Wildlife Hazard Management Manual

(Industry Guidance Material)

Approved by the Director-General of Civil Aviation and published under his authority.

Amendments

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Amendment Procedures

The Jamaica Civil Aviation Authority is responsible for the development, issuance and control of amendments to this manual.

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Foreword

This Wildlife Hazard Management Manual has been developed by the Jamaica Civil Aviation Authority (JCAA) to guide Aerodrome Operators in the assessment of the hazards posed by wildlife on and in the vicinity of their aerodrome. This manual also describes methods to develop a Wildlife Hazard Management Plan and thereafter implement a Wildlife Hazard Management Programme.

The ultimate aim is to mitigate the hazards caused by wildlife so as to maintain an acceptable level of safety for all users of the aerodrome.

This manual does not provide standards or requirements, but rather serves to provide guidance and means, but necessarily the only means, of managing the wildlife hazards commonly encountered by aerodrome operators.

Please note that a Wildlife Hazard Management Programme is required for certification under Regulation 93 of the Civil Aviation Regulations.

Approved by: _____ Date: March 11, 2016

Nari Williams-Singh
Director-General of Civil Aviation
Jamaica Civil Aviation Authority

Chapter 1 Introduction to Wildlife Hazard Management

1.1 General

1.1.1 Wildlife, particularly birds but also including mammalian species, present an ongoing hazard to the safe and expedient conduct of civil and even military aviation.

1.1.2 Wildlife may wander on to the air operations area (AOA) and aircraft must share the airspace with birds, particularly during take-off, landing and relatively low altitude phases of flight. These hazards create the potential for aircraft to collide with wildlife which may result in incidents and accidents with sometimes fatal consequences.

1.1.3 Section 9.4 of Annex 14 Volume I issues standards requiring the assessment, reporting and mitigation of wildlife strike hazards, stating that "the presence of wildlife (birds and animals) on and in the aerodrome vicinity poses a serious threat to aircraft operational safety".

1.1.4 In accordance with these international standards the Jamaica Civil Aviation Authority (JCAA) promulgates national standards in section 13.2.4 of the Manual of Aerodrome Standards (MAS) requiring the assessment, reporting and mitigation of wildlife strike hazards.

1.1.5 A wildlife strike has occurred when —

- A pilot reports striking one or more birds or other wildlife;
- Aircraft maintenance personnel identify aircraft damage as having been caused by a wildlife strike;
- Personnel on the ground report seeing an aircraft strike one or more birds or other wildlife;
- Bird or other wildlife remains are found within 200 feet of the centreline of a runway, unless another reason for the animal's death is identified.

1.2 Wildlife Hazard Assessment and Reporting

1.2.1 Before a problem can be solved, the problem must first be understood. A necessary first step toward understanding the complex problem of aircraft collisions with wildlife is the collection and analysis of data from actual wildlife strike events and other wildlife related incidents, such as rejected take-offs and go-arounds.

1.2.2 Data may come from sightings, maintenance reports, strike reports and control activities. Reporting must involve pilots and aircraft operators primarily, as well as aerodrome ground operations staff, ATC and other aviation stakeholders (e.g. aircraft maintenance organizations). Reviewing and analysing this data will help identify problems at the aerodrome and indicate the effectiveness of current bird/wildlife strike prevention methods.

1.2.3 It is recommended that the wildlife strike reporting procedure be coordinated by a single office in order to ensure an appropriate and meaningful review taking into consideration all circumstances. This procedure should be familiar to all aerodrome personnel and described in the aerodrome manual or associated aerodrome wildlife hazard policy document. All strike reports should be directed to a wildlife strike control coordinator who should forward them to the JCAA.

1.2.4 The Flight Safety Division (FSD) of the JCAA maintains a wildlife occurrences database, compiling all reported wildlife strikes and incursions. This data is forwarded to the ICAO Bird Strike Information System (IBIS).

1.3 Wildlife Hazard Mitigation and Management

1.3.1 Once a wildlife hazard risk assessment has been conducted the wildlife hazards must be managed or mitigated.

1.3.2 The methods by which wildlife hazards at or in the vicinity of an aerodrome are dealt with should be determined by the nature of the specific risks which present themselves.

1.3.3 These risk mitigation measures may include:

- Flight schedule modification
- Environment/habitat modification
- Wildlife repellent
- Wildlife removal

1.3.4 An effective Wildlife Hazard Management Programme not only mitigates the risks posed by wildlife in an efficient manner but also seeks to adapt to changing environmental and legal conditions.

Chapter 2 Wildlife Hazard Assessment

2.1 General

2.1.1 The first step in preparing an aerodrome Wildlife Hazard Management Plan (WHMP) is to conduct a Wildlife Hazard Assessment (WHA).

2.1.2 The Wildlife Hazard Assessment, conducted by a wildlife damage management biologist, provides the scientific basis for the development, implementation, and refinement of a Wildlife Hazard Management Plan. Though parts of the Wildlife Hazard Assessment may be incorporated directly into the Wildlife Hazard Management Plan, they are two separate documents.

2.1.3 Aerodromes should systematically review features on, and in the vicinity of, the aerodrome that attract birds and other wildlife. The management plan should be developed to reduce the attractiveness of these features and to decrease the number of hazardous birds and other wildlife present or to deny them physical access to these areas.

2.1.4 Land-use practices and habitat are the key factors determining the wildlife species and the size of wildlife populations that are attracted to aerodrome environments. The recognition and control of those land-use practices and habitats on or near aerodromes that attract hazardous wildlife are fundamental to effective Wildlife Hazard Management Plans.

2.1.5 It is important that land use in the vicinity of an aerodrome is monitored on a continuing basis to mitigate potential increases in wildlife due to changes in the local environment.

2.1.6 The following is a point-by-point comment on factors to be addressed in a Wildlife Hazard Assessment.

- Analysis of the event or circumstances that prompted the study.
- Identification of the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences. In most cases, this requirement dictates that a 12-month assessment be conducted so the seasonal patterns of birds and other wildlife using the aerodrome and surrounding area during an annual cycle can be properly documented.
- Identification and location of features on and near the aerodrome that attract wildlife.
- Description of the wildlife hazards to air carrier operations.
- Recommended actions for reducing identified wildlife hazards to air carrier operations.

2.1.7 In order to adequately identify "the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences" during a Wildlife Hazard Assessment, it is recommend that standardized survey procedures be used. These standardized procedures should provide an objective assessment of hazardous wildlife in the aerodrome environment that can be repeated in future years for comparative purposes.

2.1.8 One objective procedure for assessing bird populations, based on North American Breeding Bird Survey methodology, is the establishment of standardized survey points about 1 kilometre apart throughout the AOA (10-20 survey points are generally recommended depending on size of aerodrome). Assigning each bird or bird flock observed during a point count to a grid location can be useful in further refining spatial distributions of birds on the aerodrome.

2.1.9 Additional survey points may be established in nearby off-aerodrome areas (e.g., taxicab lot, golf course, or public parks/sports fields) suspected of attracting hazardous birds that move across the AOA. Standardized counts of birds should be made at each of these survey points at least twice monthly.

2.1.10 In addition, specialized surveys might be needed as part of the overall assessment to document large-to-mid-sized mammals, such as dogs (from vehicle using spotlight or night vision equipment), and small mammals, such as mongooses and mice (snap traps), on the aerodrome. These specialized mammal surveys should be conducted at least twice during a 12-month WHA.

2.2 Land uses that potentially attract wildlife

2.2.1 Landfills and other solid waste storage and processing facilities are known to attract large numbers of hazardous wildlife, particularly birds.

