control measures should be implemented in order to manage the issues arising.

3.7 Establishment of a national committee or forum

Minister's Order No. 58/2024 and Minister's Order No. 170/2022 require the wildlife strike hazards on, or in the vicinity of, an aerodrome to be assessed through, among others, the establishment of national procedures and an ongoing evaluation of wildlife hazards by competent personnel.

The establishment of a national wildlife committee or forum has proven to be effective to gain and exchange information on research and development in aerodrome wildlife control. This committee or forum is an ideal way to connect different stakeholders with wildlife concerns within the aviation community and national aerodromes.

Although the composition of a national wildlife committee or forum may vary from State to State, it should include all stakeholders associated with or interested in the problem. A national committee or forum should include, but not be limited to, representatives from:

- a) CAA;
- b) national departments (defence, agriculture, environment, planning);
- c) aerodrome operators;
- d) ANSPs;
- e) aircraft operators' association;
- f) pilots' association;
- g) environmental authorities;
- h) wildlife subject matter experts and the scientific community;
- i) NGOs, ecological associations, conservation agencies;
- j) regional authorities;

- k) general aviation associations;
- l) accident investigation board;
- m) maintenance, repair and overhaul (MRO) organization; and
- n) airframe and engine manufacturers.

The establishment of a national wildlife committee or forum will promote wildlife hazard management awareness and allow for the exchange of:

- a) actual wildlife hazard management experiences,
- b) new techniques and equipment,
- c) new research and investigation studies,
- d) national, environmental, and aeronautical legislation related to wildlife hazard management,
- e) information about hazardous wildlife biology, behaviour, population trends, wildlife attraction points, etc.,
- f) information on training standards for and/or emerging technologies; and
- g) national wildlife strikes information and trends.

4. AERODROME WILDLIFE SAFETY RISK ASSESSMENT

4.1 Introduction to safety risk assessment

Safety risk assessments can take many forms including enabling the aerodrome operator to understand the very real risk of catastrophic outcomes from wildlife strikes. More frequently, however, such processes are used to allow potentially scarce wildlife control resources to be targeted at the most important areas.

The first step in a safety risk assessment of wildlife hazards is to define the area that will be assessed. This should include the entire aerodrome and its vicinity, in particular aircraft approach and take-off.

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. *Further information regarding the use of databases is provided in Chapter 7, Advancements in technology.*

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 (see Chapter 10). Further examples of wildlife management techniques and methods can be found in Chapters 5 and 6.

4.2 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 take into account different levels of knowledge and available statistics for different aerodromes.

An example is shown in Table 4-1 regarding the values of some descriptive variables of a specific species, in order to be categorized (quantitatively and qualitatively) for probability of impact:

Table 4-1. Example of impact probability categorization.

	Probability category				
	Very high	High	Moderate	Low	Very low
QUANTITATIVE APPROACH Presence of wildlife (<i>number of days per year a species is observed on the aerodrome and its surroundings</i>)	>200	100-200	50-100	50	10
QUALITATIVE APPROACH Presence of wildlife (<i>subjective evaluation</i>)	Permanent	Most	Some	Few	Occasional
QUANTITATIVE APPROACH Average number of strikes per year (5 years)	>10	3-10	1-2.9	03.09	0-0.2
QUALITATIVE APPROACH Strikes per year (<i>subjective evaluation</i>)	Very often	Often	Some	Occasional	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.

4.3 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 4-2 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 aerodrome. *In this example, the severity of the common kestrel to aviation in a theoretical aerodrome is analysed:*

Table 4-2. 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 aerodrome)	>20%	10-20%	6-10%	2-6%	0-2%
Type of aircraft damage and/or human casualty (in strikes with common kestrel)	Catastrophic	Hazardous	Major	Minor	Negligible

Note. — Descriptions of damage category terms used above are shown below in Table 4-3.

Table 4-3. Example of safety risk severity.

Catastrophic	<ul style="list-style-type: none"> - Equipment destroyed; and - Multiple deaths.
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; and - Major equipment damage.
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 an increase in workload or as a result of conditions impairing their efficiency; - Serious incident; and - Minor incident.
Minor	<ul style="list-style-type: none"> - No safety consequences; - No aircraft damage; and - Near miss.
Negligible	

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 4-4. Example of wildlife categorization based on body mass.

Body Mass	Examples	Body Mass Value
<50 g	Sparrows	2
51 - 200 g	Starlings	4
201 – 1000 g	Pigeons	8
1 – 5 kg	Large gulls	16
>5 kg	Birds of prey	32

Table 4-5. Example of a 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

Flock size may depend on specific aerodrome location and species involved.

With the example values given in Table 4-4, it is possible to locate the analysed species in one of the severity ranges that could cause a collision with an aircraft.

Table 4-6. 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.

4.4 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 4-7.

Table 4-7. Example of risk assessment matrix.

		PROBABILITY				
		Very High	High	Moderate	Low	Very Low
SEVERITY	Very High	Red	Red	Red	Red	Yellow
	High	Red	Red	Red	Yellow	Yellow
	Moderate	Red	Red	Yellow	Green	Green
	Low	Red	Yellow	Green	Green	Green
	Very Low	Yellow	Green	Green	Green	Green

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.

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 taken into account.

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, taking into account 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 4-8 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.

4.5 Quantitative approach

A quantitative approach uses historical strike records at the aerodrome expressed as the number of strikes (by species) per 10,000 aircraft movements. As a guide, 4 or more strikes per 10,000 movements would constitute a Very High probability of a strike, whereas less than 1 strike per 10,000 movements constitutes a Very Low probability. This type of approach is suited for large aerodromes.

Table 4-9 Example of a quantitative approach/Risk Assessment Matrix for Wildlife.

			Severity of Strikes				
			Catastrophic	Critical	Moderate	Minor	Negligible
Probability of Strikes			A/C Crash & Severe	A/C Crash & Light Casualty	A/C Severe Damage & No Crash	A/C light	Near miss
Definition	Meaning	Value	A	B	C	D	E
Frequent	5/10,000 movements	5	5A (Unacceptable)	5B (Unacceptable)	5C (Unacceptable)	5D (High)	5E (Moderate)
Likely	4/10,000 movements	4	4A (Unacceptable)	4B (Unacceptable)	4C (Unacceptable)	4D (Moderate)	4E (Moderate)
Occasional	3/10,000 movements	3	3A (Unacceptable)	3B (High)	3C (High)	3D (Moderate)	3E (Low)
Seldom	2/10,000 movements	2	2A (Unacceptable)	2B (High)	2C (Moderate)	2D (Low)	2E (Very low)
Improbable	1/10,000 movements	1	1A (Unacceptable)	1B (High)	1C (Low)	1D (Very low)	1E (Very low)

Note: The level of risk for each species of bird, bat and terrestrial animal is determined as a combination of the Probability of a Strike and the Severity of the Outcome. In the example the Risk is also rated on a scale of 5 – Very Low, Low, Medium, High and Unacceptable. Alternatives might use a scale of 3 and the traffic light colours (Green, Amber, and Red) to highlight the high priority species. The risk assessment will rank the risk of each species and highlight those species that should be prioritized for risk mitigation in the WHM Programme.

Severity can be rated in terms of aircraft damage and human casualty. Negligible could mean near miss and aircraft damage. Minor could mean light aircraft damage. Moderate could mean severe aircraft damage. Critical might mean that the aircraft could crash with no human death, just wounded, and Catastrophic might mean an emergency situation with aircraft crash and severe wounds or death casualty. Each aerodrome should determine its own scale. The range of aircraft sizes operating at an aerodrome will also need to be taken into consideration, so clearly the views of the aircraft operators should be considered.

All of the above techniques are designed to assess the total risk of a bird/wildlife strike at an aerodrome. This is effectively the aerodrome operator's risk exposure. In order to assess the risk to an airline or an individual passenger flying to or from an aerodrome, some account of movement rate needs to be incorporated into the risk assessment. The simplest approach to this is to express strike frequency per aircraft movement or, more conventionally, as strikes per 10,000 aircraft movements. As with the techniques described above, the sophistication with which this strike rate can be interpreted depends upon the level of detailed information available concerning the bird/wildlife strikes that are encountered. If information is limited to the total number of strikes per year then the strike rate per 10,000 movements

may simply be categorized as low, medium or high. If bird/wildlife strikes are reliably reported and identified and there is a sufficient data set, then it may be possible to treat the strike rate for an individual species as a measure of strike probability. However, it should be borne in mind that the severity depends on the mass of the species and the flocking behaviour.

Whatever risk assessment technique is chosen; it is essential that the findings are followed up by effective risk management. For those risks that are judged very high (Level 3), a list of available actions should be developed, in consultation with bird/wildlife management experts where necessary, and the costs and benefits of the various options assessed before a decision is reached on which options to select. It is equally important that the effectiveness of these options is evaluated at appropriate intervals after they are implemented. Repeating the risk assessment process annually to determine if the risk is falling to an acceptable level is recommended.

At the same time for those risks judged low (Level 1), the actions in place should not ease and should continue at the same intensity and frequency.

Finally, it is essential that the entire process be properly documented in order to show that the aerodrome operator concerned is acting with due diligence in managing the bird/wildlife risk on and around its property.

A more thorough discussion of the assessment of risk can be found in ICAO's Safety Management Manual (SMM) (Doc 9859).

4.6 Identifying root causes of wildlife hazard

The final stage of the risk assessment of wildlife hazards is to identify the root cause of each wildlife hazard. Here, it is critical to understand the behaviour and basic requirements of each hazardous species of wildlife. Remember, each animal has a basic requirement for energy and nutrients, including water. They must maintain their bodies core temperature, they must breed and reproduce, and they must avoid being predated by another animal. When identifying root causes of wildlife hazards, consider each species and its basic requirements. Then, observe the aerodrome and surrounding areas to determine how the different habitats may aid the species in fulfilling its requirements.

This stage of the risk assessment should, wherever possible, involve a trained wildlife biologist who is familiar with ecology and animal behaviour. Ideal habitats for hazardous wildlife may not be readily apparent, and the attractiveness of aerodrome habitats may vary seasonally. Consider all stages of an animal's requirements throughout the annual cycle. Breeding seasons, annual migrations, seasonal weather patterns, and food availability are all factors that can contribute to temporal changes in wildlife hazard.

5. HABITAT MANAGEMENT

5.1 General

Habitat management is probably the most important method of preventing or reducing wildlife strikes on and around an aerodrome. The airfield habitat should be less attractive to the animals than the surrounding areas. If there are off-aerodrome sites that attract birds, these may need dealing with – also these can create flight line of flight paths of birds moving from one area to another (e.g. from an overnight roost to a feeding location) then the aerodrome should, in conjunction with local regulators seek to reduce the attractiveness of these off aerodrome sites also.

Modifying the on-site habitat and environment to eliminate or exclude food, water and shelter can limit the attractiveness of an aerodrome to wildlife. Additionally, habitat management of attractive sites on, or in the vicinity of, the aerodrome is the foundation for an aerodrome's WHMP because it addresses the root cause of wildlife hazards.

Land use practices that attract hazardous wildlife populations on, or in the vicinity of, the aerodrome can significantly increase the potential for wildlife strikes.

Wildlife is attracted to habitat because of their specific requirements for food, water, breeding activities and safety. A habitat that provides these requirements increases the likelihood of their presence and the risk of a strike.

Before undertaking activities to manage habitats, a safety risk assessment that identifies the hazardous wildlife and the root cause of their association with specific habitats (*See Chapter 4, Aerodrome Wildlife Safety Risk Assessment*) must first be carried out. Understanding habitat attractants requires the study of how wildlife uses these habitats.

Following a safety risk assessment, any habitat used by hazardous wildlife should be identified and a habitat management strategy should be developed. This strategy should prepare for the impacts of habitat management activities on the hazardous wildlife species at the aerodrome. In some cases, management activities that decrease the risk of strikes with some species may increase the risk of strikes with others. In these cases, the risk assessment should be used to determine which species present the greatest risk and are therefore the target of habitat management efforts.

When considering proposed land uses, aerodrome operators, local planners and developers must consider whether the proposed land uses, including new development projects, will increase wildlife hazards.

5.2 Attractants

5.2.1 Food

Vegetation

Vegetation is frequently the dominant land cover at many aerodromes and can consist of open grassland, shrubs and trees. Certain vegetation may produce seeds, berries and attract invertebrates or other animals that are a food source for various hazardous wildlife. Managing an aerodrome's vegetation to minimize its attractiveness to wildlife is a critical activity.

Management actions targeted at vegetation can increase the risk of exposing prey items in the short-term. For example, mowing grass too short may expose invertebrates or other small animals, making them available to predatory birds. On the other hand, when the vegetation becomes too tall, it could fall down, providing shelter and a fertile layer for mice or other wildlife. When planning any habitat modification, one must consider how the change may increase the availability of prey, and therefore, the risk of a wildlife strike. Bare soil gives weed a chance to grow and may expose food such as seeds or invertebrates. Soil cultivation can also expose these food sources and may even bring buried prey items closer to the surface to attract hazardous wildlife. The timing and frequency of management actions on an aerodrome should be oriented to minimize hazardous wildlife.

