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Doc 9137

Airport Services Manual

Part 3 — Wildlife Hazard Management
Fifth Edition, 2020



Approved by and published under the authority of the Secretary General

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AMENDMENTS

Amendments are announced in the supplements to the *Products and Services Catalogue*; the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

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FOREWORD

Previous editions of this manual focused on the control of birds on, and in the vicinity of, aerodromes. With the recognition that other forms of wildlife may also present a hazard to the operation of aircraft, the provisions on bird hazard reduction in the fifth edition of Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations* were expanded to include a broader focus on wildlife strike hazard reduction. The eighth edition of Annex 14, Volume I requires that action be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft. Thus, the guidance provided in the fourth edition of this manual was expanded to include both bird and other wildlife control for the purpose of reducing the hazard of bird/wildlife strikes to aircraft.

Amendment 3 to the *Procedures for Air Navigation Services — Aerodromes* (PANS-Aerodromes, Doc 9981) will include provisions and procedures to mitigate the risk posed by wildlife to aviation safety, through the proactive management and control of wildlife at aerodromes and their vicinities. PANS-Aerodromes, Part II, Chapter 6 contains provisions on the establishment of a Wildlife Hazard Management Programme (WHMP) at aerodromes, including guidance on habitat and land use management, reporting and recording wildlife incidents, expelling and deterring wildlife, and personnel training. This fifth edition of the *Airport Services Manual*, Part 3 — *Wildlife Hazard Management* (Doc 9137) (formerly titled Wildlife Control and Reduction) contains revised guidance, consistent with the aforementioned Part II, Chapter 6 and highlights the importance of developing a WHMP specific to each aerodrome.

This document was written on the assumption that birds and other wildlife are a serious hazard to aircraft, and outlines what can and should be done to address this hazard. It is not the purpose of this document to discuss the relative importance of various hazards but to stress the importance of good organization and planning in the creation of a successful WHMP.

The primary purpose of this manual is to provide aerodrome personnel with the information necessary to develop and implement an effective wildlife control group for their aerodrome. The management structure may differ at each aerodrome, however all structure types should be in accordance with the threat. The seriousness of a wildlife hazard problem is affected by geographic location, attractiveness of the aerodrome habitat to wildlife and air traffic density.

This manual suggests organizational structures that may effectively manage wildlife hazard control. A brief history in Chapter 1 describes the evolution of the wildlife hazard and provides examples of significant wildlife strikes. This manual explains why wildlife hazards occur at an aerodrome, the roles and responsibilities of all the stakeholders involved in wildlife hazard control, and the modifications to be carried out at an aerodrome to remove the features which attract wildlife. The content of this fifth edition was reviewed by the wildlife hazard management subject matter experts from the ICAO Wildlife Hazard Management Expert Group (WHMEG), supported by Airports Council International (ACI).

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GLOSSARY

ABBREVIATIONS AND ACRONYMS

AIP	Aeronautical information publication
ANSP	Air navigation services provider
ATC	Air traffic control
ATIS	Automatic terminal information service
CAA	Civil Aviation Authority
FOD	Foreign object debris
GIS	Geographical Information System
IBIS	ICAO Bird Strike Information System
LRAD	Long range acoustic device
MRO	Maintenance, repair and overhaul
NGO	Non-governmental organization
NOTAM	Notice to airmen
RADAR	Radio detection and ranging
RPAS	Remotely Piloted Aircraft System
SMS	Safety management system
WHMP	Wildlife Hazard Management Programme

Chapter 1

INTRODUCTION

1.1 WHAT IS A WILDLIFE HAZARD?

1.1.1 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.

1.1.2 The risk of a wildlife hazard depends on the size, behaviour 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.

1.1.3 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 Wildlife Hazard Management Programmes (WHMP). 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.

1.2 HISTORICAL BACKGROUND

1.2.1 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.

1.2.2 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.

1.2.3 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 harbour. Sixty-two people died out of the seventy-two passengers and crew members on board.

1.2.4 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).

1.2.5 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.

1.2.6 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*).

1.2.7 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.

1.3 FUNDAMENTALS OF WILDLIFE HAZARD MANAGEMENT

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

1.3.2 A strike is a collision between wildlife and an aircraft; a “near miss” is the potential of a wildlife strike.

1.3.3 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.

1.3.4 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.).