2.2.2 Drinking water intake and treatment facilities, storm water and wastewater treatment facilities, associated retention and settling ponds, ponds built for recreational use, and ponds that result from mining activities often attract large numbers of potentially hazardous wildlife.

2.2.3 To prevent wildlife hazards, land-use developers and aerodrome operators may need to develop management plans, in compliance with applicable national regulations, to support the operation of storm water management facilities on or near public-use aerodromes to ensure a safe operating environment.

2.2.4 On-aerodrome storm water management facilities allow the quick removal of surface water from impervious surfaces, such as pavement and terminal/hangar building roofs. Existing detention ponds collect storm water, protect water quality, and control runoff. Because they slowly release water after storms, they create standing bodies of water that can attract hazardous wildlife.

2.2.5 Using appropriate wildlife hazard mitigation techniques, aerodrome management should take immediate corrective actions to address any wildlife hazards arising from existing storm water or other such facilities located on or near an aerodrome.

2.2.6 Wetlands typically attract diverse species of wildlife. If wetlands are located on or near aerodrome property, be alert to any wildlife use or habitat changes in these areas that could affect safe aircraft operations.

2.2.7 Confined livestock operations (i.e., feedlots, dairy operations, hog or chicken production facilities, or egg-laying operations) often attract flocking birds that pose a hazard to aviation. Aquaculture activities conducted outside of fully enclosed buildings are also inherently attractive to a variety of birds.

2.2.8 Some aerodromes are surrounded by vast areas of farmed land. It is recommended that a wildlife damage management biologist review, in coordination with local farmers and aerodrome management, these types of seasonal land uses. Restrictions to seasonal land uses that are incompatible with aviation safety should be incorporated into the WHMP where possible.

2.2.9 Depending on geographic location and plant selection and spacing, aerodrome landscaping can attract hazardous wildlife. Approach landscaping with caution, and confine it to aerodrome areas not associated with aircraft movements. In cooperation with a wildlife damage management biologist, review all landscaping plans. Monitor all landscaped areas on a continuing basis for the presence of hazardous wildlife

2.2.10 There may be circumstances where two (or more) different land uses that would not, by themselves, be considered hazardous wildlife attractants that are in such an alignment with the aerodrome as to create a wildlife corridor directly through the aerodrome and/or surrounding airspace.

2.2.11 An example of this situation might involve a lake located on the east side of an aerodrome and a large hayfield on the west side of an aerodrome. Together these geographical features could create a flyway for birds directly across the airspace of the aerodrome. There are numerous examples of such situations; therefore, aerodrome operators and the wildlife damage management biologist must consider the entire surrounding landscape and community when developing the WHMP.

Chapter 3 Developing the Wildlife Hazard Management Plan (WHMP)

3.1 Introduction

3.1.1 In recognition of the increased risk of serious aircraft damage or the loss of human life that can result from a wildlife strike, greater emphasis is being placed on preparing aerodrome Wildlife Hazard Management Plans that effectively deal with the problem.

3.1.2 A programme to reduce the risks associated with bird and other wildlife strikes is referred to in section 13.2.4 of the Manual of Aerodrome Standards (MAS). An aerodrome should implement a wildlife hazard management programme in order to reduce the risks presented by birds and wildlife at the aerodrome and in its vicinity. The scale and details of this programme will vary from aerodrome to aerodrome, but all programmes should contain basic information as described in section 3.2 of this manual.

3.1.3 The goal of an aerodrome's Wildlife Hazard Management Plan is to minimize the risk to aviation safety, aerodrome structures or equipment, or human health posed by populations of hazardous wildlife on and around the aerodrome. The Wildlife Hazard Management Plan should be incorporated in to the aerodrome operator's Safety Management System (SMS).

3.1.4 It is important to note that regardless of whether a Wildlife Hazard Management Plan has been developed, aerodrome operators must be ready to deal with hazardous wildlife on or near the aerodrome. The aerodrome operator must be prepared to take immediate action to deal with unexpected incursions of hazardous wildlife into the AOA, loading ramps, or parking areas.

3.1.5 Aerodrome management may request the wildlife biologist who prepared the Wildlife Hazard Assessment to assist with the preparation of the Wildlife Hazard Management Plan and to review the finished plan. However, only the aerodrome operator can commit resources (time, money, personnel), and the ultimate responsibility for the development and implementation of the plan rests with the aerodrome operator. The completed plan forms a part of the Aerodrome Operator Manual which must be submitted to the Authority for review and approval.

3.1.6 The first step in solving any wildlife damage problem is to answer the following nine questions for each species:

1. What are the wildlife doing that make the control of their numbers or damage necessary? The type of activity that needs to be controlled will determine both the severity of the problem and the type of control methods used.

2. Which species of wildlife are causing the problem? Accurate identification of the exact species is critical because different species often require different management techniques.

3. Why are the wildlife on the aerodrome? Are they attracted to the aerodrome for food, water, or shelter; or are they just flying over the aerodrome from night time roosting sites to daytime feeding sites? The answer to this question will determine, to a large extent, the most appropriate control methods to use.

4. What are the daily and seasonal movement patterns of the wildlife among feeding, loafing, and roosting/nesting areas? Try to identify the times of day and seasons of year, as well as locations on aerodrome, where the wildlife pose the most critical threat to aviation safety and where they are most vulnerable to management actions.

5. What is the legal status of the problem species? All wildlife species are not afforded equal legal protection by government.

6. What effective and legal management methods are available? In wildlife hazard management, effective and legal are not necessarily synonymous.

7. How selective are these control methods? The objective is to control only the target wildlife, not every species in the area.

8. How much will it cost to apply the selected control methods? The cost of control might dictate which methods are practical, given the seriousness of the threat caused by the species.

9. What are public attitudes toward the problem wildlife species and the hazards that these species pose? Public opinion also may influence the type of management actions taken.

3.2 Contents of the Wildlife Hazard Management Plan

3.2.1 The Wildlife Hazard Management Plan will outline appropriate wildlife hazard mitigation techniques. Develop measures to minimize hazardous wildlife attraction in consultation with a wildlife damage management biologist.

3.2.2 The Wildlife Hazard Management Plan must accomplish the following:

- Identify personnel responsible for implementing each phase of the plan,
    - a manager who is accountable for developing and implementing the wildlife hazard management programme;
    - a coordinator who should oversee the daily activities and analyse the collected data and carry out risk assessments in order to develop and implement the programme;
    - trained and competent staff who should detect and record the presence of, assess, and expel hazardous wildlife. It is recommended that the training of staff engaged in bird control activities include an element of ornithological knowledge, to enable aerodrome bird control staff to make reliable and accurate identifications of birds both from observations and post bird strike during the collection and analysis of bird remains. A facility by which stakeholders can obtain a scientific analysis (feather or DNA) taken from an unidentifiable carcass following a strike should also be described in the WHMP;
- Identify and provide information on hazardous wildlife attractants on or near the aerodrome;
- a process of habitat and land management both on the aerodrome and in its vicinity in order to reduce the attractiveness of the area to wildlife. Where applicable and relevant, this should include effective grass management techniques and a long/tall grass policy for "on-airfield" areas;
- Prioritize appropriate management measures;
- Recommend necessary equipment and supplies;
- Identify training requirements for the aerodrome personnel who will implement the Wildlife Hazard Management Plan;
- Identify when and how the plan will be reviewed and updated;
- a process to report, collect and record data on struck and living birds/wildlife;
- a process to analyse the data and assess the bird/wildlife hazard in order to develop mitigation, proactive and reactive measures. This should include a risk assessment methodology;
- a process to expel or remove hazardous wildlife;
- a process for liaison with non-aerodrome agencies and local landowners, etc., to ensure the aerodrome operator is aware of developments that may contribute to creating additional bird hazards in the infrastructure, vegetation, land use and activities in the aerodrome vicinity (crop harvesting, seed planting, ploughing, establishment of land or water features, hunting, etc., that might attract birds/wildlife); and
- a process to have regular meetings with all stakeholders of the aerodrome's bird/wildlife strike prevention committee.