Agriculture

Agricultural systems can increase the presence of wildlife on and around aerodrome lands depending on the cropping system. Agricultural systems that produce highly nutritious foods that can be exploited by wildlife (for example cereal grain) can increase the risk of strikes, as will those that involve frequent field tillage or mowing that exposes seeds, invertebrates or small animals. Certain cropping systems may benefit the aerodrome by removing vegetation that would otherwise provide habitat for prey species (e.g., hay operations that remove cut grass that would otherwise provide refuge for invertebrates or small mammals). Agricultural systems far from the aerodrome may aid in decreasing strike risks by luring hazardous wildlife away from the area of flight operations.

Waste Management

Food and garbage waste bins, slaughterhouses and open-air markets may be highly attractive to scavenging wildlife.

Landfills and garbage dumps are a significant source of food for wildlife. Certain species will travel several tens of kilometres to reach a dump. Birds flying to and from these sites may cross over an aerodrome or aircraft flight paths. It is not uncommon to observe hazardous birds, for example gulls, kites and vultures, soaring over dump sites in the thermals created by composting garbage. The greater presence of birds may give rise to problems for approaching aircraft.

5.2.2 Water

Water bodies

Water is a primary requirement for wildlife: it offers them drinking water; a resting site; an escape from predators and a feeding site. Eliminating water habitats or excluding wildlife from using these habitats will decrease the number of wildlife using an aerodrome.

Ponded water that forms in depressions can be an attractive habitat for a variety of wildlife, particularly water birds, and should be removed. Water bodies can be made inaccessible in a variety of ways: for example, covering them with wires or netting to inhibit birds from landing. Water bodies that cannot be eliminated or covered should be designed to discourage their use by wildlife as much as possible and have a perimeter road so that wildlife-control personnel can quickly access all parts of the water body to disperse birds.

Emergent vegetation in drainage ditches may decrease the drainage capability and provide refuge and food sources for wildlife. Alternatively, emergent vegetation may exclude hazardous wildlife from using them. Steep banks may limit access to some types of wildlife, whereas others will not be affected.

Wetlands are often used by significant numbers of water wildlife, which tend to be a higher hazard species due to their size and flocking behavior. If possible, any change to these water bodies should reduce their attractiveness to wildlife if the wildlife is known to present a flight safety risk.

The existence of several bodies of water around the aerodrome may result in wildlife movements from one to another, thereby increasing the risk of wildlife strikes, especially if the aerodrome lies between those water bodies.

Wastewater management

Wastewater management facilities and their settling ponds often attract large numbers of wildlife. The closer the building is to the aerodrome, the greater the potential risk. The aerodrome operator should develop an agreement with those responsible for the wastewater management facility to ensure that wildlife hazards resulting from sewage ponds are suitably managed. New facilities should not be constructed near an aerodrome or where wildlife movements to and from the ponds may affect aircraft movements.



Figure 1. Floating balls and bird netting to cover the water, and drainage opening protection

Quarries

Areas from which raw materials and stone are extracted are often filled with water. It is common for these areas to be left without being restored, thereby attracting birds. With any new excavation, the site should be restored to a state that suits flight safety. The enhancement of old extraction pits should be discouraged, as this can increase the risk of wildlife hazards.

5.2.3 Shelter (resting, security and nesting)

Open areas

Grasses can shelter prey that are fed upon directly by hazardous wildlife. Wildlife may hide in grasses or rely on open expanses of grassland to detect predators at a distance. Grasses can also provide a breeding habitat. Managing the species of grass on the aerodrome, as well as the height and density of grasses, may reduce the attractiveness of the habitat.

Soil will influence the vegetation that grows on a site and will also act as habitat for soil-dwelling organisms, some of which may be prey for hazardous wildlife. Some hazardous wildlife may use burrows or tunnels in the soil as a place to shelter from the environment, escape predators, or breed.

Other offsite land uses, such as parks, golf courses, and other amenity grasslands may attract hazardous wildlife. Managing these sites requires the dedicated engagement of stakeholders outside the aerodrome in order to influence land use changes that can reduce the attraction to hazardous wildlife.

Aerodrome pavement may provide a resting and loafing site for wildlife that are attempting to stay warm. Pavement can retain heat longer than its vicinity, resulting in wildlife using it to warm up on colder days. After rainfall, invertebrates (e.g. earthworms) may avoid the wet soil by coming onto the pavement areas, increasing their availability to hazardous wildlife. After heavy rainfall, pavement areas may become more attractive to gulls, increasing their presence at the aerodrome.

Forest

Trees and shrubs provide nesting or roosting opportunities for wildlife. Depending on the wildlife safety risk assessment, these may have to be eliminated on aerodrome property. The aerodrome operator should be aware of such areas in the vicinity of the aerodrome and the potential transiting routes for wildlife.

Nature reserves

The establishment of nature reserves in the vicinity of aerodromes can provide a strong attractant to hazardous wildlife. In general, nature reserves are formed where unique, diverse or remnant habitats exist and they may host hazardous species. The aerodrome operator should develop a solid relationship with reserve management, so that if habitat enhancement is conducted on the reserves, wildlife hazards to aircraft are considered.

Buildings

Wildlife often seek shelter and breeding sites on aerodrome property in the structural beams of hangars and bridges, in the nooks of jet ways and other structures. Aerodromes should adopt a zero tolerance for hazardous wildlife using any aerodrome structure.

The attraction of hazardous wildlife should be considered in the design phase of buildings, hangars, bridges and other structures at aerodromes to minimize exposed areas that birds can use for perching and nesting.

5.3 On-aerodrome management

5.3.1 General

On-aerodrome habitat management involves the removal and alteration of habitat features that attract hazardous species. Typical actions include adjusting the design of aerodrome buildings and structures, preventing wildlife from accessing aerodrome property using fencing, adjusting grass height, the pruning or removal of trees and shrubs, management of waste on the aerodrome and the removal of standing water (ponds, puddles).

The key to effective habitat modification is to remove existing attractions without introducing new enticements that may appeal to other species. Every species on the aerodrome represents a direct or indirect hazard; however, aerodromes should consult their risk assessment matrix to identify the species with the greatest risk. On-aerodrome habitat modification should be aimed primarily against those species that pose the greatest risk to aircraft safety.

The aerodrome operator should be aware of not only managing habitat attractants on airside locations, but also ensure that habitat attractants are identified and managed landside.

5.3.2 Design (aerodrome buildings and structures)

Screening holes and openings of hangars can prevent access to these buildings. In the case of hangars, where doors may be left open for an extensive period of time, netting can be installed across the base of the rafters to exclude birds from nesting in the rafter system. Adding a slope greater than 45 degrees to edges of buildings can also deter birds from nesting on these sites.

Where perching sites are present on existing structures, their access can often be eliminated with the installation of netting. Anti-perching devices, such as spikes, can be installed on ledges, roof peaks, rafters, signs, posts and other roosting and perching areas. If wildlife is already present on existing structures, the aerodrome operator should refer to Chapter 6 for more management techniques.

Unused structures such as sheds, abandoned buildings and structures, old windbreaks and rotten fence posts should be removed from aerodrome lands to prevent nesting and roosting.

Where birds have already nested in buildings, nest removal may be possible, but should be done in consultation with local and national environmental requirements. The trapping, removal or relocation of young birds may be conducted if nest removal is not completed outside the breeding season.

Perching sites are important for birds; they offer vantage points that overlook the immediate surroundings. Perches are places from which birds sing, call and display. They also act as observation points, hunting lookouts and as places to rest, digest, preen, roost and gather socially. As potential perches for birds, lone trees, hedgerows, fences, gates, posts, shrubs, stumps, junk, weed patches and boulders should be removed from aerodrome lands. If this is not possible, spoked wires can be attached to perching sites to discourage their use. Power lines are popular perches and should be relocated underground. Certain specific wire can also be fitted to runway, approach, taxiway and apron lights to discourage their use as perches.

Aircraft parked on aprons or fields are also popular nesting locations. Birds usually enter aircraft through small access holes just large enough to accommodate them. Parked aircraft should be regularly checked for nesting birds, and if they are expected to be parked long-term, the aerodrome operator should consider installing netting to prevent such access.

5.3.3 Fencing

A complete perimeter fence is the prime method of preventing hazardous wildlife, other than birds, from gaining access to the aerodrome. There is a variety of fencing available, including electric fences. The most suitable fence for an aerodrome depends on many factors, including the observed wildlife hazards, the potential impacts of certain types of fencing, seasonality of hazards, costs (both for construction and maintenance) and adjacent habitat types. Adding the use of cattle gates at entry and exit points for vehicle access points within a perimeter fence can prevent many hoofed mammals from crossing into aerodrome property.

Fencing should be buried below the ground when possible, to discourage animals from digging under the fence to gain access to aerodrome property.

Fences and gates should remain closed and be regularly inspected.



Figure 2. Well-maintained fence, at least 3m high, no gap at the bottom and dig protection are required.

5.3.4 Grass

Grass height should be decided based on the target high risk species. Grass height may be limited next to the manoeuvring area, but grass may be kept at a taller height depending on the management of local high-risk species.

There is no single recommended grass height that is effective at all aerodromes. It is recommended that aerodromes conduct a site-specific study to find an optimal grass height. The decision to maintain short or tall grass depends on which species pose the highest hazard at the specific aerodrome.

Vehicle access to grass areas should be restricted to minimize damage and alteration to grass heights. Damaged grass areas might lead to standing water and the emergence of weeds attractive to hazardous wildlife.

Vegetation that is undesirable or mildly toxic to wildlife may deter wildlife feeding. For example, there are varieties of tall fescue and perennial ryegrass that contain fungal endophytes that may be unattractive to some birds, mammals and insects. The aerodrome operator should be aware of State regulations concerning these varieties.

There are alternatives to grass covering bare soil around an aerodrome. An example of this is the application of a wood mulch added to water, seed, fertilizer and soil amendments which can provide coverage to areas that may be more attractive to hazardous species and help aid in the growth of new grass. The use of artificial turf may reduce food, shelter and burrowing attractants for hazardous wildlife.

Aerodrome operators may need to obtain advice from specialists working in conjunction with local agronomists on the seed mixes to be used for planting on the airfield. The mix should permit development of slow-growing plants producing a minimum of seeds, to avoid providing food for birds, yet with sufficient regeneration to maintain good soil coverage. Consideration should be given to using high entophyte type plants to minimize wildlife use of the vegetation.

Most evidence shows that short grass (5-10 cm) attracts more birds than longer grass (15-20 cm). In some cases, very long grass (1 m) is necessary to deter the major hazardous species of birds. Predators, including raptors and certain terrestrial grassland bird species, do not like to hunt for their prey, particularly small mammals, in long grass. When birds are not hunting, they like to have clear all-round vision to avoid danger. Longer grass creates an insecurity factor and discourages them from landing, resting or nesting in this type of grassland habitat.

Therefore, the larger and most hazardous species, because they are usually much taller than 20 cm, require grass heights well in excess of the typical "tall" grass range. Grass management has to be adapted for each aerodrome. No general principles can be adopted on this subject at the international level.

Aerodromes which do not have vegetation covering the soil do not offer much food to birds, but may attract certain species to nest or roost directly on the soil. At aerodromes where sparse or no vegetation attracts hazardous species, studies could be conducted to determine possibilities for plant coverage that prevents nesting and roosting without increasing food sources. It is not automatically the best choice to provide a grass covered airfield. If the surrounding areas are arid desert, then the green grass may well attract birds.

Depending on the type of grass used and the local climate, grass coverage needs to be maintained. Depending on the type of grass, the machinery used to mow will have to be adapted to pick up maximum amounts of grass after mowing, and must not create ruts, which may offer wildlife a favourable environment. For example, if they become filled with water. The continual collection of grass may also lead to reduced soil fertility and may require periodic added fertilization, preferably in the form of low-nutrient organic fertilizer.

The period during which grass is cut is a determining factor in wildlife hazard management. It is essential to be able to carry out this work under dry weather conditions and be sure that it can be completed as rapidly as possible.

Consideration should also be given to conducting grass cutting at night time. Night cutting eliminates the risk of attracting birds to the mowers to feed. The period after mowing should allow for grass to grow to its optimal height before the next mowing is carried out.

The grass that is cut must be sufficiently mulched, or preferably collected and removed from the aerodrome. The presence on the ground of decomposing grass creates a thatch layer that favours an increase in invertebrate numbers which will in turn attract birds. Clumps of grass also provide ideal nesting habitat for field rodents and can contribute to high rodent populations which can attract raptors.

This may mean an airfield should have grass cut to a particular length such that local bird species cannot find food and cannot rest because their sight is interrupted by the grass. At other locations it may be more

important to not provide perching opportunities on structures or, in dry areas not to provide access to surface water. A study of the aerodrome environment should lead to the implementation of a WHMP that describes the management needed for the different areas and habitats of the aerodrome perimeter.



Figure 3. Long grass maintenance regime

5.3.5 Forest, vegetation and agriculture

Large areas of brush, shrubs or forests, natural or decorative, can provide habitat with safe areas where wildlife loaf, perch, roost and nest. These areas are commonly found on undeveloped aerodrome grounds and can attract birds and other wildlife.