1.3.5 Measures to manage wildlife hazards at aerodromes may include, but are not limited to: manipulating habitats (see Chapter 4, Habitat management), harassment and repellent techniques and removal of wildlife (see Chapter 5, 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 6, Advancements in technology).

1.3.6 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 (see Chapter 4, 4.4).

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

1.3.8 This manual 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)

1.3.9 State authorities should analyse and approve the location of new aerodromes, to ensure that issues with high potential for wildlife attraction are considered and mitigated where necessary.



Chapter 2

STAKEHOLDERS

2.1 INTRODUCTION

2.1.1 A variety of stakeholders should contribute to wildlife hazard management at the aerodrome. These include, but are not limited to, the aerodrome operator, 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.

2.1.2 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 (see 2.6).

2.2 AERODROME OPERATORS

2.2.1 General

2.2.1.1 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.

2.2.1.2 To achieve this goal, each aerodrome operator should develop, implement and demonstrate an effective WHMP (see Chapter 9, Wildlife Hazard Management Programme). The 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 (see Chapter 3, Aerodrome wildlife safety risk assessment). 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 (See Chapter 7, Training).

2.2.1.3 The aerodrome operator should provide pilots and aircraft operators with recurrent wildlife behaviour and habits that may impact aircraft safety (see Chapter 8, Operational notifications).

2.2.1.4 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.

2.2.2 Aerodrome wildlife coordinator or manager

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.

2.2.3 Aerodrome wildlife control personnel

A wildlife controller 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:

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

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

2.2.4.1 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.

2.2.4.2 This data will mainly contain records of:

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

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

Wildlife observations and control activities records

2.2.4.3 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 (See Chapter 5.2, Patrols and observations):

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

2.2.4.4 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.

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

Periodic wildlife surveys

2.2.4.6 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.

2.2.4.7 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.

2.2.4.8 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.

2.2.4.9 The periodic surveys should be carried out by personnel with the knowledge and experience of studying wildlife.

2.2.4.10 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

2.2.4.11 All stakeholders must report wildlife-related incidents defined in Chapter 1, 1.3.4, to the aerodrome operator.

2.2.4.12 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.

2.2.4.13 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.

2.2.4.14 The aerodrome operator should report wildlife incidents to the CAA in accordance with national regulations on incident reporting.

2.2.4.15 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.

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

2.2.4.17 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

2.2.4.18 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 (See Chapter 4, 4.2, Attractants).

2.3 STAKEHOLDERS WITHIN THE AERODROME

2.3.1 Airside personnel

2.3.1.1 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.

2.3.1.2 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.

2.3.2 Air traffic control (ATC)

2.3.2.1 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.

2.3.2.2 ATC should report all aerodrome wildlife incidents through the established procedures (for more examples, see Chapter 8, Operational notifications). In addition, ATC should maintain a continuous liaison with the aerodrome wildlife hazard control personnel.

2.3.2.3 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.

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

2.3.3 Pilots

2.3.3.1 All pilots should report wildlife strikes through the established procedures (see Chapter 8). 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 necessarily.

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

2.3.3.3 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.

2.3.4 Aircraft operators

2.3.4.1 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.

2.3.4.2 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.

2.3.4.3 The aircraft operator should provide training on wildlife hazards in relation to flight operations (see specific examples in Chapter 7, 7.2.1) and reporting requirements to pilots and ground personnel.

2.3.5 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.

2.4 IDENTIFYING EXTERNAL STAKEHOLDERS IN THE COMMUNITY

2.4.1 The importance of identifying external stakeholders

2.4.1.1 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.

2.4.1.2 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.

2.4.2 Land owners

2.4.2.1 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 (see 2.6, Methods of communication). Land uses that should be considered by aerodrome operators are outlined in Chapter 4, Habitat management.

2.4.3 State authorities

2.4.3.1 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 circle¹ in the vicinity of the aerodromes because they may be attractive for wildlife, may be a helpful starting point.

2.4.3.2 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.

2.4.3.3 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).

2.4.4 Environmental authorities

2.4.4.1 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.

2.4.4.2 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.

2.4.4.3 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.

1. The 13-km circle was based on a statistic that 95% of bird strikes occur below 2 000 ft, and that an aircraft on a normal approach would descend into this zone at approximately 13 km from the runway. An assumption was made that birds would remain overhead the attraction (at up to 2 000 ft) and that overflying aircraft would be at risk.