Chapter 4 Implementing the Wildlife Hazard Management Programme

4.1 General

4.1.1 No aerodrome or aircraft type is immune from the hazards of wildlife strikes. In addition to strikes, wildlife that are roosting, nesting, or burrowing on aerodromes can cause structural damage to buildings, equipment, and aircraft as well as nuisance and health problems for workers and passengers.

4.1.2 This chapter outlines the strengths and weaknesses of various wildlife control methods recommended for use on aerodromes. This chapter is not the final word on this subject. Wildlife damage control is a dynamic field, and new products, technologies, and innovations are continuously being introduced. In addition, changes in the legal status of control techniques, chemical registrations, and wildlife species occur at the federal and state level. Thus, this chapter is only a starting point for information on wildlife control techniques.

4.1.3 Four basic control strategies are available to solve wildlife problems on aerodromes:

1. Aircraft flight schedule modification;
2. Habitat modification and exclusion;
3. Repellent and harassment techniques; and
4. Wildlife removal.

4.1.4 Integrate all four control strategies into the Wildlife Hazard Management Plan as appropriate.

4.2 Aircraft flight schedule modification

4.2.1 Although not generally practical for regularly scheduled commercial traffic on larger aerodromes, there may be various situations when flight schedules of some aircraft can be adjusted to minimize the chance of a strike with a wildlife species that has a predictable pattern of movement.

4.2.2 Air traffic controllers may, on occasion, need to temporarily close a runway with unusually high bird activity or a large mammal (e.g. dogs or goats) incursion until wildlife control personnel can disperse the animals.

4.3 Habitat modification and exclusion

4.3.1 Introduction

4.3.1.1 Habitat modification means changing the environment to make it less attractive or inaccessible to the problem wildlife.

4.3.1.2 All wildlife requires food, cover, and water to survive. Any action that reduces, eliminates, or excludes one or more of these elements will result in a proportional reduction in the wildlife population at the aerodrome.

4.3.1.3 Habitat modifications to make the aerodrome and surrounding area as unattractive as possible to hazardous wildlife must be the foundation of every aerodrome's Wildlife Hazard Management Plan.

4.3.1.4 Initially, management actions to reduce food, cover, and water on an aerodrome might be expensive. However, when costs are amortized over several years, these actions might be the least expensive approach to reducing wildlife populations on the aerodrome.

4.3.1.5 Once a habitat modification is done correctly, it is generally not necessary to go back and do it again. Also, these control methods are generally well accepted by the public and minimize the need to harass or kill wildlife on the aerodrome.

4.3.2 Food

4.3.2.1 Some of the more common urban food sources for birds on and near aerodromes include handouts from people in taxi stands and parks, grain elevators, feed mills, sewer treatment plants, and improperly stored food waste around grocery stores, restaurants, and catering services. Rural food sources attractive to birds include sanitary landfills, feedlots, certain agricultural crops (especially cereal grains and sunflower), and spilled grain along road and railways.

4.3.2.2 Be aware of food attractants for birds that exist on and in proximity to the aerodrome. On the aerodrome, require bird-proof storage of food waste, prohibit bird feeding, and promote good sanitation and litter control programs.

4.3.2.3 Do not use trees and other landscaping plants for the landside of aerodromes that produce fruits or seeds attractive to birds.

4.3.2.4 On airside areas, the large expanses of grass and forbs can sometimes provide ideal habitat for rodent and insect populations that attract predatory bird species, and mammalian predators. In addition, grasses allowed to produce seed heads can provide a desirable food source for flocking bird species.

4.3.2.5 The management of airside vegetation to minimize rodents, insects, and seeds might be complex, requiring insecticide, herbicide, and rodenticide applications; changes in vegetation cover; and adjustments in mowing schedules (e.g., mowing at night to minimize bird feeding on insects exposed by the mowing). Such management plans will need to be developed in conjunction with professional wildlife biologists and horticulturists knowledgeable with the local wildlife populations, vegetation, and growing conditions.

4.3.3 Cover

4.3.3.1 All wildlife requires cover for resting, roosting, escape, and reproduction. Many bird problems can be solved by eliminating availability of such areas either through removal or by exclusion.

4.3.3.2 Take care when selecting and spacing plants for aerodrome landscaping. Avoid plants that produce fruits and seeds desired by birds. Also avoid the creation of areas of dense cover for roosting.

4.3.3.3 Thinning the canopy of trees, or selectively removing trees to increase their spacing, can help eliminate bird roosts that form in trees on aerodromes.

4.3.3.4 The management of an aerodrome's airside ground cover to minimize bird activity is a controversial subject in North America. The general recommendation, based on studies in England in the 1960s and 1970s, has been to maintain a monoculture of grass at a height of 6-10 inches (Transport Canada) or 7-14 inches (U.S. Air Force). Tall grass, by interfering with visibility and ground movements, is thought to discourage many species of birds from loafing and feeding.

4.3.3.5 However, the limited studies conducted in North America have not provided a consensus of opinion on the utility of tall-grass management for aerodromes. In addition, maintenance of tall grass can result in increased rodent populations, a food source for predatory birds. Finally, maintenance of monotypic, uniform stands of tall grass is difficult and expensive on many aerodromes because of varying soil conditions and the need for fertilizer and herbicide applications.

4.3.3.6 Ensure that plant varieties attractive to hazardous wildlife are not used on the aerodrome. Do not plant disturbed areas or areas in need of re-vegetating with seed mixtures containing millet or any other large-seed producing grass.

4.3.3.7 Prevent plant maturation and seed head production on aerodrome property already planted with seed mixtures containing millet, rye grass, or other large-seed producing grasses by the use of disking, ploughing, or another suitable agricultural practice.

4.3.3.8 Consider developing and implementing a preferred/prohibited plant species list, reviewed by a wildlife damage management biologist, which has been designed for the geographic location to reduce the attractiveness to hazardous wildlife for landscaping aerodrome property. Avoid installation of ponds, fountains, reflecting pools, and other water bodies as part of an aerodrome's landscaping scheme.

4.3.3.9 A promising approach to reducing wildlife attraction to aerodrome ground cover, irrespective of the height, is the use of vegetation that is undesirable or mildly toxic to wildlife. For example, there are varieties of fescue grass that contain fungal endophytes. Some of these endophytes are unpalatable to grazing birds, as well as to rodents and grazing mammals. These endophytic grasses might also support fewer insect numbers.

4.3.3.10 Other ground cover, such as wedelia or Bermuda grass, might be appropriate for subtropical airfields. Finally, artificial (synthetic) turf in selected areas might be useful in providing a more sterile environment for wildlife at aerodromes.

4.3.3.11 Until more research is completed, no general guidelines on grass height or vegetation type for airside ground cover will be made. Consult with professional wildlife hazard management biologists and horticulturists to develop a vegetation type and mowing schedule appropriate for the growing conditions and wildlife at the location.

4.3.3.12 The main principles to follow are to use a vegetation cover and mowing regime that do not result in a build-up of rodent numbers or the production of seeds, forage, or insects desired by birds.

4.3.3.13 Finally, dense stands of trees and undergrowth on aerodrome property can provide excellent cover for wildlife. In general, clear or at least sufficiently thin these habitats to eliminate the desired cover and to allow easy visual and physical access by wildlife control personnel.