Brush and bushy vegetation should be eliminated from aerodromes when possible and at the very least be eliminated from the proximity of manoeuvring areas.

Tree species that produce soft fruits, berries, or high numbers of seeds are especially attractive to wildlife and should be removed. Trees also provide cover for medium-sized and large mammals. Large trees located at the edges of open areas provide excellent vantage points from which raptors can survey for food. In addition, trees can create an edge effect, which is an intermediate area often rich in bird life because it borders two different habitats such as grassland and wooded areas. Trees should be located as far as possible from runways.

Where tree removal is not possible, undergrowth should be removed. Trees can also be thinned at their tops to make them less attractive as roosting sites. Trees should be frequently inspected for colonies of nesting or roosting birds.

Some varieties of decorative trees and shrubs may be acceptable but should be selected with the appropriate assistance of experts to ensure low risk species are chosen.

Agricultural activities at aerodromes may attract hazardous wildlife and it is recommended that aerodrome lands not be used for agriculture.

Aerodromes that have on-site agricultural practices should ensure that crop selection is done in line with their wildlife hazard management programme. Modified ploughing and harvesting practices may also be necessary to decrease the risks to aviation.

5.3.6 Waste management

Aerodromes should require a wildlife-proof storage of food waste, prohibit wildlife feeding and promote good sanitation and litter control programmes. In many instances, simply closing the lid of waste bins can limit the access to these food resources by hazardous wildlife.

Waste disposal sites on aerodrome property should be removed to an off aerodrome location, outside of the 13-km circle. If this is impossible, organic waste should not be accessible to hazardous wildlife (e.g. buried or incinerated). Where waste management must occur on aerodrome property, disposal activities should also be conducted at night to attract fewer birds. Additional mitigation could also include fencing, netting or overhead wires to prevent access.

Improperly disposed refuse can attract wildlife and the aerodrome should ensure that waste management procedures include closing the lids of garbage bins and that waste is disposed of into bins and not littered on the property. Signage to discourage the feeding of wildlife should also be erected in public areas.

5.3.7 Water

The best method to reduce the attractiveness of water bodies on aerodrome property is to remove them: for example, by draining or filling. Where aerodromes have drainage ditches, these can be replaced with buried culverts. Where drainage ditches remain, aerodromes may have to clear these ditches of emergent vegetation. Areas where temporary water pools form after rain or spring melts should be filled or fitted with improved drainage systems.

Clearing the ditches at regular intervals is important. They should be graded so that the water will run off as rapidly as possible. Grass and other vegetation should be cut on the sloping banks. Where practicable, the water attractant can be eliminated by replacing ditches with buried drain pipes.

Where water bodies cannot be removed, there are methods which can help reduce the attractiveness to wildlife. Water bodies should be cleared of emergent and submerged aquatic vegetation and the banks should be cleared of vegetation and brush. This can be done by cutting, dredging, or herbicide use.

The slopes of water bodies should be graded to a steep slope, which will discourage burrowing mammals, bird species and offer a clearly defined edge which can be easily mowed.

Physical barriers should be erected to prevent wildlife access to water bodies. Methods include fencing around the perimeter, exclusion wiring and netting across all the surfaces or riprap installed on water embankments. Visual enhancements can be attached to the wires and netting to prevent birds from flying into the barriers. In certain instances, barriers such as large black balls that float on water bodies have been used successfully to prevent access to water bodies.

If water bodies cannot be covered or drained, dredging will increase the water depth and, as a result, decrease the surface area.

Where storm water management ponds are present on aerodrome property, the aerodrome should ensure a maximum retention period for the storm water to reduce attractiveness (e.g. in North America, this time period has been identified as 48 hours).

5.4 Off-aerodrome management

Generally, the aerodrome does not have the opportunity to directly manage habitats outside of the aerodrome. Therefore, it is necessary for the aerodrome to develop good relationships with the adjacent landowners and the local government to be able to influence land uses that affect hazardous wildlife distribution, movements and abundance.

The first stage consists of gathering specific data on wildlife outside the physical boundaries of the aerodrome. While it is critical to know the seasonal abundance of each hazardous species on and near the aerodrome, it is also important to know how those species interact with the aerodrome. For example, knowledge of movement routes makes it possible to provide pilots with reliable information on potential hazards within approach and departure paths. Knowing where species nest/den etc. can be very important in determining control strategies for young animals that are frequently most at risk of causing a strike.

The areas surrounding the aerodrome have a direct impact on the presence of wildlife on the aerodrome. Their physical location may also result in animals crossing the aerodrome regularly. It may be necessary to gain an understanding of wildlife behaviour outside the aerodrome.

The concept of compatible land use planning is the environmental relationship between aerodromes and their community neighbours. Its implementation requires careful study and coordinated planning. Land use around aerodromes can influence restrictions on aircraft flights and affect aircraft safety.

A 13-km circle centred on the aerodrome reference point is recognised where land use should be assessed with regard to wildlife hazard management. However, the circle may be extended or reduced based on a wildlife evaluation of the aerodrome vicinity. State should consider all aviation safety concerns related to land development in the vicinity of the aerodrome to minimize the attraction of wildlife. Aerodrome operators are encouraged to communicate their safety concerns with the local authority in order to raise awareness (see *Chapter 3, 3.6, Methods of communication*). Prior planning is necessary to ensure that incompatible land use is not allowed to become established. Such developments should be subjected to a risk assessment process as described in Chapter 4 and changes sought, or the proposal opposed, if a significant increase in the wildlife strike risk is likely to result.

In order to successfully deal with land use issues, a comprehensive WHMP including coordination among the aviation regulatory authority, aerodrome operator, aircraft operators and the surrounding communities should be implemented.

Note. — A list of types of land use that should be prevented, eliminated or mitigated is available in the Procedures for Air Navigation Services - Aerodromes (PANS-Aerodromes, Doc 9981), Part II, Attachment to Chapter 6.

A monitoring process of sites where hazardous wildlife is to be found should be instigated, at least seasonally. The survey of the land use around aerodromes should be reviewed at a period determined by the safety risk assessment. In general, it is desirable to carry out a new comprehensive land use survey assessment every five years.

Modern technology like satellite detection facilitates the registration and monitoring of different land use types (see Chapter 7, *Advancements in technology*).

The aerodrome operator should engage with local farmers in the vicinity of the aerodrome to encourage them to choose agriculture practices that are the least attractive to hazardous species. These practices may include types of crop, livestock and grain and feed storage.

The appropriate authority should encourage prohibiting or restricting the establishment of new or existing organic waste sites near aerodromes. If a waste management site in the vicinity of an aerodrome cannot be closed, it may be necessary to provide control measures at the site to reduce its attractiveness to hazardous wildlife.

The types of environments in the vicinity of an aerodrome, have a direct impact on the presence of wildlife are described below:

1. Local Agricultural Practices

In general, experts advise against growing agricultural crops on the aerodrome. Outside the aerodrome site, it is difficult to influence the choice of crops, unless national legislation has been adopted on this subject. Whatever the situation, it may be necessary to engage with local farmers in the vicinity of the aerodrome to influence their activities.

Many countries already regulate the use of agricultural land in the vicinity of aerodromes to minimize the attraction of wildlife. The planning of crops around the aerodrome may take the form of crop plans, recommendations for farming methods, or even the adoption of legislation. In all cases, it is extremely essential for the aerodrome operator to establish coordination with the local authorities and to ensure that they are aware of the risks to aviation which may arise from wildlife.

2. Landfill/Garbage Disposal Sites

Landfills and garbage dumps are a significant source of food for birds. Certain species will travel several kilometres to reach a dump. Birds flying to and from these sites may cross over an aerodrome or aircraft flight paths. It is not uncommon to observe birds, in particular gulls, soaring over dump sites in the thermals created by composting garbage. The greater presence of birds may give rise to problems for approaching aircraft. The presence of garbage dumps on aerodromes must be totally prohibited. In accordance with various national recommendations for the prevention of bird hazards, regulations call for the elimination of garbage dumps within a radius of up to 13 kilometres of the aerodrome. Even this regulation may be inadequate to prevent hazards if the aerodrome is located between the landfill and the roosting site of the birds using the landfill.



Figure 4. Trained falcon at landfill and garbage disposal site, Falcon Environmental Service

3. Sewage Treatment and Wastewater Plants

These plants and their settling ponds often attract large numbers of birds. The closer the plant to the aerodrome, the greater the potential hazard is likely to be. It is necessary for aerodrome operators to develop agreements with those responsible for the plants to ensure that birds hazards that result from sewage ponds are suitably mitigated. New plants should not be constructed near an aerodrome or where bird movements to and from the plant may affect aircraft movements.



Figure 5. Permeable floating cover at sewage

4. Reservoirs, lakes, pond, rivers and salt marshes

Wetlands are often used by significant numbers of water birds, which tend to be among the higher hazard species due to their size and flocking behaviour. If possible changes to these waterbodies should be undertaken to reduce their attractiveness to birds if the birds are known to present a flight safety risk.

The existence of several bodies of water may result in bird movements from one to another, thereby increasing the risk of bird strikes especially if the aerodrome lies between those waterbodies. Particular attention has to be paid to the risk of bird strikes at aerodromes situated in coastal areas or near estuaries.

5. Gravel Pits and Quarries

Areas from which raw materials and stone are extracted are often filled with water. It is common for these areas to be left without being restored, thereby attracting birds. In the case of any new excavations, it is important to ensure that, following its exploitation, the site is restored to its initial state. In some cases, old extraction pits are being enhanced to increase the biodiversity of an area which, if near an aerodrome, may increase the bird hazard.

6. Nature Reserves

The establishment of nature reserves in the vicinity of aerodromes can attract wildlife, especially if hunting exists outside of the reserve. In general, nature reserves are formed where unique, diverse or remnant habitats exist. They may or may not harbour hazardous species. Aerodromes should develop a solid relationship with reserve management, so that if habitat enhancement is conducted on the reserves' wildlife hazards to aircraft are a primary consideration.

7. Possible future hazards in the vicinity of the aerodrome – safeguarding

Aerodrome operators should take steps to prevent new or increased hazards caused by developments in the vicinity of the aerodrome and should also encourage developments that reduce wildlife hazards. ICAO quotes a distance of 13km from the aerodrome. However, developments beyond 13km can still create a hazard if animals move past the aerodrome or runway ends, to and from the newly developed land use. Information needs to be collected by the appropriate State authority and/or the aerodrome operator about the local wildlife species, their abundance and their movements to and from feeding and roosting areas at different times of the year.

Where such developments are likely to increase the hazard, the aerodrome operator should communicate those concerns to the developer, municipal planners and the national aviation authority.

8. Landscaping of Aerodromes

In many projects for the revitalization, extension or construction of new aerodromes, external landscaping is given importance in the project in order to welcome aerodrome users in an agreeable manner. The planting of trees, bushes and other plants has the undesired effect of attracting wildlife, and particularly birds. The management of the wildlife hazard should be considered part of the project planning from the very beginning. Care should be taken with the selection of sites for planting and the varieties used which can have a significant impact on the presence of wildlife. In all cases, plants which produce food such as berries and fruit should be avoided. Also, continuous stands of vegetation should be avoided. Preferably,

trees should be spaced so that they do not form a continuous canopy and shrubs should not be planted under the canopy of trees and should also be spaced so as to not touch each other. Open form trees and shrubs should be selected, avoiding coniferous trees and shrubs which provide year round shelter.

Aerodromes should conduct an inventory of bird attracting sites within the ICAO defined 13km bird circle, paying particular attention to sites close to the airfield and the approach and departure corridors. A basic risk assessment should be carried out to determine whether the movement patterns of birds/wildlife attracted to these sites means that they cause, or may cause, a risk to air traffic. If this is the case, options for bird management at the site(s) concerned should be developed and a more detailed risk assessment performed to determine if it is possible and/ or cost effective to implement management processes at the site(s) concerned. This process should be repeated annually to identify new sites or changes in the risk levels produced by existing sites.

Once sites that support birds/wildlife that are, or might, cause a flight safety problem are identified, management options can be developed. These can range from minor habitat modification, changing cropping or other agricultural practices, major drainage operations or large -scale removal of bird/wildlife populations. Again, the choice of technique will depend on the particular situation encountered and expert advice should be sought if necessary. Larger scale off-aerodrome bird/wildlife management may also involve liaising with local conservation interests, especially if the sites that need to be managed are nature reserves. In some cases, it may be impossible to resolve the conflicting interests of flight safety and conservation, but in trying to do so the aerodrome will be in a better position to show due diligence in the event of an accident or legal claim in the future.

6. MANAGEMENT OF HAZARDOUS WILDLIFE

6.1 The importance of understanding animal behaviour

Wildlife can react in different ways to different methods of dispersal, and protect themselves from predators by hiding or fleeing. The role of the wildlife control personnel on duty at an aerodrome is to understand the ways in which hazardous wildlife species are likely to react vis-à-vis the different methods of dispersal in order to reduce their presence on or around an aerodrome most effectively and reduce their risk to aircraft.

Hazardous species may respond differently to expelling and deterring techniques. Some species fly away from the stimulus while other species crouch down and hide or even approach the stimulus. Knowing these responses will enable the controller to select the correct method to reduce the immediate risk.