4.3.3.14 Remove all unnecessary posts, fences, and other structures that can be used as perches by birds. Piles of construction debris and discarded equipment, unmowed fence rows, and other unmanaged areas are not only aesthetically unpleasing but typically provide excellent cover for commensal rodents (rats and house mice) and den sites for feral dogs. Eliminate such areas on aerodromes.

4.3.4 Water

4.3.4.1 Water acts as a magnet for birds; therefore, all standing water on an aerodrome should be eliminated to the greatest extent possible. Fill or modify to allow rapid drainage of depressions in paved and vegetated areas, and disturbed areas at construction sites that accumulate standing water after rain.

4.3.4.2 This is particularly important at coastal aerodromes where fresh water is highly attractive to birds for drinking and bathing. Do not establish retention ponds, open drainage ditches, outdoor fountains and other wetland sites on or adjacent to aerodromes.

4.3.4.3 Where possible, modify storm water detention ponds to allow a maximum 48-hour detention period for the design storm. Avoid or remove retention ponds and detention ponds featuring dead storage to eliminate standing water. Design detention basins to remain totally dry between rainfalls.

4.3.4.4 Where constant flow of water is anticipated through the basin, or where any portion of the basin bottom might remain wet, design the detention facility to include a concrete or paved pad and/or ditch/swale in the bottom to prevent vegetation that might provide nesting habitat.

4.3.4.5 When it is not possible to drain a large detention pond completely, use physical barriers, such as bird balls, wires grids, pillows, or netting, to deter birds and other hazardous wildlife. Evaluate the use of physical barriers and ensure they will not adversely affect water rescue.

4.3.4.6 Encourage off-aerodrome storm water treatment facility operators to incorporate appropriate wildlife hazard mitigation techniques into their operating practices

4.4 Exclusion Techniques

4.4.1 Introduction

4.4.1.1 If food, water, or cover cannot be eliminated by habitat modification, then actions can sometimes be taken to exclude the wildlife from the desired resource.

4.4.1.2 Exclusion involves the use of physical barriers to deny wildlife access to a particular area.

4.4.1.3 As with habitat modification, exclusion techniques, such as installing a covered drainage ditch instead of an open ditch, can initially be costly.

4.4.1.4 However, exclusion provides a permanent solution that is not only environmentally friendly, but when amortized over many years, might actually be the least expensive solution.

4.4.2 Exclusion of Birds

4.4.2.1 Architects should consult biologists during the design phase of buildings, hangers, bridges, and other structures at aerodromes to minimize exposed areas that birds can use for perching and nesting. For example, tubular steel beams are much less attractive as perching sites than are I-beams.

4.4.2.2 If desirable perching sites are present in older structures, access to these sites (such as rafter and girded areas in hangers, warehouses, and under bridges) often can be eliminated with netting. Curtains made of heavy-duty plastic sheeting, cut into 12-inch strips, and hung in warehouse or hanger doorways, can discourage birds from entering these openings.

4.4.2.3 Anti-perching devices, such as spikes, can be installed on ledges, roof peaks, rafters, signs, posts, and other roosting and perching areas to keep certain birds from using them.

4.4.2.4 Changing the angle of building ledges to 45 degrees or more will deter birds. However, it is emphasized that incorporating bird exclusion or deterrence into the design of structures is the most effective, long-term solution.

4.4.2.5 Gull and waterfowl use of retention ponds and drainage ditches can be reduced with over-head wire systems. A system of wires spaced 10 feet apart or in a 10- x 10-foot grid will discourage most gulls and waterfowl from landing. Similar wire systems have been successfully used to keep gulls off roofs and out of landfills and crows out of electrical substations.

4.4.2.6 When it is desirable to eliminate all bird use, netting can be installed over small ponds and similar areas. However, birds are sometimes tangled in the netting and maintenance problems arise with high winds.

4.4.2.7 Complete coverage of ponds with plastic, 3-inch diameter "bird balls" or floating mats will completely exclude birds and yet allow evaporation of water.

4.4.2.8 Designing ponds with steep slopes will discourage wading birds.

4.4.2.9 Use of culverts to totally cover water in drainage ditches is recommended whenever possible.

4.4.3 Exclusion of mammals

4.4.3.1 Institute a "zero tolerance" policy for livestock, and other large mammals in the AOA because of their severe threat to aviation safety. The best, albeit most costly, procedure for excluding these animals off the AOA is proper fencing. A 10-12 foot chain link fence with 3-strand barbed wire outriggers is recommended.

4.4.3.2 A 4-foot skirt of chain-link fence material, attached to the bottom of the fence and buried at a 45° angle on the outside of the fence will prevent animals from digging under the fence and reduce the chance of washouts. This type of fencing also greatly increases aerodrome security.

4.4.3.3 Properly install and maintain all fencing. Keep the fence line free of excess vegetation. Patrol the fence line at least daily, and fix any washouts, breaks, or other holes in the fence as soon as they are discovered.

4.4.3.4 Cattle Grids are widely used to prevent hoofed livestock from traversing across fenced areas through permanent openings maintained for vehicular access. These devices, if at least 15 feet in length perpendicular to the fence, will prevent large mammals from entering through gated areas on aerodromes.

4.5 Repellent Techniques

4.5.1 Introduction

4.5.1.1 Repellent and harassment techniques are designed to make the area or resource desired by wildlife unattractive or to make the wildlife uncomfortable or fearful.

4.5.1.2 Long term, the cost-effectiveness of repelling wildlife usually does not compare favourably with habitat modification or exclusion techniques. No matter how many times wildlife are driven from an area that attracts them, they or other individuals of their species will return as long as the attractant is accessible.

4.5.1.3 However, habitat modifications and exclusion techniques will never completely rid an aerodrome of problem wildlife; therefore, repellent techniques are a key component of any wildlife hazard management plan.

4.5.1.4 Repellents work by affecting the animal's senses through chemical, auditory, or visual means.

4.5.1.5 Habituation or acclimation of birds and mammals to most repellent devices or techniques is a major problem. When used repeatedly without added reinforcement, wildlife soon learn that the repellent devices or techniques are harmless. The devices become a part of their “background noise”, and they ignore them.

4.5.1.6 Critical factors to be recognized in deploying repellents are—

- There are no "silver bullets" that will solve all problems;
- Likewise, there is no standard protocol or set of procedures that is best for all situations. Repelling wildlife is an art as much as a science. The most important factor is having motivated, trained, appropriately equipped personnel who understand the wildlife situation on their aerodrome;
- Each wildlife species is unique and will often respond differently to various repellent techniques. Even within a group of closely related species, such as gulls, the various species will often respond differently to various repellent techniques; and
- Habituation to repellent techniques can be minimized by—
    - using each technique sparingly and appropriately when the target wildlife is present,
    - using a variety of repellent techniques in an integrated fashion, and
    - reinforcing repellents with occasional lethal control (with necessary permits in place) directed at abundant problem species.

4.5.1.7 Advances in electronics, remote sensing capabilities, and computers are resulting in the development of "intelligent" systems that can automatically deploy repellent devices (e.g., noisemakers, chemical sprays) when targeted wildlife enter a designated area.

4.5.1.8 These devices might help reduce habituation and increase effectiveness of repellents in some situations. However, these devices will never replace the need for trained people on the ground to respond appropriately to incursions by a variety of highly adaptable, sentient wildlife species.

4.5.2 Wildlife patrols and runway sweeps in vehicles

4.5.2.1 Regular patrols of airside areas to disperse birds and other hazardous wildlife are a critical component of an integrated program of wildlife hazard management on aerodromes.

4.5.2.2 Often, driving a vehicle toward the wildlife will be enough to cause the wildlife to disperse, especially if the driver has been deploying repellent and removal techniques and strategies as outlined below.

4.5.2.3 Regular patrols and sweeps also permit wildlife control personnel to learn the daily movement patterns, habitat preferences, and behaviour of wildlife on the aerodrome.

4.5.2.4 This information can be useful in determining wildlife attractants on the aerodrome that need to be removed (e.g., low areas that gather standing water after rains) and in anticipating problem situations.

4.5.2.5 All wildlife carcasses found during runway sweeps should be removed, identified to species, and documented on a wildlife strike log for carcass remains.

4.5.3 Chemical repellents for birds and mammals

4.5.3.1 Several chemical products are available on the market for the repelling of wildlife. Most are non-toxic and safe for use. These chemical repellents are designed to irritate wildlife either by touch, smell, or by providing a foul taste.

4.5.3.2 The operator should seek the guidance of the National Environment and Planning Agency (NEPA) before including chemical repellents in their WHMP.

4.5.4 Chemical repellents for mammals

4.5.4.1 There are a number of taste and odour repellents marketed to repel deer, rabbits, and other mammals from browsing on vegetation. These include products that are applied directly to the vegetation and general area (odour) repellents (e.g., predator urine).

4.5.4.2 Some of these products might be appropriate for short-term protection of valuable landscaping plants and fruit trees. However, their use on aerodromes to repel or discourage deer or other mammals is not recommended because they are unlikely to have any influence on wildlife movements in the aerodrome operating area.

4.5.5 Audio repellents for birds

Propane cannons.

4.5.5.1 Propane cannons (exploders) generate a shotgun-sounding blast. In general, birds quickly habituate to cannons that detonate at systematic or random intervals throughout the day.

4.5.5.2 Thus, to ensure they remain effective, use cannons sparingly and only when birds are in the area. Reinforcement by occasional killing a few birds (of common species such as gulls and pigeons under an appropriate permit) with a shotgun might also enhance effectiveness.

4.5.5.3 Systems designed so cannons placed around an aerodrome can be detonated remotely on demand by radio signal when birds are in the area are a useful means of reducing habituation.

Distress-call and electronic noise-generating systems.

4.5.5.4 Recorded distress calls are available for common birds on aerodromes, such as gulls.

4.5.5.5 Such calls, broadcast from speakers mounted on a vehicle, will often initially draw the birds toward the sound source to investigate the threat. The birds can then be dispersed by pyrotechnics or by using a shotgun to shoot an occasional bird.

4.5.5.6 As with propane cannons, distress calls routinely broadcast from stationary speakers, with no associated follow-up stimuli that provide additional fear or stress, have little utility.

4.5.5.7 Birds also habituate rapidly to other electronic sound systems that generate a variety of synthetic sounds from stationary speakers.

Shell crackers and other pyrotechnics.

4.5.5.8 There are a variety of projectiles that can be fired from breech-loaded shotguns or from specialized launchers to provide an auditory blast or scream, as well as smoke and flashing light, to frighten birds. Some of the newer cartridges have ranges of up to 250 m.

4.5.5.9 These pyrotechnics, when used skilfully in combination with other harassment techniques and limited lethal control (shooting via shotgun), can be very useful in driving birds off of an aerodrome.

4.5.5.10 An advantage of these pyrotechnic devices is that they require a person to fire the projectile, thus ensuring that they are deployed directly at the target birds and that the birds associate the pyrotechnic with a threat (person).

Ultrasonic devices.

4.5.5.11 Ultrasonic (i.e., above the sound range detected by humans) devices have not proven to be effective bird repellents. In fact, most birds do not detect frequencies as high as humans can detect, much less frequencies above the level of human detection.

4.5.5.12 During tests conducted by the U.S. Department of Agriculture's National Wildlife Research Center, pigeons showed no response when exposed within 10 feet to a fully functional, high-frequency sound generating device.

4.5.5.13 Do not deploy these devices in hangers or other aerodrome settings to deter birds.

4.5.6 Audio repellents for mammals

4.5.6.1 Probably the most commonly used audio scaring device for deer is the propane cannon. However, deer rapidly habituate to propane cannons.

4.5.6.2 Their use on aerodromes to repel dogs, deer, and other mammals from runways is not recommended except for short-term (i.e., several days), emergency situations until a more permanent solution (fencing or deer removal) can be achieved.

4.5.6.3 Other electronic noise-generating devices also have proven ineffective in repelling dogs, deer, or other mammals for more than a few days. Pyrotechnics also provide only short-term repellence for mammals.

4.5.7 Visual repellents for birds

4.5.7.1 Most visual repellents are simply a variation on an ancient theme—the scarecrow. In general, visual repellents, such as hawk effigies or silhouettes, eye-spot balloons, flags, and Mylar reflecting tapes, have shown only short-term effectiveness and are inappropriate for use as a long-term solution to bird problems on aerodromes.

4.5.7.2 Most short-term success achieved with these devices is likely attributable to "new object reaction" rather than to any actual frightening effect produced by them. For example, in a test in the U.S., a flag with a large eye-spot was exposed to pigeons in an abandoned building. As soon as the flag was put up, the pigeons left the building, giving the impression that the eye-spot was highly repellent to the birds. However, within 24 hours, the pigeons returned. From then on, the pigeons behaved in a completely normal fashion and showed no interest in, or reaction to, the flag.

4.5.7.3 One visual deterrent that has been successfully used in recent years is the display of dead birds in a "death pose." Several experiments and field demonstrations have shown that a dead turkey vulture (freeze-dried taxidermy mount with wings spread), hung by its feet in a vulture roosting or perching area, will cause vultures to abandon the site.

4.5.7.4 Initial trials using dead gulls and ravens suspended from poles have also shown promising results in dispersing these species from feeding and resting sites. The dead bird must be hung in a "death pose" to be effective.

4.5.7.5 Dead birds lying supine on the ground or in the roost are generally ignored or might even attract other birds.

4.5.7.6 Research is under way to determine if artificial "dead-bird effigies" can be developed that will be just as effective as the taxidermy mounts.

4.5.7.7 Another new concept in visual repellence that has shown utility in recent years is the use of hand-held laser devices that project a 1-inch diameter red beam to disperse birds.

4.5.7.8 These devises have been used successfully to disperse birds from night-time roosting areas in reservoirs and trees.

4.5.7.9 Advantages are effectiveness at long range (over 400 m) and lack of noise. Lasers have also shown some effectiveness in dispersing birds from hangers.

4.5.7.10 Effectiveness is diminished or non-existent in daylight conditions. As with the use of firearms, the use of lasers in an aerodrome environment obviously requires caution.

4.5.8 Visual repellents for mammals

4.5.8.1 For the most part, visual repellents such as flags and effigies have proven ineffective for repelling mammals. Their use is not recommended for keeping dogs, deer, or other mammals off aerodromes. Red lasers (see 4.5.7.7 above) were ineffective in dispersing deer.

4.5.9 Trained dogs and falcons to repel birds

4.5.9.1 Trained falcons and other birds of prey have been used intermittently on various aerodromes in Europe and North America to disperse birds since the late 1940s.

4.5.9.2 The advantage of falconry is that the birds on the aerodrome are exposed to a natural predator for which they have an innate fear. The disadvantage is that a falconry program is often expensive, requiring a number of birds that must be maintained and cared for by a crew of trained and highly motivated personnel. Furthermore, the effectiveness of falconry programs in actually reducing strikes has been difficult to evaluate.