When confronted with deterring or expelling techniques, all wildlife will initially become 'alert' to a potential threat before they exhibit their 'response'. For example, many birds that have become accustomed to the presence of routine wildlife control on an aerodrome adopt a 'watch and wait' behaviour. A wildlife control vehicle or person will result in wildlife becoming 'alert' but not necessarily responding until the control method becomes clear. If wildlife remains undetected on the aerodrome, it will learn that such a response saves itself energy and will therefore be able to continue with its activities unhindered. The reaction of species can therefore be controlled by moving past the wildlife, stopping and waiting or instigating an action. Since different species will react in different ways at different aerodromes in different seasons, time of the day and weather conditions, it is essential that these responses are understood on a site-by-site basis. Control can be achieved by understanding whether the 'response' of wildlife will be to ignore, hide or flee.

At aerodromes where active wildlife control measures are routinely implemented, behaviours may differ from aerodromes where infrequent actions are undertaken. The most likely response will again differ in relation to the amount of time target species have been subjected to deterring or expelling techniques at any given aerodrome.

Wildlife control operators must therefore be able to identify the species present at their aerodrome and understand their behaviour. The aerodrome should provide a wildlife guidebook to officers to assist them in detecting species, in particular rarer species that may not frequent the aerodrome on a regular basis. A dynamic risk assessment based on the likely reaction of the species present, the location of aircraft movements at the time and the control methods available will then enable the most appropriate cause of action. Chasing hazardous wildlife with simple methods such as loud noises and manual techniques (arm waving, clapping, etc.) may be all that is required to disperse them directly away from the wildlife control personnel. More sophisticated methods may include using a distress call system to draw a flock of gulls away from a runway, or using pyrotechnics to deter a group of circling raptors.

Wildlife control personnel should be equipped with a range of appropriate systems for deterring,

dispersing or removing species they are likely to encounter and the ability to deploy such systems wherever necessary on the aerodrome. The objective of deterring or expelling is not to scare wildlife randomly around an aerodrome but to control movements and disperse them away from high risk areas. The ultimate objective is to render the aerodrome a hostile location and 'educate' hazardous species that the risk of remaining within the aerodrome environment outweighs the potential rewards that the environment may offer.

All active control systems should only be deployed when required, in order to reduce habituation (the process by which wildlife learns to ignore a stimulus if it has no actual threat). Overuse of individual methods results in habituation and the subsequent failure of those methods. Human operated (active) control will always, therefore, be more effective than automated (static) scaring systems. Similarly, the use of lethal threat will remain an important tool to reinforce the effect of non-lethal expelling and deterring techniques. Once the responses of different wildlife species at an aerodrome are understood, they can be associated with control actions to reduce their risk. When recording such actions, the patrols and observations explained below should be considered.

6.2 Intervention techniques

Intervention techniques are actions taken by a wildlife control operator to remove wildlife from areas of high risk. One of the intentions of intervention techniques is to train the wildlife not to occupy areas where they are not wanted. If an animal learns that the effort to occupy a place and get chased away is greater than the benefit provided by the food or opportunity to rest in that area, it may stop returning. Most intervention techniques rely on scaring wildlife with an audible or visual threat. This can include the following:

- Movement of the patrol vehicle and the human pressure associated with the wildlife control operator. (Care must be taken that the patrol itself does not become a hazard to aircraft operations.)
- Noise to scare wildlife such as sound generators, pistol or gun shots, and pyrotechnics or firecrackers. (Care must be taken that wildlife are moved away from aircraft operations.)
- Noise to deter wildlife such as recorded distress or alarm calls. (Care must be taken that such calls do not attract curious or predatory species.)
- Visual repellents including lasers, kites, balloons, scarecrows and small models.
- Trained predators such as falcons and dogs used to chase wildlife.
- Trapping, tagging and relocation, especially for larger animals and protected species.
- Culling or killing. (This is generally a last resort, as a dead animal is not a trained animal. It is not an option for certain species such as endangered or protected species.)
- In some situation chemical repellents and pesticides might have a role to play, although the use of poisons and environmental pollutants should be discouraged. Care must be exercised to avoid any intervention from accidentally flushing birds at ill-timed moments in to the path of aircraft. Care must also be taken the patrol vehicle or personnel do not become air safety hazards. Wildlife training discussed in Chapter 8 is a crucial requirement to reduce this risk.

Mobile patrols should be more persistent than the wildlife. Simply moving wildlife and then driving away is seldom effective wildlife control. It often is necessary to remain in the area following control to prevent the immediate return of wildlife or to repeatedly return to the area at frequent intervals to ensure that the controlled wildlife have not returned and to reinforce control if necessary. The aim is to achieve a bird free aerodrome and the control needs to be thorough to ensure the birds leave the airfield.

6.3 Patrols and observations

Patrols of airside areas to check for birds and other hazardous wildlife are a direct requirement for wildlife hazard management of aerodromes. Critical risks result from wildlife being present on or crossing runways and approach or departure paths, therefore patrols should aim to prevent their presence in these areas. These patrols should facilitate either immediate dispersal from those locations or preventative dispersals from areas likely to result in such movements. Additionally, ATC and other personnel should inform wildlife controllers when they observe wildlife; the wildlife controller can then determine the level of hazard (*See Chapter 5, Aerodrome Wildlife Safety Risk Assessment*).

Patrols should target the locations of hazardous wildlife activity, especially near runways and approach or departure paths. Local knowledge, data assessments and visual observations can provide vital information on where recent hazardous wildlife has been congregating or dispersed from.

During patrols, the recording of hazardous wildlife will enable the aerodrome operator to identify existing and future problem areas (for example, low areas that gather standing water after rains, blocked drainage ditches, unmanaged grassland, fruit- or berry-bearing bushes, buildings or lighting and signage stands that provide perching areas etc.). Such areas should be logged to take proactive habitat management action.

Wildlife control operators should ensure that wildlife does not habituate to routine pathways or timings. If the same path is followed on every occasion, wildlife may learn when it is safe to remain in an area and will only briefly depart on the approach of a vehicle. Randomization of routes and wildlife controller behaviour is beneficial. By waiting, or by returning to the same location shortly afterwards, controllers will gain an understanding of the observed species and which areas are being used most frequently. Constantly varied patrols will also help wildlife controllers to learn the behaviour in different seasons, times of the day, weather conditions and habitat preferences of wildlife at an aerodrome. For example, some aerodromes conduct wildlife management patrols at least 15 minutes prior to any movement. When possible, wildlife management personnel should position themselves at the most critical areas. For the patrols, the wildlife controllers should have appropriate vehicles, binoculars and recording devices (e.g. pad of paper, tablet, audio recorder).

During patrols, any wildlife remains found should be collected, identified to the species level and documented in a wildlife log. Even if remains are not evidenced as being recorded in a collision with an aircraft, its presence on the aerodrome may assist with identifying risks with that species that could prevent future strikes.

When a control action is undertaken, the wildlife management personnel should ensure they record the following information;

- a) name of the personnel on duty;
- b) shift start and finish time;
- c) time for each activity or record;
- d) weather and lighting conditions;
- e) location of activities;
- f) details of the wildlife observed and/or dispersed;
- g) numbers of each species seen, including zero sightings;
- h) type of dispersal action taken;
- i) reaction of wildlife to dispersal; and
- j) direction of dispersal.

6.4 Repellents

6.4.1 Overview

The following provides an outline of possible options for controlling wildlife on aerodromes to reduce strike risks. This list is not exhaustive but covers a group of the main techniques used around the world for active wildlife control on aerodromes. There are many more systems available than it is possible to cover here. There is no single solution or set of procedures that is best for all situations. Aerodrome operators should carry out a thorough review of any equipment before purchase to ensure that it is fit for purpose. Each wildlife species is unique and will often respond differently to various repellent techniques. Factors such as food resources, weather, time of year or day and predation can clearly interact to diminish or enhance repellent effectiveness.

To lessen habituation: use each technique sparingly and appropriately when target wildlife is present; use various repellent techniques in an integrated fashion; and if necessary, reinforce repellents with occasional lethal action directed at problem species.

Equipment used by wildlife management personnel on the aerodrome to control hazardous wildlife should be appropriate to the aerodrome environment and species encountered.

Advances in electronics, remote sensing and computers have resulted in systems that can automatically dispense repellents (for example, noisemakers, chemical sprays) when targeted wildlife enter selected areas. These devices are used to reduce habituation and increase the effectiveness of other repellent techniques. It should be remembered that automated repellents are not a substitute for trained people on the ground, who can respond appropriately to incursions by various wildlife species, and should be considered only when more traditional methods of control and dispersal have proved ineffective.

6.4.2 Audio repellents

Pyrotechnics

Use of pyrotechnic wildlife scaring techniques, either from a cartridge fired from a shotgun, a specialized pistol or from a stationary cannon, is a common means of dispersing wildlife at aerodromes. Wildlife will usually move away from the detonation so it is possible to control their direction to some degree: detonations behind wildlife can hasten their departure, and to either side can keep them on track and to hold a flock together. Pyrotechnics fired high in the path of an approaching flock will cause it to pause and orbit. However, birds will often avoid a significant headwind and they will eventually turn back.

There are various projectiles, fired from breech-loaded shotguns or from specialized launchers, which provide an auditory blast or scream as well as smoke and flashing lights to frighten birds. Pyrotechnics, when used skilfully in combination with other harassment techniques and limited lethal reinforcement (shooting with a shotgun), are useful in driving birds off an aerodrome. Using pyrotechnics distributed by wildlife management personnel and targeting a specific species, helps teach wildlife to associate the pyrotechnic with a threat (person).

The effect of a cartridge can be improved by using a trace, especially when trying to control direction. The trace should be visible in sunlight throughout its flight.

Several types of pistols are used at aerodromes. The pistol should be fit for purpose and be pressure-tested for the type of cartridge used. Using pyrotechnics may present a FOD hazard to aircraft which should be managed accordingly.

In many circumstances, wildlife management personnel may not be allowed to fire a cartridge beyond the aerodrome perimeter, but by firing at a greater angle its effect can be extended outwards over a considerable distance, including locations with the approach path. A large flock of birds, rather than several smaller ones, is more likely to leave the aerodrome using this method. However, firing directly into a flock will probably fragment the cartridge and the wildlife may not regroup. Care is needed to control and not scare birds away. A detonation in close proximity to a flock may be useful to disperse wildlife that regroups quickly, such as flocks of starlings.

Each aerodrome should coordinate with ATC concerning the use of pyrotechnics.

In very dry conditions, proactive fire prevention is needed after a shot is taken. In these conditions, any trace should be followed until it has landed to check it has not ignited the vegetation.

Propane cannons (exploders) produce a shotgun sound blast. In general, birds quickly habituate to propane cannons that detonate at random or pre-set intervals throughout the day and they can scare birds into flight paths, creating extra hazard. To ensure they remain effective, cannons should be used only sparingly and only when birds are in specific areas. Reinforcement by occasional shooting of a common bird species with a shotgun may improve the effectiveness of the cannons. Some systems are

designed so that cannons placed around an aerodrome may be detonated remotely, on demand by radio signal. Such systems are preferable to those on random timers.

Propane cannons are the most commonly used audio repellent for deer. However, deer, like most wildlife, will rapidly habituate to their use. Such systems are therefore best implemented infrequently for short-term emergencies (a few days) and should not be relied upon to repel wildlife effectively. Propane cannons are likely to be more useful as a secondary tool provided they are manually operated via remote control. Automated cannons should not be used as this may result in scaring wildlife into a higher risk location as opposed to controlling their departure.



Figure 6. Flare shooting with shotgun, Dublin International Airport



Figure 7. Portable equipment pyrotechnic with assortment of flares, Vancouver International Airport

Distress calls

Distress calls are a unique call only given by certain bird species when they have been caught by a predator. Distress calls should not be confused with other calls such as alarm calls and contact calls.

Flocking species such as gulls, corvids, lapwings and starlings are the species that tend to have, and therefore respond most positively to, distress calls. Distress calls should be species-specific, although for mixed flocks the call of the most prevalent species should be chosen. Distress call equipment should always be manually operated as static automatic units increase the risk of habituation and have the potential to scare birds into the critical airspace rather than control their movements. The most effective units are vehicle mounted, administered through roof-mounted, forward-facing speakers. Hand-held units can also be used. Distress call equipment should always be used from a stationary position, although starlings may be herded using a slowly moving vehicle.

With the distress call equipment, the controller is attempting to recreate a scenario where a bird has been caught by a predator. Other members of the species will then investigate the threat as a group and fly to the origin of the call, circling above and trying to ascertain where the potential danger is coming from. Throwing a lure up (white for gulls and black for corvids for example), which resembles a struggling victim, can stimulate a flock to lift if necessary. Aerodrome operators should be aware that predatory mammals may approach the sound of a distress call as they investigate a possible food opportunity. Volume settings should be natural so they will not attract birds onto the aerodrome from a distance. It is good practice to start the broadcast at a low volume and increase it until the target birds start to respond.

When the call is stopped, the remaining birds' instincts are to move away from the danger as a group. They will fly further away from the source of the perceived threat in the direction from which they arrived. Birds will become habituated to distress calls relatively quickly hence they should be used sparingly within a suite of techniques underpinned with lethal control. At the time a distress call is being broadcast, other forms of dispersal should not be implemented as this may confuse the behavioural reaction of the birds in question.



Figure 8. Squawker using high fidelity natural sounds such as distress



Figure 9. Loudspeaker mounted on a vehicle

Electronic noise-generating systems

Modern technology allows for the use of systems that can emit targeted sounds over very long distances. These long-range acoustic devices (LRAD) offer the opportunity to target any sound type (acoustic wail, distress call, synthetic bang etc.) at wildlife some distance away. As the use of distress calls is primarily to draw birds towards the sound source their use at significant distances may not be appropriate for an aerodrome. Similarly, the use of 'noise' may startle wildlife but if it is unable to determine where the noise is coming from it may be difficult to control their reaction. Caution is required with the use of long-range projection devices to ensure they do not draw birds in from a wider environment.



Figure 10. An underground stationary gas-powered noise generator

6.4.3 Visual repellents

Presence of humans and vehicles

While there are many visual stimuli that can be used to control wildlife, the most effective tool that elicits a response from hazardous wildlife is often the simple sight of a vehicle or person who implements wildlife

hazard management. Wildlife that is consistently harassed within the aerodrome environment will quickly become aware of the approach of a controller and may react if the vehicle stops or a person alights from the vehicle before any control method is implemented. This demonstrates a learned behaviour in that wildlife is aware that control is forthcoming and it will leave before any further threat occurs.

Visual objects

Most visual repellents are a variation of the scarecrow. Visual repellents such as hawk effigies, silhouettes on kites, eye-spot balloons, flags, reflective tape and lures have short-term effectiveness that are not suitable as long-term solutions to an aerodrome's bird problems. If a system can educate hazardous species that control personnel is on-site, it may have some value as an indicator but it does not generally work as a long-term control method. Displaying dead birds in a "death pose" can scare other birds from entering a specific area by presenting what is interpreted by the birds as a deadly threat. However, species of scavenging wildlife are attracted to dead birds lying on the ground so their use on aerodromes should be carefully considered prior to any deployment.

Lasers

Certain species of birds perceive the approaching laser beam as a threat, causing the birds to fly away. Lasers are best used at night or at dawn and dusk. Since lasers may present a secondary hazard to pilots or drivers of other vehicles, caution should be exercised.

Guidance on how to protect flight operations from the hazardous effects of laser emitters is contained in the Manual on Laser Emitters and Flight Safety (Doc 9815).



Figure 11. Bird Laser, Dublin International Airport

Remotely piloted aircraft systems (RPAS) and drones

See Chapter 7.

Trained predators

Trained dogs and falcons introduce a predator presence, resulting in a flee response of hazardous wildlife. Proper training for animals and instruction for their handlers will ensure that the animals do not become a strike risk.



Figure 12. Trained dogs, Schiphol International Airport



Figure 13. Falconry deployed to stimulate a predator response in hazardous wildlife, Vancouver International Airport

Non-lethal projectiles

Any projectiles can be shot or catapulted toward the targeted species to elicit a flee response. Aerodromes should be aware of any restrictions for using these devices and wildlife personnel should be properly trained to ensure their safe handling.

6.4.4 Trap and relocate

Hazardous wildlife can be caught and released away from the aerodrome. The aerodrome operator should be aware of local laws and regulations when trapping and releasing hazardous wildlife. If live bait is used, it should be monitored and fed regularly (daily at a minimum). When bait or decoys are used, measures should be taken to prevent additional wildlife from being attracted to the aerodrome.

6.4.5 Chemical repellents

Non-lethal chemical repellents work by affecting the animal's senses through smell or taste aversion. These repellents may be sprayed on roosting sites, food sources or other gathering areas where hazardous wildlife is present. Certain chemical repellents (e.g. predator urine) may actually attract other hazardous wildlife, and aerodromes should be aware of the impacts of using these repellents. It is important to note that only chemical repellents registered and approved by the proper national, regional and local authorities should be used.

6.4.6 Lethal control

All lethal control should be undertaken humanely and safely by management and according to local laws at all times. It is often a national law to ensure that lethal action is only implemented after non-lethal methods have shown to be unsuccessful. Aerodrome personnel should maintain a record of the managed species and those removed through lethal control each year. Where a State does not allow the use of lethal means, the issue should be addressed at the State and national wildlife committee level.

The implementation of lethal action to reduce or eliminate the presence of hazardous wildlife on or around an aerodrome requires understanding the behaviour of the species being targeted. Action to influence and educate wildlife may be needed in full view of all targeted species in order for them to associate lethal action with the presence of a wildlife controller. When habitat management and wildlife repellents fail to reduce risk, the implementation of lethal methods can therefore reinforce the effect of non-lethal techniques. It can also be used to reduce the numbers of hazardous individual animals, remove sick or injured wildlife, or to deal with an immediate risk. In certain circumstances lethal measures can be used to eradicate an airside population of a species that cannot be educated by non-lethal methods.

Adults and juveniles can be euthanized using humane methods such as firearms or carbon dioxide gas. Bird eggs may be oiled or addled to prevent hatching or nests can be removed after eggs are laid.

6.5 Recording and Reporting

6.5.1 Recording all daily activities

Keeping records of all activity related to wildlife hazard management is fundamental to the WHMP. Data is required in order to be able to assess the effectiveness of the Plan as a whole, as well as specific trends such as habituation.

There is an increased tendency towards airlines and/or their insurers to pursue legal action to recover the costs of wildlife strike damage from aerodromes at which they occur. It is important that aerodromes record the wildlife control actions that they take in order to be able to demonstrate that they had an adequate WHMP in place at the time of an incident and that the Plan was functioning properly. Data gathered as part of a plan is also important in assessing the effectiveness of the actions taken.

A number of different methods for recording this data exist, from simple paper records to sophisticated devices including laptops, tablet PC or other electronic devices. The latter save time and effort, especially if the data is to be subsequently entered into a computer for further analysis. Whatever the means of recording used, the important issue is that a comprehensive record of the bird control activities is kept in order to demonstrate that the aerodrome is following its own policies and procedures. Records need to include the time, location and nature of the following:

- Each patrol or inspection and the route taken;
- Observation of any unusual condition of the habitat or site such as the state of the vegetation, trees, water bodies or perimeter fence;
- Species of wildlife sightings including any particular activity such as feeding or resting, and the discovery of any carcasses, dropping or other signs of activity;
- Interventions that are made;
- The outcome of any intervention, the response of the wildlife and the effectiveness of the hazard elimination.
- Incidents such as wildlife strikes on aircraft and near misses. (Systems will also be in place for such reporting by pilots, airlines and ground staff.).

6.5.2 Monthly Reporting

Daily records can be summarized into monthly reports, which aid in the evaluation of trends in wildlife numbers, control actions, and wildlife strikes. Monthly reports should be reviewed by the Aerodrome Wildlife Committee of stakeholders to assess performance of the WHMP. The Committee should be involved in the creation of Performance Indicators for managing wildlife at the aerodrome. Performance indicators can encompass any metric associated with reducing risk to aircraft operations, including reducing the number of wildlife strikes, reducing the total mass of wildlife strikes, reducing the average mass of wildlife strikes, or reducing the number of hazardous wildlife around the aerodrome.

6.5.3 Reporting to CAA

According to Minister’s Order No. 89, dated 05.05.2022 “On the reporting and follow-up of occurrences in civil aviation in the Republic of Albania” transposing European Regulation No. 376/20214 and Commission Implementing Regulation (EU) 2015/1018, occurrences which may represent risk to aviation safety shall be reported to the ACAA through the mandatory occurrence reporting systems.

All bird and wildlife strike occurrences should be reported to the ACAA, this includes confirmed, unconfirmed, near miss or significant event; such reports should be annotated as such in the relevant narrative headings or content.

MO 89/2022(EU 376/2014 and EU 2015/1018)	Question	Interpretation, guidance and key attributes
Wildlife strike including bird strike	Does this now mean all birdstrikes?	<p>Yes, this includes all wildlife and birdstrikes with or without damage. Suspected/Possible birdstrikes or encounters with flocks should also be reported.</p> <p>Key additional attributes require:</p> <p>Species (of bird/wildlife if identified) and location of damage (on the aircraft)</p>

Birdstrikes shall be reported to ACAA by using CAA MOR 5 form, which can be found through the official website of Albanian Civil Aviation Authority and shall be send to mor@aca.gov.al.

BIRDSTRIKE OCCURRENCE REPORT

To be completed on discovering evidence that a birdstrike has, or may have, occurred.

To be completed for all birdstrikes, whether or not damage has been caused.

When completed, please sent to: **Albanian Civil Aviation Authority (ACAA)**

"Sulejman Delvina" Street

1001, Tirana, Albania

E-mail: mor@acaa.gov.al

Fax: +355 (0) 42 22 39 69, Mob: +355 (0)42 25 12 20

Are you concerned about the confidentiality of this report and wish to be contacted before it is processed? If so, please ensure you provide us with your contact details.

CONFIDENTIAL? Yes No



1. Aircraft Operator []	2. Aircraft Make/Model []	3. Call Sign Arrival/Departure []																								
4. Aircraft Registration []	5. Date of Occurrence (dd.mm.yyyy) [] . [] . []	6. Local Time of Occurrence [] Hrs (24 hr) <input type="checkbox"/> Dawn <input type="checkbox"/> Day <input type="checkbox"/> Dusk <input type="checkbox"/> Night																								
7. Aerodrome []	8. Runway in Use []	9. Location if En Route (Nearest Town/Reference) []																								
10. Height (AGL) []	11. Speed (IAS) []																									
12. Phase of Flight <input type="checkbox"/> A. Parked <input type="checkbox"/> B. Taxi <input type="checkbox"/> C. Take off Run <input type="checkbox"/> D. Climb <input type="checkbox"/> E. En Route <input type="checkbox"/> F. Descent <input type="checkbox"/> G. Approach <input type="checkbox"/> H. Landing Roll	13. Part(s) of Aircraft Struck or Damaged																									
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14. Effect on Flight <input type="checkbox"/> None <input type="checkbox"/> Aborted Take-Off <input type="checkbox"/> Precautionary Landing <input type="checkbox"/> Engines Shut Down <input type="checkbox"/> Other (Specify)	15. Sky Condition <input type="checkbox"/> No Cloud <input type="checkbox"/> Some Cloud <input type="checkbox"/> Overcast	16. Precipitation <input type="checkbox"/> None <input type="checkbox"/> Fog <input type="checkbox"/> Rain <input type="checkbox"/> Snow																								
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20. Pilot Warned of Birds <input type="checkbox"/> Yes <input type="checkbox"/> No																										
21. Remarks (Describe damage, injuries and other pertinent information) []																										
DAMAGE/COST INFORMATION																										
22. Aircraft time out of service []	23. Estimated cost of repairs or replacement (EUR) []	24. Estimated other Costs (EUR) (e.g loss of revenue, fuel, hotels) []																								
25. Name and title of person making report []	26. Signature/Date [] . [] . []	27. Address and tel. no []																								

Figure 14. ACAA MOR 5 – Birdstrike Occurrence Report Form

7. ADVANCEMENT IN TECHNOLOGY

7.1 General

There are continuing advancements in existing technologies that can predict and detect wildlife potentially hazardous to aircraft operations and provide information thereon to reduce the risk of these hazards. Such technologies and procedures are particularly important in dealing with the significant hazards posed by wildlife in the vicinity of aerodromes.

Some aerodromes might employ remote detection systems such as radar or video monitoring systems. Such technology will probably never replace the need for manned patrols and interventions, but could assist with reducing the frequency of patrols.

Coordination between the remote monitoring centre and operators that might respond to wildlife sightings is required.

7.2 Satellites for land use monitoring

Satellite imagery can aid in monitoring off-aerodrome sites that may attract hazardous wildlife. Land use around the aerodrome may be monitored by viewing a series of satellite images taken over a specific period of time. These images can allow aerodrome managers to track changes in land uses that may impact the distribution of wildlife around the aerodrome. Expansions of wetlands or waterbodies, landfills, or amenity grasslands, are all examples of land use changes that may increase the strike risk of wildlife. The availability of satellite imagery can provide quantifiable data on land uses and becomes critical evidence for habitat management measures and communicating with stakeholders.

7.3 Geographical information system (GIS)

Geographical Information Systems (GIS) can be used by aerodrome managers to manage and analyse spatial data. Much of the data collected as part of a WHMP is spatially referenced, as it pertains to a specific geographical location. Using GIS to analyse the data allows aerodrome managers to assess patterns of wildlife observations and control interventions as they relate to aircraft operations. Wildlife strikes can be related to specific points on the runway and mapped with GIS to show “hotspots” where strikes occur.

GIS may also be used to track and analyse land uses off the aerodrome. When combined with other data collection methods (such as satellite land use imagery), GIS can be a powerful tool for analysing and understanding how wildlife hazards are distributed and interact with the aerodrome operating environment. It is recommended to provide professional training for aerodrome personnel in charge of working with GIS, to optimize the quality and reliability of the results.

7.4 Detection systems

7.4.1 Radio detection and ranging (RADAR)

RADAR (e.g. avian or FOD detection radar) can act as a tactical tool that detects and tracks wildlife hazards in real time.