4.5.9.3 "Bird Hazards to Aircraft" – Blokpoel (1976) outlined the following summary of falconry for aerodromes that is still a good overall assessment:

(a) properly trained birds of prey of the right species for the job at hand, used regularly and persistently by skilled and conscientious personnel, are effective in clearing birds from airfields during daylight and good weather;

(b) for good results, daily operations on a year-round basis are required in most cases;

(c) several falcons are required to have at least one bird ready at all times; and

(d) to obtain, train, operate, and care for falcons, a staff of at least two full-time, well-trained personnel is required.

4.5.9.4 The use of trained dogs, especially border collies, to chase geese and other birds from golf courses, aerodromes, and other sites is a recent development.

4.5.9.5 As with falcons, the advantage is exposure to a natural predator. Likewise, the disadvantage is that the dog must be under the control of a trained person at all times, and the dog must be cared for and exercised 365 days a year.

4.5.9.6 A dog will have little influence on birds that are flying over the aerodrome.

4.5.10 Radio-controlled model aircraft to repel birds

4.5.10.1 Radio-controlled (RC) model aircraft, which provide both visual and auditory stimuli, occasionally have been used to harass birds on aerodromes.

4.5.10.2 One advantage is that the RC aircraft is under the control of a person and can be directed precisely to herd the birds away from the aerodrome runway. A second advantage is that the RC aircraft can be deployed on an "as needed" basis with little maintenance needed between flights.

4.5.10.3 Some RC aircraft have been designed to mimic the appearance of a falcon and even to remotely fire pyrotechnics.

4.5.10.4 The disadvantage is that a trained person is required to operate the RC aircraft in an aerodrome environment.

4.5.10.5 Before using RC aircraft, ensure that the radio frequencies used are compatible with other radio uses in the airfield environment.

4.5.11 Nonlethal projectiles to repel birds

4.5.11.1 Paint balls and rubber or plastic projectiles, fired from paint-ball guns and 12-gauge shotguns, respectively, can be used to reinforce other dispersal techniques employed to repel birds.

4.5.11.2 With paint balls, a high-quality paint-ball gun should be used to provide sufficient accuracy and velocity (typically fired from 5 to 30 m from the bird).

4.5.11.3 There are several types of rubber or plastic projectiles (slugs, buck shot, pellets, beads) for use in a shotgun.

4.5.11.4 The proper distance from the bird for firing varies by projectile and species of bird. Personnel using these techniques need to be trained in firearm use and in the use of the particular projectiles being deployed.

4.5.11.5 The objective is to shoot from a sufficient distance so that the projectile induces temporary pain but no injury in the bird struck.

4.6 Wildlife removal techniques

4.6.1 Introduction

4.6.1.1 Habitat modification, exclusion, and repellent techniques are the first lines of action in any Wildlife Hazard Management Plan.

4.6.1.2 However, these actions will not solve every problem; therefore, hazardous wildlife sometimes must be removed from an aerodrome. Such removal can be accomplished by capturing and relocating or by killing the target animals.

4.6.1.3 Great care should be taken when intending to remove species protected under the Wild Life Protection Act. And guidance must be sought from NEPA where it is decided to remove wildlife from the aerodrome or its vicinity.

4.6.2 Capturing birds and mammals

4.6.2.1 The disposition of live-captured birds and mammals will depend on the legal, political, and social realities of each situation.

4.6.2.2 State wildlife agencies are increasingly restrictive about the relocation of captured wild animals, particularly for common species, because of disease concerns and the creation of additional wildlife problems at release sites.

4.6.2.3 When practical, euthanize unprotected birds, such as pigeons, using procedures recommended by NEPA.

4.6.2.4 Dispose of common mammals captured on aerodromes by following NEPA's guidance.

4.6.3 Chemical capture of birds

4.6.3.1 Alpha Chloralose (A-C) is an immobilizing agent for use in capturing waterfowl, coots, and pigeons.

4.6.3.2 Guidance must be sought from NEPA before A-C or any other chemical capturing agents may be used on wildlife.

4.6.3.3 A-C, incorporated into bread baits, is ideal for selectively capturing ducks, geese, and coots that can be hand-fed at urban ponds and parks.

4.6.3.4 Corn baits are recommended for pigeons or groups of waterfowl or coots that cannot be individually baited.

4.6.3.5 Birds ingesting a clinical dose of A-C can be captured in 30 to 90 minutes. Complete recovery normally occurs within 8 hours but can take up to 24 hours.

4.6.4 Live-trapping birds

4.6.4.1 The major advantage of live trapping is selectivity: any non-target birds can be released unharmed.

4.6.4.2 The major disadvantage is that live trapping is often labour intensive. Traps must be tended frequently to remove captured animals and, in the case of cage traps with decoy birds, to provide food and water.

4.6.4.3 Trapping is used on some aerodromes to remove raptors (predatory birds) in the aircraft operating area.

4.6.4.4 Bal-chatri, noose carpets, Swedish goshawk, or sliding padded pole traps are typically used.

4.6.4.5 Live trapping, using walk-in type traps on roofs or other isolated sites, can be used to remove pigeons at aerodromes. Euthanize captured pigeons following NEPA guidelines. If relocated, pigeons can fly long distances to return to the site of capture.

4.6.4.6 Net launchers use a blank rifle cartridge to propel a net. Fired from the shoulder much like a shotgun or rifle, net launchers can capture individual or small groups of problem birds that can be approached within about 15 m.

4.6.5 Chemical capture of mammals

4.6.5.1 Large mammals, such as deer, can be captured with tranquilizer guns, but this is generally not a practical or desirable option for aerodromes.

4.6.5.2 However, in those situations where the use of firearms is not safe or practical, the use of tranquilizer guns might be appropriate.

4.6.5.3 The use of tranquilizer guns requires personnel with a high degree of skill and experience. If used in an aerodrome environment, safeguards must be in place to ensure partially tranquilized deer do not enter runway areas.

4.6.6 Live-trapping mammals

4.6.6.1 Specialized drop-door traps, drop nets, or rocket net set-ups can be used to live-capture mammals.

4.6.6.2 Smaller box-type or basket live-traps can be used to capture medium-sized mammals, such as feral dogs. Leg-hold traps and snares can also be used.

4.6.6.3 Successful mammal trapping, especially with leg-hold traps and snares, requires a high degree of skill and experience. Once set, traps must be checked frequently (at least once every 12 hours).

4.6.6.4 Trappers must be knowledgeable in procedures for handling and euthanizing mammals.

4.6.6.5 Consult with NEPA on the use of certain types of traps and on euthanizing wildlife.

4.6.7 Killing birds and mammals

4.6.7.1 In general, killing of wildlife on an aerodrome is the last option deployed after habitat modification, exclusion techniques, and repellent actions have been implemented.

4.6.7.2 However, the management of a wildlife hazard situation on an aerodrome might require killing a particular animal or require that a local population of a problem species be reduced by lethal means until a long-term, nonlethal solution is.

4.6.7.3 In addition, lethal control of a few individuals is sometimes necessary to reinforce nonlethal frightening techniques. Some lethal control is usually necessary as part of an integrated Wildlife Hazard Management Plan for an aerodrome.

4.6.7.4 The following information must be developed to justify lethal control and to minimize adverse public reaction to a programme involving killing:

- Documentation that the wildlife species is an economic, safety, or health threat.
- Justification of why nonlethal options are not adequate to solve the problem.
- An assessment of the impact that the killing will have on local and regional populations of the species (i.e., is the level of killing planned likely to result in a significant reduction in numbers of the species at the local or regional level?).
- Assurance that the killing procedure is appropriate (i.e., safe, effective, and humane) and specific for the target wildlife species.
- Documentation of the effectiveness of the killing program in helping to solve the problem (e.g., reduction in bird strikes).
- Recommended steps to be taken, if any are feasible, to reduce the need for killing in the future.

4.6.8 Destroying eggs and nests

4.6.8.1 Do not allow birds to nest on aerodrome property.

4.6.8.2 Provided the correct permits are in place, destroy (break eggs and remove nest material) any nests with eggs found on an aerodrome. Egg addling (oiling, shaking, or puncturing), whereby the birds continue to incubate nonviable eggs, is not recommended for aerodromes. Egg addling encourages the nesting birds (and any nonbreeding birds associated with them) to stay on the aerodrome.

4.6.8.3 At the time of nest destruction, harass the adult birds from the aerodrome. Check the nesting area weekly for re-nesting until the end of the nesting season.

4.6.8.4 Where practical, install physical barriers, as discussed above, to prevent re-nesting.

4.6.8.5 Each situation will have to be addressed on a case-by-case basis, depending on the species of bird and level of threat posed, location from runways, bird movement patterns, and other factors.

4.6.9 Shooting birds

4.6.9.1 Pigeons using hangers, bridge girders, and other sites can be shot at night with an air rifle.

4.6.9.2 This night-time shooting is done quietly and discretely, with the objective being to disturb the birds as little as possible so that the maximum number can be removed.

4.6.9.3 Common birds, such as gulls and geese, in the AOA that are not responding to various repellent methods can be shot with a 12-gauge shotgun.

4.6.9.4 This shooting is done during daylight in the open so that other birds can witness the action.

4.6.9.5 Shooting a shotgun has several effects on a flock of birds. First, it reinforces other audio or visual repelling techniques. Second, the loud noise, coupled with the death of one or more of the flock members, can frighten the rest of the flock away. Third, the target birds are permanently removed.

4.6.9.6 Four cardinal rules apply when using shooting as a control method at aerodromes:

- Use only personnel who are trained in the use of firearms and who have an excellent knowledge of wildlife identification.
- Use the proper gun and ammunition for the situation.
- Have necessary permits in place, and keep accurate records of birds killed by species and date.
- Notify aerodrome security, air traffic control, and, if appropriate, the local law enforcement authority before instituting a shooting program. Local ordinances against the discharge of firearms within certain distances of buildings, or within the city limits, may need to be waived.

4.6.10 Shooting mammals

4.6.10.1 If fencing is inadequate to keep deer or other large mammals off an aerodrome or if such wildlife has gotten inside the aerodrome's fence, shooting is the best procedure for removal.

4.6.10.2 Feral dogs may also be shot if all other methods of wildlife management have failed to adequately address the hazard posed.

4.6.10.3 Because of inherent safety considerations and to ensure safe and efficient removal, shooting on aerodromes must be by professional sharpshooters, using non-ricocheting bullets in rifles equipped with night-vision scopes and noise suppressers.

4.6.10.4 Elevated shooting stands can be erected on the ground or on a truck bed to direct shots toward the ground. Shooting of mammals on aerodromes must be coordinated through NEPA.

4.6.11 Toxicants for mammals

4.6.11.1 Small rodent populations (e.g., mice) might erupt in grassy and brushy areas or around construction debris on aerodromes, attracting raptors and creating a hazard to aviation. In general, control rodent populations by habitat management (mowing, sanitation, clean-up of brushy areas and piles of debris).

4.6.11.2 However, there might be situations where the use of a rodenticide is appropriate to reduce rodent populations in airside vegetation.

4.6.11.3 The control of commensal rodents in aerodrome terminal buildings and other facilities will not be discussed here because these jobs are usually handled by private pest control operators.

4.6.11.4 Care must be taken to minimize non-target bird and mammal exposure with broadcast and hand-placed baits.

4.6.11.5 Guidance must be sought from the Pesticides Control Authority (PCA) and NEPA.

4.6.12 Fumigants for mammals

4.6.12.1 Burrowing rodents on aerodromes can be killed by fumigation of burrows with either gas cartridges or aluminium phosphide tablets.

4.6.12.2 Gas cartridges, ignited from a burning fuse after placement in the burrow, generate carbon monoxide.

4.6.12.3 Aluminium phosphide pellets react with moisture in the burrow to produce phosphine gas.

4.6.12.4 Care must be taken to plug all burrow entrances with sod after placement of the cartridge or pellets in the burrow.

4.6.12.5 As with all pesticide use, it is critical to ensure that national wildlife protection laws are adhered to.

4.6.12.6 Guidance must be sought from the PCA and NEPA before deploying fumigants..

4.6.13 Lethal traps for mammals

4.6.13.1 Body gripping traps and neck snares can be used to remove medium-sized mammals that create problems on aerodromes.

4.6.13.2 The use of these lethal traps requires a high degree of skill and experience to selectively capture the target animal.

4.6.13.3 Once set, traps must be checked frequently (at least once every 12 hours) to euthanize any animals that might be captured but not killed.

4.6.13.4 Trappers must be knowledgeable in procedures for handling and euthanizing captured mammals.

4.6.13.5 Operators must consult with NEPA before deploying lethal traps.

4.7 Training

4.7.1 Introduction

4.7.1.1 Once an assessment of hazards has been completed and a Wildlife Hazard Management Plan has been developed, the plan must be implemented by well-trained and knowledgeable individuals if it is to be successful in reducing wildlife strikes and accepted by the public.

4.7.1.2 Depending on the size of an aerodrome and the level of wildlife hazard, the Wildlife Hazard Management Plan may be implemented by a single aerodrome employee undertaking wildlife control activities on an occasional "as needed" basis or by a full-time wildlife biologist with a staff of operations personnel providing continuous patrols.

4.7.1.3 Some of the personnel involved in these control activities, hereafter referred to as wildlife control personnel (WCP), might not have formal education in wildlife biology. All WCP must have sufficient training to be knowledgeable in the basic principles of wildlife management and in the identification, behaviour, general life history, and legal status of the hazardous species in the area.

4.7.1.4 WCP also must be trained in the proper implementation or deployment of various control strategies and techniques outlined in the Wildlife Hazard Management Plan.

4.7.1.5 Finally, an awareness of endangered and threatened wildlife species that might visit or reside on the aerodrome is critical.

4.7.1.6 The following areas of training and levels of skill are suggested for WCP implementing control activities on aerodromes under a Wildlife Hazard Management Plan.

4.7.1.7 It is emphasized that, once a plan is in place, in addition to the training provided to WCP, there must be periodic oversight and review of the plan and its implementation by a professional biologist trained in wildlife damage control

4.7.1.8 As emphasized in Chapter 4, a major problem in the use of repellent techniques or devices is habituation of the wildlife species to the threats. These techniques all require training for their proper deployment.

4.7.2 Bird identification

4.7.2.1 All species have unique vocalizations, behaviours, and habitat preferences that are useful in field identification.

4.7.2.2 Thus, to become an expert in field identification of all bird species at a location requires many years of training and practice.

4.7.2.3 WCP require basic training so they can identify, in all plumages, commonly seen hazardous birds, as well as those rarer species that are considered hazardous when present or are of concern because of endangered- or threatened-species status.

4.7.2.4 Binoculars are essential for detailed, close-up observations sometimes necessary for identification as well as for the detection and identification of birds or other wildlife at a distance. Provide WCP with a quality pair of binoculars, and train WCP in their use.

4.7.2.5 Equip each WCP with his or her own bird identification field guide, to be carried in the vehicle while on patrol. As a learning aid, encourage WCP to make annotations in their field guides regarding behaviour or appearance next to identified birds.