RADAR data can be used by wildlife controllers to monitor wildlife activity, especially birds, over large areas of an aerodrome and its vicinity. The sensor data may also be used for the real time tracking of wildlife in response to control measures. This is especially important when controlling birds at night to ensure they have exited the aircraft operating area.

RADAR data may also be used to create avoidance algorithms for aircraft and bird flight paths. When flight paths are predictable, an avoidance algorithm may be used to trigger an alert to an air traffic controller that an increased strike risk is imminent.

RADAR may provide strategic data for the assessment of wildlife hazards. RADAR datasets that span anywhere from a single season to several years can reveal patterns of wildlife movements. These patterns can then be used to target habitat attractants and strategize mitigations that reduce the risk of wildlife hazards.

RADAR datasets can show spatial patterns and timing of bird and bat movements. Aerodrome and aircraft operators can then alter flight operations to minimize the likelihood of aircraft operating in areas of high bird concentrations.

These same datasets may be used to assess patterns of habitat use on and off the aerodrome. Priorities for habitat management can be created by identifying areas that provide a strong attractant for hazardous wildlife. These data may be critical to convince external stakeholders that a hazard exists when wildlife is using off-site properties and take appropriate measures.

RADAR data can be used to assess the efficacy of mitigation measures (treatment and control) of habitat use and active control techniques.

The ability of RADAR sensors and their associated processing software to detect and track wildlife activity at different altitudes, distances, and under varying atmospheric conditions must be understood to maximize the benefit of a RADAR system. RADAR signals may be blocked by obstacles, influenced by ground clutter, and are not always able to detect all wildlife.



Figure 15. A bird detection radar

7.4.2 Camera detection

Wildlife monitoring cameras may include thermal detection cameras (infrared), or high or low-definition cameras. The process usually consists of the installation of a series of cameras that monitor the field continuously, detecting movement of objects. These cameras may be associated with software that analyses and processes the images. This information can be used in conjunction with avian radars (helping to determine that radar detections are accurate), as an alert system to the wildlife control unit and to carry out data collection about the movements of wildlife on and in the vicinity of an aerodrome.

7.5 Remotely piloted aircraft systems (RPAS) and drones

RPAS and drones have the ability to manage wildlife from the air and can manoeuvre over hazardous wildlife to harass or survey. RPAS that harass wildlife may be constructed to simulate a predator (e.g. bird of prey). Surveillance RPAS have cameras attached that give the operator a view of the land on and in the vicinity of the aerodrome that can assist with identifying hazardous wildlife. Surveillance benefits may include night time observations and monitoring areas that are difficult to access. An example of this is observing rooftops where nesting can be seen without having to climb the roof.

Any operational RPAS must comply with local and national regulations. An aerodrome must have established flight rules for the operation of an RPAS on and around the aerodrome. RPAS operators should be certified to the degree that the law requires.

7.6 Pulse lights on aircraft and aerodrome use of flashing light patterns

Wildlife can detect flicker or pulse rates (frequency) as well as particular colours (wavelength). Lighting techniques can therefore be used to deter them away from aircraft. Frequency and wavelength may be adjusted; as different species may react to different lighting techniques.

Pulse lighting is a modification to the aircraft lighting that pulses lights at a specific frequency and pattern. Wildlife may be able to detect the aircraft sooner, resulting in increased avoidance time.

Flashing light patterns are produced by displaying one or more moving shapes on LED screens. There are different combinations of moving patterns that can be used according to the targeted species. The continuous movement of the pattern may induce a sense of discomfort in birds which move away from the light-emitting screens. This repellent device depends on the ability of wildlife to see the device and is affected by the size of the screen and the landscape of the aerodrome.

7.7 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.

7.7 Habituation

The classic challenge for wildlife hazard management is that most animals will become accustomed to certain dispersal interventions or find new ways to settle themselves safely in the aerodrome environment. Therefore, it is vital for aerodrome operators to continuously adjust and vary the measures taken. An aerodrome should proactively seek different or new ways to reduce the wildlife hazard.

Various new methods for either habitat management at aerodromes, detection systems or new dispersal techniques have been developed in the past years. There are many methods of wildlife dispersal available. Aerodrome operators should assess the need before purchasing equipment.

8. TRAINING

8.1 Introduction

The significance of wildlife and habitat management plans must be recognised as a major safety priority of all aerodromes regardless of size, aircraft movements or the lack of a perceived threat.

- Aerodrome must have specific comprehensive wildlife and habitat management training programmes.
- Staff tasked for wildlife and habitat management must be trained and assessed as fully competent to perform their duties.
- It is important that the role is comprehensively explained to staff and that they fully understand their roles and responsibilities.

8.2 Objectives of the training programme

It is important for aerodromes to outline the objectives of a bespoke wildlife and habitat management plan. It is not sufficient for staff to undertake any role within the aerodrome wildlife team without appropriate wildlife and habitat training.

Plan objectives:

- Ensure training plan meets best international, national & local standard;
- To deliver appropriate wildlife/habitat management training to staff that are tasked with managing and implementing the plan;
- Ensure local aerodrome conditions and effective control measure are included in training plan;
- Ensure that staff have a full understanding of procedures and practices required to deliver on objectives of the WHMP;
- Provide practical training programme that ensure full competency on wildlife control practices.

8.3 Training requirements

An aerodrome operator should adequately train their wildlife hazard control personnel and managers in wildlife hazard management. This training should be conducted by competent wildlife hazard control personnel or specialists with proven experience in this field in accordance with recognized competency-based training principles.

An aerodrome operator should ensure that wildlife management personnel are competent. Competency is the combination of skills, knowledge and attitude required to perform a task to the prescribed standard. Potential wildlife management personnel should complete a training programme and be tested, and the results recorded and kept on file. This record-keeping period may be defined by local and national regulations. In the absence of such regulations, records should be kept long enough to provide proof of competency.

Recurrent training should be carried out to ensure that personnel are kept up-to-date with any changes in wildlife hazard management at the aerodrome. Recurrent training is recommended to be completed at least every two years.

8.4 Content of a training plan

When training personnel for wildlife hazard management, the topics mentioned in the Procedures for Air Navigation Services - Aerodromes (PANS-Aerodromes, Doc 9981), Part II, Appendix 1 to Chapter 6, should be covered and may also include, but are not limited to:

- a) nature and extent of the wildlife management problem;
- b) management of hazardous wildlife and their habitat;
- c) national and local regulations, standards and guidance material related to aerodrome wildlife hazard management programmes;
- d) overview of aerodrome WHMP;
- e) wildlife ecology and biology;
- f) wildlife identification and observation, including the use of field guides and wildlife survey methods;
- g) protected species, including related regulations and policies;
- h) documentation, identification, and reporting measures of wildlife strikes;
- i) off-aerodrome land use issues;
- j) wildlife removal techniques;
- k) safe use of firearms, hazardous materials;
- l) stakeholder involvement;
- m) importance of awareness and outreach programmes; and
- n) basic principles of the safety management system (SMS) and how they apply to aerodrome wildlife hazard management (See the manual on Flight Safety and Volcanic Ash (Doc 9974) and the Safety Management Manual (Doc 9859)).

Within the aerodrome, personnel may require different levels of training depending on their role within the WHMP.

Wildlife personnel should also have the necessary competencies to operate on the aerodrome. *These competencies can be found in the Procedures for Air Navigation Services - Aerodromes (PANS-Aerodromes, Doc 9981).*

Personnel appointed to provide training in wildlife management at the aerodrome should ultimately be determined by the aerodrome operator. They should be able to demonstrate proven competence in the field of work and produce evidence that they have completed a formal course of instruction combined with professional experience.

8.5 Aerodrome Location

Aerodrome location will dictate much of the content of the training programme and the procedures that are best suited to each aerodrome. Aerodromes located at the coast or close to forests will require a different set of control measures than those aerodromes located near arctic or desert locations. Aerodromes developing WHMPs must take the local and regional aspect of wildlife management into consideration.

8.6 Standardisation of Training

Training must be conducted professionally by appropriately qualified personnel using approved material drawn from appropriate national and international standards and publications. Training content and programmes must be approved by a wildlife manager with guidance from a subject matter expert to ensure that programme content is sufficient and all mandatory safety and operational requirements are met.

8.7 Blended Learning Approach

Aerodromes must have a targeted WHMP that supports the roles of each person responsible for managing or implementing a WHMP. Training will be delivered from a theoretical, practical, and procedural and will include a familiarisation programme.

8.8 Additional Trainings Requirement

8.8.1 Airside Training

All employees operating airside at aerodromes will have received appropriate airside training to ensure that they can perform their airside duties in a safe and efficient manner. Airfield training will include radio telephony procedures and practical assessments.

8.8.2 Environmental Training

Awareness of environmental factors are very important for aerodromes and are an ever-increasing influence on aerodrome procedures. Wildlife teams must be fully aware of all environmental issues and how they can contribute to the sustainability policy at aerodromes. The following guidelines should apply at aerodromes:

- Understanding of environmental sustainability;
- Environmental evaluation and analysis of wildlife plan;
- Use of best practice environmental techniques.

8.8.3 Practical/On the Job Training

It is not sufficient to provide theoretical training for this role as much knowledge will be gained from carrying out the task under a proficient and competent person. The programme should be sufficiently

enough to ensure effective delivery and should have a sign off process on the proficiency of the person across all the practical, procedural and skills required to manage and implement the plan. It is critical that each aspect of the procedures required for wildlife habitat and management are well practiced and understood by the wildlife team.

8.8.4 Wildlife Management Control Measures

It is critical that the wildlife team receives comprehensive training on the different techniques that can be used in the wildlife management plan. This must include all procedures and practices that are at the disposal of the aerodrome. Each team member must receive full training on all aspects of the plan to include familiarisation with all equipment that is available to the team.

8.8.5 Assessment of Training Process

Aerodromes must be assured that the wildlife training programme is adequate to deliver trained personnel to deliver on the objectives of the plan; accordingly, each training programme will require an assessment process that will clearly demonstrate the proficiency of the plan.

Assessment Process

- Theoretical assessments that demonstrate team members have the knowledge necessary to deliver the objectives of the wildlife management programme;
- Familiarisation with procedures, practices & techniques of wildlife management;
- Practical assessments that demonstrate team members have the practical knowledge necessary to operate all equipment and techniques;
- General suitability, whereby team members can demonstrate a level of operational competencies to deliver on the objectives of the wildlife management plan.

All training programmes should be reviewed prior to delivery to ensure that the programme is up to date and reflective of current best practice of wildlife management techniques.

8.8.6 Runway Incursion Prevention Training

Due to the nature of the role and the requirement to operate close to runways (never inside the flight strip unless with ATC permission) staff must have completed runway incursion prevention training.

8.8.7 Post Incident Training

Where a wildlife management person is involved and found to have failed to follow procedures, the option to retrain may exist. It is important that the area of weakness is identified and remedial action taken. All incidents on the airfield are investigated by aerodrome authorities, sometimes in cooperation with ATC.

8.8.8 Research Plan

It is very important that aerodromes employ the best possible practices available to them when developing wildlife plans. Detailed accurate information based on proven research is an important element in ensuring that best practice principles apply.

Where possible, aerodromes should have a dedicated resource that will ensure that advances in the field of wildlife management and habitat management, (whether that be scientific, procedural or proven improved control techniques) are reflected in the aerodromes' wildlife and habitat management plan.

8.8.9 Refresher Training

Each aerodrome should have an effective refresher training programme that the wildlife team will complete on a regular basis. The training must include a dedicated wildlife management and habitat module which will reflect on statistical information, procedural reviews, staff feedback and a central piece by a subject matter expert at the aerodrome (internal or external) and by a senior manager responsible for the aerodrome management and habitat plan.

8.8.10 Training Programme for other Aerodrome Users

Aerodrome operator will ensure that all operators at the aerodrome are aware of their responsibilities in respect of Wildlife control. Reference should be made to procedures that apply to all operators at the aerodrome. This plan should be included at induction for all staff and also the main points included in refresher plans. Wildlife habitat management and control should feature in any aerodrome wide safety campaign as a matter of course.

Training awareness programme should be made available the following groups:

Stakeholder Training Programme:

- Air Traffic Services;
- Airlines (in particular home-based pilots and companies);
- Ground handlers;
- Food catering companies;
- Waste removal companies;
- Contractors' construction projects;
- Other entities as deemed necessary.

Training offered should cover the goals and objectives of the aerodrome wildlife management plan and the role each company and staff member can play their part in this essential programme.

9. OPERATIONAL NOTIFICATIONS

9.1 General

Operational notifications include active correspondence addressing wildlife issues on or near an aerodrome, notifications and alerts. Protocols allowing clear, concise communication should be established prior to the implementation of operational notifications and included within the training requirements for personnel involved with wildlife management. This becomes especially important during active control of wildlife hazards and emergencies. Personnel and offices responsible for wildlife hazard management should be identified for ease of contact during both day and night.

Personnel involved with data collection, surveys, patrols, wildlife control and emergency responses should work closely with air navigation services provider (ANSP) personnel. Wildlife controllers should coordinate with the ANSP when necessary to ensure that the movements of dispersing wildlife will not affect aircraft.

Clear and precise procedures should be developed for ATC and controllers should be trained such that they are able to give specific and timely information to pilots and wildlife control crews to avoid identified hazards. Operational standards for procedures and training protocols should be uniformly developed and implemented among State.

Pilots have the authority to alter flight operations when hazard advisories are issued. Training in procedures for such altered flight operations based on these data should be provided by airlines and developed and monitored by ACAA.

Data from predictive models and remote-sensing systems, where available, should be shared with all entities responsible for reducing wildlife strike hazards, including aerodrome operations personnel, ATC, airlines, pilots and regulators. Communications procedures and regulatory oversight are necessary to ensure the timely exchange of information and proper responses to hazard advisories. Data from models and remote-sensing systems can be supplied at varying levels of detail to different agencies. For example, aerodrome operations and wildlife control personnel will need detailed and specific information on the level of hazard and the specific time and location of the detected or predicted hazard to appropriately respond with control or dispersal equipment. The ANSP will need to be advised when there is a potential wildlife hazard and may provide this information to pilots (*see the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444)*).

Data links are available through wireless computer systems or cellular phone technology to alert individuals and agencies that can respond to hazard advisories. Data links to specific aerodrome operations, including their vehicles, are currently available in numerous States and aerodromes. Links to ATC should be established with appropriate audio or visual triggers when threshold levels are met. Uplinks to aircraft are possible with existing communications networks, in either voice or digital formats, should action from pilots be necessary.

The continual dissemination of general warnings for extended periods of time should be avoided. General warnings such as “birds in the vicinity of the aerodrome” offer little information to aid pilots and eventually may be ignored if not updated with more specifics.

Drivers should follow the procedures for their particular aerodrome when reporting sightings of wildlife, with respect to the correct use of radiotelephony and standard phraseology. Their reports may include more specific information such as:

- a) large flock of birds on grass north of taxiway Bravo; and
- b) feral dog in vicinity of runway 17 and taxiway Charlie.

Essential aerodrome information is information regarding the manoeuvring area and its associated facilities which is necessary to ensure the safe operation of aircraft. Essential aerodrome information is passed to aircraft whenever possible prior to start-up or taxi and prior to the commencement of final approach. For example:

- a) caution large flock of bird's north of runway 27 near taxiway A; and
- b) wildlife 1, permission to disperse flock of geese at approach end of runway 09.

9.2 Automatic terminal information service (ATIS)

ATIS is a continuous broadcast of recorded aeronautical information for aerodromes and their immediate surroundings. ATIS broadcasts contain essential information, such as current weather information, active runways, available approaches, wildlife hazards and any other information required by the pilots. The broadcasts indicate significant (moderate or severe) wildlife activity, as reported by an approved agency that presents temporary hazards on the ATIS broadcast. Pilots take notice of available ATIS broadcasts before contacting the local control unit, which reduces the controllers' workload and relieves frequency congestion.

The recording is updated in fixed intervals or when there is a significant change in the information. ATIS broadcasts involving wildlife should be timely and specific as defined in the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444). Pilots do not need to know species-specific information but they do need to know general descriptive information detailing size and number of animals, locations and timing of occurrence. Examples include:

- a) large birds on approach to Runway 32 between 500 - 2,000 feet AGL;
- b) deer observed near threshold of Runway 05R; and
- c) flocking birds on airfield.

9.3 Notice to airmen (NOTAM)

A NOTAM is a notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations. They can communicate persistent bird and wildlife hazards and can be mandatory or advisory in nature. Examples of NOTAM subjects include changes in hours of operations, hazards such as pavement issues, wildlife, snow, surface conditions, and others. NOTAMs are effective at providing seasonal wildlife alerts when bird migration or nesting occurs and can also provide useful information concerning the presence of threatened or endangered species.

9.4 Pilot report

A pilot report may be filed to indicate encounters with hazardous wildlife. The pilot reports are short-lived warnings providing immediate information on pilot observations that are transmitted in real time to ANSPs. Large animals near active surfaces, soaring vultures and raptors within approach and departure corridors and waterfowl such as geese feeding in grassy areas next to runways, are all examples of timely reports generated by pilots.

9.5 Aeronautical Information Publication (AIP)

Additional information at aerodromes, such as an indication of bird concentrations at the aerodrome, together with an indication of significant daily movement between resting and feeding areas, to the extent practicable, and charts related to bird concentrations in the vicinity of the aerodrome, should all be included in the Aeronautical Information Publication (AIP).

Note. — More information on the contents of the Aeronautical Information Publication is available in the Procedures for Air Navigation Services — Aeronautical Information Management (PANS-AIM, Doc 10066), Appendix 2.

10. WILDLIFE HAZARD MANAGEMENT PROGRAMME

10.1 Aerodrome Wildlife Hazard Management Programme (WHMP)

10.1.1 Introduction

Aerodromes should have a process to review and evaluate the wildlife habitat and wildlife management plan to provide safety assurance that the plan is fully effective and correctly implemented. The review should be completed on an annual basis but also must include an on-going review process to ensure that the plans are always current and fully functional at all times.

A review should consider the general workings of the plans with a view to efficiency and effectiveness. Reference to statistics from previous years (five) should form part of the review. Trend analysis of statistics is a key to ensuring there is an informed view as to the success and effectiveness of wildlife management plans.

A Wildlife Hazard Management Programme (WHMP) is a method for aerodrome operators to adopt reasonable wildlife risk control measures, address features that may attract wildlife, control the presence of wildlife on, and in the vicinity of, the aerodrome. A WHMP should be developed based on the wildlife hazard risk assessment, according to the size and complexity of the aerodrome.

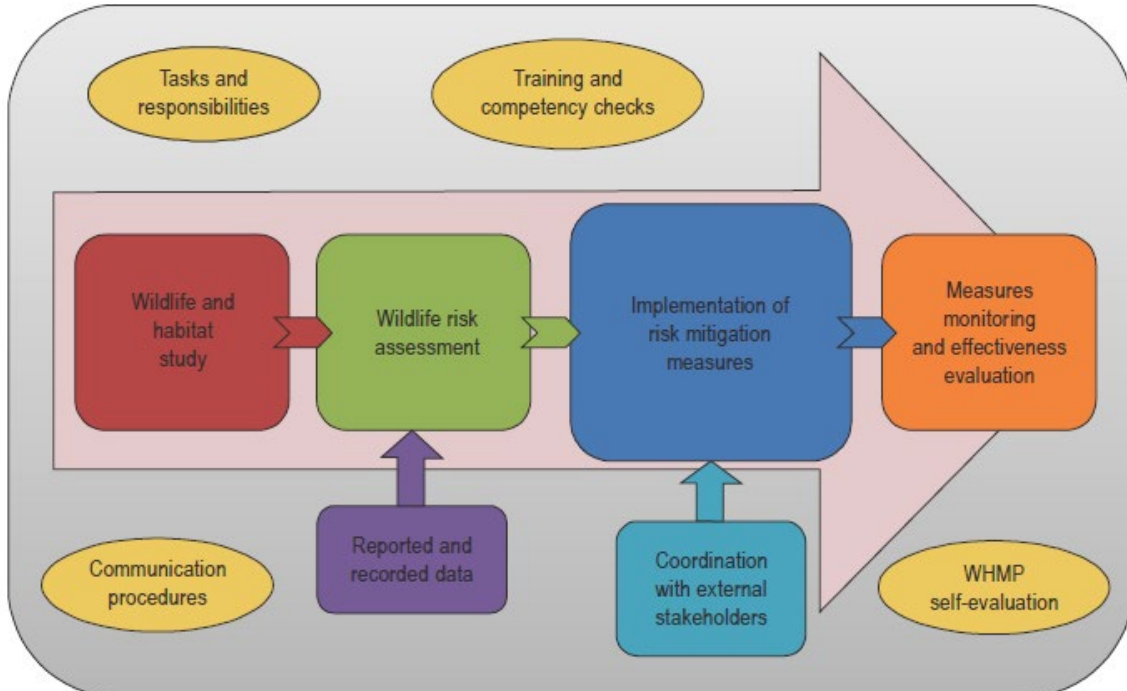


Figure 16. Wildlife Hazard Management Programme Process

An aerodrome should establish procedures for data collection, risk analysis and the implementation of wildlife control measures. Aerodrome personnel should be competently trained in wildlife hazard management with well-defined roles and responsibilities.

The WHMP should not only consider the establishment of internal actions specific to the aerodrome operator. For it to be effective, involving different stakeholders and external entities throughout its development will be needed, since they may be linked to the presence of wildlife, attracting habitats, land use, etc.

Wildlife hazards on, and in the vicinity of the aerodrome are constantly changing due to modifications in land use, management policies, and environmental factors. In addition, wildlife can adapt or habituate to control strategies that were once effective, or they might develop new behavioural or feeding patterns on, or near, the aerodrome. These factors can affect the efficacy of the WHMP's success.

The WHMP should be reviewed if changes to wildlife hazards are observed (e.g. planned land use changes, significant strike event, new wildlife species observed, operational changes, etc.) and at a minimum, this review should occur annually. The WHMP should be revised as necessary.

A WHMP should include, as a minimum:

- a) a description of the organization of the WHMP;
- b) the roles and tasks of aerodrome personnel involved with the WHMP;
- c) a description of the aerodrome operations;
- d) procedures including means and aerodrome personnel for collecting, reporting and recording data on observed wildlife and wildlife strike events;
- e) a wildlife safety risk assessment method and procedure (including annual reviews);
- f) procedures, means and personnel for habitat and land management;
- g) procedures, means and personnel for the expelling, deterring and removing of wildlife, including lethal means where appropriate;
- h) procedures for coordinating with internal and external stakeholders;
- i) procedures, means and provisions for the training of aerodrome personnel; and
- j) procedures and performance indicators to monitor the mitigation measures applied and assess their effectiveness, as well as the effectiveness of the WHMP itself (in terms of increase or decrease on the wildlife strike risk level).

10.1.2 Roles and tasks in the WHMP

The WHMP should detail the roles and tasks of all aerodrome personnel who:

- a) develop and implement the WHMP;
- b) oversee the daily activities (detailed in the sections below);
- c) record wildlife (presence and movements);
- d) record and analyse the collected data (observations, wildlife strikes, etc.);
- e) carry out periodic surveys, wildlife studies and safety risk assessments to develop and implement the WHMP;

- f) manage the habitat to reduce the attractiveness of identified areas, if relevant;
- g) expel, deter and remove hazardous wildlife;
- h) report wildlife strikes to the CAA and ICAO;
- i) coordinate with stakeholders and external entities;
- j) evaluate and update the WHMP as needed; and
- k) for any other reason, is involved in wildlife hazard management.

In addition to the previous responsibilities, the aerodrome operator should appoint a wildlife manager or coordinator who will coordinate all tasks related to wildlife hazard management associated to the WHMP.

With regard to the wildlife control personnel at the aerodrome, if they do not cover the operating hours of the aerodrome, it should be indicated which groups would be in charge of wildlife control in their absence.

Further information about roles and tasks regarding stakeholders are in Chapter 3, Stakeholders.

10.1.3 Collecting, reporting and recording data on wildlife strikes and observed wildlife

Collected data should be as accurate and reliable as possible since it will help identify hazards at the aerodrome and within its vicinity.

The WHMP should refer to the protocols or communication procedure between the different stakeholders present at the aerodrome involved in detection, recording, collecting and reporting of wildlife observations and strikes.

The aerodrome operator should ensure that there is a process for rapid communication among those involved in wildlife control as well as with ATC and airlines. This is necessary when a specific wildlife hazard is present to allow the issuance of appropriate warnings to aircraft operating on, and within the vicinity of, the aerodrome, by the ANSP.

It should also be indicated what means and procedures the aerodrome operator uses to collect and identify species by feathers, animal remains, DNA analysis, etc.; as well as the personnel involved in the previous activities.

More information about how wildlife surveys should be conducted and how wildlife incidents should be recorded and reported is available (*See Chapter 3, 3.2.5 Collecting, reporting and recording data on wildlife incidents and observed wildlife*).

10.1.4 Wildlife safety risk assessment

The data collected and recorded throughout the year should be used to carry out a wildlife risk assessment (*see Chapter 4*).

The results and conclusions of the wildlife risk assessment should be documented in the WHMP and provide information about the hazardous wildlife species and their presence. This will help identify which are the most sensitive areas of the aerodrome and its vicinity, since areas with high presence of wildlife may coincide with aircraft flight paths.

The aerodrome operator should prioritize its wildlife management depending on the level of risk. Mitigation measures should be applied to species with the highest risk.

10.1.5 Wildlife safety risk assessment

The aerodrome operator should apply measures for habitat and land use management, to prevent the entry of wildlife at the aerodrome and to expel or eliminate the wildlife currently present within the aerodrome.

The WHMP should include the resources used to perform wildlife management tasks (e.g. vehicles, pyrotechnics, traps, etc.). Personnel in charge of habitat and wildlife management, and personnel responsible for carrying out the preventive and corrective measures should be indicated. *Further information about these measures can be found in Chapter 5, Habitat management and Chapter 6, Management of hazardous wildlife.*

All different mitigation measures should be included in the WHMP, enabling appropriate assessments throughout the year.

It is advisable that each measure in the WHMP include the following information, at a minimum:

- a) species and risk activity targeted;
- b) type and description of mitigation;
- c) technical details;
- d) implementation period and time frame;
- e) personnel responsible for its application; and
- f) results and effectiveness.

Each measure should have an appropriate performance indicator, i.e. a specific measurable characteristic that can assess its effectiveness.

Some examples of performance indicators are provided below:

Example 1

Issue: The buzzard population at Aerodrome X increased despite habitat management, resulting in an increased risk. The main food source for the buzzards was identified as small rodents. Rodenticide was introduced on the aerodrome to reduce the number of rodents as food source for buzzards.

Indicators: the number of buzzards on the aerodrome; the number of rodents on the aerodrome; the mass of rodenticide used; the number of buzzard strikes.

Example 2

Issue: Cracks and cavities are found in the terminal building. Increased number of swifts and pigeons are nesting and sheltering. The aerodrome operator introduces netting in these cavities to prevent access.

Indicators: number of cracks or cavities detected; number of cracks or cavities covered; number of nests in the cavities; number of birds in the cavities; amount of faeces found in the cavities.

10.1.6 Coordination with stakeholders

The WHMP should include a description of the communication, cooperation and coordination mechanisms with all relevant stakeholders; especially with those involved in activities that may encourage the presence of wildlife (crop harvesting, water features, pigeon racing, landfills, hunting, etc.).

Wildlife hazard management mitigation measures undertaken by external stakeholders in the vicinity of the aerodrome should be recorded, monitored and evaluated in the aerodrome WHMP.

Further information about stakeholders can be found in Chapter 3.

10.1.7 Personnel training

The WHMP should include training information for:

- a) wildlife control personnel; and
- b) those responsible for WHMP development and implementation.

The WHMP should include procedures for the initial and recurrent training of personnel involved in wildlife control and in wildlife hazard management.

Further information about training contents and requirements can be found in Chapter 8, Training.

10.1.8 Self-evaluation

The aerodrome operator should have a procedure to evaluate at least the following aspects periodically:

- a) proper implementation of tasks and responsibilities regarding wildlife control;
- b) adequate functioning of communication protocols;
- c) correct identification of the most hazardous species and attracting areas; information is updated periodically and appropriately;
- d) effective collection and recording of data (including the protocol for collecting animal remains and identification of wildlife strikes);
- e) accuracy and effectiveness of the reporting system;
- f) state of implementation and effectiveness of each mitigation measure;
- g) periodic coordination with stakeholders (wildlife local committees, working groups, etc.) according to schedule; and
- h) occurrence of appropriate wildlife training according to schedule.

10.2 Wildlife Hazard Management Programme Evaluation

10.2.1 Evaluation Process Overview

The aerodrome operator should evaluate the effectiveness of the WHMP annually, at minimum. Changing conditions on the aerodrome, both operational and ecological, personnel performance and outdated procedures may be identified during this evaluation, prompting a review of the WHMP.

WHMP evaluation may have several levels of complexity and detail, and may consist of simple responses to basic checklists, or establishing a quantifiable measurement system, which includes leading and

lagging indicators and qualifications, from which it will be considered if the WHMP is working well or if it needs to be improved.

The most basic level of WHMP evaluation should be to respond affirmatively or negatively to questions contained therein. If the answers to those questions are negative or unclear, measures should be established to address shortcomings. Basic questions may include:

- ✓ Are wildlife management roles, tasks and responsibilities adequately established at the aerodrome?
- ✓ Is the “wildlife manager or coordinator” considered in the WHMP?
- ✓ Is there a proper communication procedure between the different stakeholders to alert about the presence of strikes with wildlife?
- ✓ Are the wildlife management personnel aware of the species that pose a risk to air traffic and about attractive areas for wildlife at the aerodrome and its vicinity?
- ✓ Are wildlife observations and strikes recorded and reported properly?
- ✓ What is the average of identification of species on wildlife strikes?
- ✓ Does the WHMP include an appropriate wildlife risk assessment conducted by competent personnel?
- ✓ Are habitat management measures and measures of dispersion and extraction of wildlife taken at the aerodrome?
- ✓ Is the effectiveness of these measures measured?
- ✓ Is there coordination with external stakeholders? Are regular meetings held with them? Is the local wildlife committee effective?
- ✓ Is training on wildlife management given to personnel involved in wildlife management (at all different levels)?
- ✓ Is the self-evaluation of the WHMP being performed?

Once this base is established, complexity can be increased by asking more specific questions to determine the degree of compliance.

- ✓ Has a land use plan been established with regard to effective land use on and off the aerodrome, as it pertains to the WHMP?
- ✓ What ecological measures are implemented to reduce wildlife attractiveness at the aerodrome and in the vicinity?
- ✓ Are garbage dumps forbidden around the aerodrome? If yes, within what distance are they forbidden?
- ✓ Is the aerodrome fence suitable to prevent hazardous wildlife incursions?
- ✓ Which repellent methods are implemented at the aerodrome?
- ✓ Are aerodrome personnel employed and trained specifically to control and disperse wildlife at the aerodrome?
- ✓ What is the wildlife strike rate at the aerodrome over the last five years (with or without damage to the aircraft)?
- ✓ Is there a procedure to regularly collect information about wildlife on, and in the vicinity of, the

aerodrome, both dead and living?

- ✓ Has a procedure for the positive identification of wildlife remains been established?
- ✓ How many reports from pilots are related to intrusions of wildlife, other than birds, over the last five years?
- ✓ Has a list of wildlife attractants at, and in the vicinity of, the aerodrome been completed?

The foundation for these evaluations is the maintenance of consistent records of wildlife presence, wildlife control activities and wildlife incidents. Using a standardized format for all record keeping allows for an easy compilation of events and activities into monthly and annual statistical and narrative summaries. Once these summaries are available, objective examinations and comparisons of trends in strikes, wildlife activities, control methods deployed, and other factors can be made. Examples of systematic documentation procedures include: daily logs of wildlife activities, surveys, patrols, wildlife strikes with aircraft and wildlife control activities.

The most rigorous and systematic method to know how well wildlife is being managed at the aerodrome would be to use a performance measurement mechanism. Performance indicators (parameters used for monitoring and assessing performance) are select metrics that are most closely aligned with the ultimate goal of reducing wildlife risks, and will help to assess if the wildlife hazard is adequately managed by the aerodrome operator.

Performance indicators should be metrics obtained and measured in a simple way, and which are clear about what they measure. They can be primary (lagging) or secondary (leading) indicators.

Primary (lagging) indicators measure events that have already occurred. They are also referred to as outcome-based indicators and normally represent, but not always, the negative outcomes the organization is aiming to avoid. Secondary (leading) indicators measure processes and inputs being implemented to improve or maintain performance. These are also known as activity or process indicators as they monitor and measure conditions that have the potential to lead to or contribute to a specific outcome. Lagging indicators are typically output oriented, easy to measure but hard to improve or influence (e.g. number of wildlife strikes), while leading indicators are typically input oriented, hard to measure and easy to influence (e.g. number of repellent activities).

Although there has generally been a tendency to use lagging indicators (number of wildlife strikes related to aircraft movements, percentage of strikes resulting in damage or effect on flight, etc.) as measures of the effectiveness of a WHMP, leading indicators are good indicators as well. They show how personnel are performing their tasks and how the system is prepared to prevent the worst events (incidents and accidents) from happening, through good safety practices, correct use of procedures, etc.

Some leading indicators for evaluating a WHMP would be:

- a) presence of wildlife at the aerodrome;
- b) completeness of wildlife strike reports;
- c) completeness of wildlife management logs;
- d) percentage of wildlife species identification in strike events;

- e) percentage of personnel receiving wildlife management training;
- f) percentage of wildlife management actions completed; and
- g) frequency of meetings of wildlife committees.

An ideal performance measurement will take into account both primary and secondary indicators. In order to use these metrics, it is essential to have an accurate historical record of all activities and events that belong to wildlife hazard management.

10.2.2 Evaluation Plan

10.2.2.1 Evaluation Plan Report

This comprehensive annual report should be prepared and compiled by an appropriately qualified person who has full knowledge of the plan and the standards required for effective delivery. The completed report along with all recommendations must be forwarded to the aerodrome wildlife committee and the senior management responsible for the delivery of the plans.

10.2.2.2 Evaluation Inputs

The wildlife manager (or appropriate professional) tasked with performing the annual evaluation should undertake de-briefing from staff on general effectiveness and observations on all aspects of the plan. The evaluation seeks non-performance or areas for improvement. Staff are often best positioned to provide valuable feedback on the plans. Feedback should be sought from:

Assessment Process

- Wildlife team management & staff;
- Airline personnel (in particular aircraft engineers and home-based pilots);
- Air traffic control;
- Ground handlers;
- Other parties as required.

10.2.2.3 Aerodrome Survey

A wildlife survey is a valuable tool for aerodromes to ensure their wildlife management and habitat plans are effective, meet all regulations and standards required. The survey will be completed formally on an annual basis by qualified professional/s. Evaluation of all operational, practical, procedural and technical aspects of wildlife and habitat management will form part of this survey. A comparison with previous year's findings and recommendations to ensure the survey delivers on the purpose of the survey.

10.2.2.4 Statistical Comparisons Year on Year

It is extremely important that accurate statistics are gathered and interpreted by competent person/s to ensure that aerodromes can have effective control measures in a timely fashion. Reference should be made to previous statistical data over the last five years and recommendations and action points raised accordingly. Particular attention should be placed on the quality and accuracy of aerodrome wildlife statistics and how these statistics are interpreted so that trends are measured and mitigation measures immediately put into place.

10.2.2.5 Review of Procedures

A full comprehensive review of all control procedures and practices to ensure that effective control measures are in place and are correctly followed and documented. A review of seasonal migration patterns is essential.

10.2.2.6 Equipment Serviceability

A full equipment audit shall be undertaken annually to establish serviceability and effectiveness of all equipment used to support wildlife management.

10.2.2.7 Rotational Procedure

A systematic review of rotational control procedures and the perceived effectiveness of the process. Particular attention to identification of new species and control measures are required to deal with the species.

10.2.2.8 Research Review

Where possible, aerodromes should have a dedicated resource that will ensure that advances in the field of wildlife management and habitat management, whether that be scientific, procedural or proven improved control techniques are reflected in the aerodromes' wildlife and habitat management plan.

10.2.2.9 Intelligence Gathering

The importance of gathering intelligence locally at the aerodrome and surrounding areas can contribute greatly to ensuring that control measures are effective. A plan for sharing information with local aerodromes or aerodromes with similar wildlife and habitat issues is a useful process of mutual benefit where control measures are compared and evaluated.

10.2.2.10 Wildlife Documentation Audit

An evaluation of all reports and records to ensure they meet appropriate standards as they must provide accurate information that can be understood and that will be of value in the evaluation process.

A full check of all wildlife team documentation, paying particular attention to following documentation:

- Locations of wildlife, identification, patterns of movement, control measures records;
- What measures were used, what precise method and how effective?
- Nuisance species reports;
- Protected species, endangered species register;
- Monthly alert reports;
- Rotational control measures records;
- Recording aerodrome wildlife hot spots (on/off aerodrome) and potential strike danger records;
- Analysis of wildlife strikes, removal techniques records;
- Reported strikes on near misses (over last 5 years) records;
- Investigated strike and near miss reports;
- Analysis of carcass (on site and external analysis) records.

Emphasis should be placed on quality of all records in particular daily logs to ensure the best quality intelligence is gathered so that this information can be fed back into the plan in a timely fashion.

10.3 ACAA evaluation of wildlife hazard management programme effectiveness

The ACAA should evaluate the WHMP to ensure the effective and efficient mitigation of wildlife hazards. ACAA may be able to identify gaps in the WHMP and should ensure that the WHMP complies with any regulations.

ACAA can evaluate the programme's effectiveness and determine its compliance with regulations by conducting periodic inspections and audits. The ACAA may use evaluation questionnaires similar to those indicated in 9.2, Wildlife hazard management programme evaluation.

11. MANAGEMENT OF CONFLICT BETWEEN WILDLIFE HAZARD MANAGEMENT AND AERODROME SAFETY

The aerodrome operator department responsible for wildlife hazard management should report to the ACAA the Aerodrome Wildlife Hazard Report/Study, or ACAA may conduct and oversight regarding Wildlife Hazard Management Programme, as thoroughly described in Chapter 10. In cases when there is a conflict found by the Environment Inspector between wildlife hazard management and aerodrome safety, e.g. trees or ponds, or waste management sites, which may penetrate into the Obstacle Limitation Surfaces etc.

Afterwards, ACAA will consult with SAS or LEG for remedial action, and can also coordinate also with concerned organization (Environmental Organisations, ANSPs etc.) for remedial action.

In case of conflict between wildlife hazard management and aerodrome safety, the process flow below (Table 11-1) describes thoroughly the procedures to manage such conflict and provide as output remedial actions to solve the conflict between aerodrome safety and wildlife hazard management requirements.

Table 11.1 – Management of conflict between wildlife hazard management and environmental requirements.