4.7.2.6 There are also a number of excellent field guides available from bookstores

4.7.3 Mammal Identification

4.7.3.1 Unlike birds, there are typically only a few mammal species of importance on an aerodrome.

4.7.3.2 Train WCP to identify, not only by sight but also by sign (e.g., tracks, burrows, and faecal material), the common large and mid-sized mammals that live around the aerodrome.

4.7.3.3 Train WCP to identify signs (e.g., trails in grass, burrows) indicative of a population eruption of field rodents, such as mice or rats.

4.7.3.4 A survey by a biologist using snap traps might be necessary to identify the species and relative abundance of rodents occupying various aerodrome habitats. In addition, rodent species can be identified by examination of skull remains in pellets (boluses) regurgitated by raptors. These pellets are often found on the ground beneath perching sites used by raptors.

4.7.3.5 In addition to learning to identify the hazardous birds and mammals on the aerodrome, WCP should have some understanding of the biology and behaviour of these species. This information will make the job of wildlife hazard management more interesting and be useful in anticipating problems and deploying control measures more effectively.

4.7.3.6 For each species of bird, it is important to know if it is present year round or only in summer, in winter, or during migration.

4.7.3.7 For example, in which habitats and at what time of year do locally breeding bird species nest and when are young fledged from nests? What are the daily movement patterns between roosting, feeding and loafing areas in relation to the aerodrome? What are the feeding behaviours and food preferences of each species on the aerodrome? Which habitats does each species prefer? How does weather influence the presence and behaviour of various species on the aerodrome? How does each species react to approaching aircraft and to various repellent devices?

4.7.3.8 By being observant and noting the behaviour of these hazardous species, useful insights can be gained that will lead to more effective habitat management or repellent strategies.

4.7.4 Wildlife and environmental laws and regulations

4.7.4.1 All WCP should have a basic understanding of national wildlife legislation.

4.7.4.2 WCP involved in taking any wildlife species must have a clear understanding of which species have no legal protection and, for all others, the species and numbers allowed to be taken under permits issued.

4.7.4.3 Permits also will list the methods of removal allowed and acceptable procedures for disposing of removed wildlife.

4.7.4.4 Detailed records must be maintained of wildlife taken under permit.

4.7.5 Wildlife control techniques

Firearms.

4.7.5.1 It is critical that only personnel trained in the use of firearms, authorized by the relevant authorities, and knowledgeable in field identification of the target and similar-looking non-target species are allowed to use firearms on the aerodrome.

4.7.5.2 Skill, experience, and the proper equipment are needed to be safe and to maximize the effectiveness of a shooting program, whether it is to remove specific problem animals or to kill one or more individuals to reinforce repellent techniques.

4.7.5.3 All discharged shell casings are potential Foreign Object Debris (FOD) and must be picked up.

Pyrotechnics.

4.7.5.4 Pyrotechnics can cause injury or damage if discharged incorrectly or carelessly. For example, serious injuries have occurred when pyrotechnics were accidentally discharged inside vehicles. Proper equipment (safety glasses, ear protection) and training is essential for safe use of pyrotechnics.

4.7.5.5 In addition, training is needed to deploy the correct pyrotechnic for each situation and wildlife species and to minimize habituation.

4.7.5.6 It is critical that pyrotechnics (and other repellent devices) not be deployed in situations where the birds or mammals might be flushed into the path of departing or arriving aircraft.

Pesticide application.

4.7.5.7 WCP applying restricted-use pesticides, applying pesticides for hire, or applying pesticides to the land of another must be Certified Applicators or working under the direct supervision of a Certified Applicator and then may only use pesticides covered by the Certified Applicator's certification.

4.7.5.8 Proper application equipment and safety clothing must be used. Detailed records of pesticide applications must be maintained.

4.7.6 Record Keeping

4.7.6.1 A key component of a Wildlife Hazard Management Plan is developing a system to

(a) document the daily activities of WCP;

(b) log information about wildlife numbers and behaviour on the aerodrome; and

(c) record all wildlife strikes with aircraft.

4.7.6.2 This information is essential to document the effort being made by the aerodrome in reducing wildlife hazards. The information is also extremely useful during periodic evaluations of the Wildlife Hazard Management Plan and when revisions to the plan are proposed.

4.7.6.3 Instruct WCP on the importance of record keeping and train them to record this information in a standardized format.

4.7.6.4 Chapter 5 provides more details about record keeping and wildlife strike reporting.

Chapter 5 Evaluating the Wildlife Hazard Management Programme

5.1 Introduction

5.1.1 Wildlife populations on and in the vicinity of aerodromes are constantly changing in response to changes in land use and other environmental factors.

5.1.2 In addition, wildlife might adapt or habituate to control strategies that were once effective, or they might develop new behavioural or feeding patterns on or near the aerodrome.

5.1.3 New wildlife control technologies might become available, or established products or techniques might be withdrawn or banned.

5.1.4 Finally, there might be changes in wildlife control and management personnel at an aerodrome.

5.1.5 Once a Wildlife Hazard Management Plan is in place, develop a process to evaluate the plan at least annually.

5.2 Reporting

5.2.1 The importance of accurate monitoring and record keeping cannot be overemphasized. Without consistently maintained records of wildlife activity, wildlife strikes, and wildlife management actions, the proper evaluation of a program is impossible. Without evaluation, no assessment of the effectiveness of a program can be made.

5.2.2 Furthermore, without accurate records and proper evaluation, it might be difficult to justify and defend certain management actions, such as wildlife removal, or to defend the aerodrome during litigation in the aftermath of a damaging wildlife strike.

5.2.3 Maintain a daily log of wildlife activity and management actions; important factors to record include:

(a) Date, time, and location on aerodrome where wildlife is observed;

(b) Species of wildlife and approximate numbers; and

(c) Control actions taken and response of wildlife.

5.2.4 Record this information on a standard form that can be used by wildlife control personnel at the site where the activity takes place. If a form is not available, record the information in a log book kept at the operations base.

5.2.5 The use of a standardized form or recording format is strongly recommended. The information recorded will be most useful if it is summarized into monthly and annual statistics (see below). Use of a standardized format allows this summarization to be easily done.

5.2.6 The use of computerized database systems customized to provide summaries of wildlife control activities is recommended.

5.2.7 Maintaining a consistent record of wildlife strikes is essential for defining the wildlife hazard level for an aerodrome and for evaluating the aerodrome's Wildlife Hazard Management Plan.

5.2.8 In addition to maintaining these strike records for internal use at the aerodrome, submit strike reports to the JCAA. The JCAA will incorporate the information into its Wildlife Occurrence Database and forward same to IBIS.

5.2.9 In addition to maintaining a daily log of wildlife control activities and wildlife strikes, it is important to keep records of other preventative management actions that might not be part of the daily routine of wildlife control.

5.2.10 Examples of such actions might be installing or repairing fencing, thinning trees, clearing construction debris, applying pesticides or repellents, conducting grass-height management, installing netting in hangers or wires over ponds, and regrading pavement or grass areas to eliminate standing water.

5.2.11 In addition, activities such as writing letters to catering services about proper storage of food waste are also important management actions. Documenting these activities in some type of summary file or table can aid in determining the total cost and effectiveness of the wildlife control program.

5.2.12 Periodically summarize information from the Daily Wildlife Control Activities log and from wildlife strikes records to provide baseline data for analysing and evaluating the wildlife control program.

5.2.13 A logical approach is to conduct monthly summaries that are then incorporated into an annual report. These summaries do not need to be complex but must reflect the level of activity for the common control techniques deployed.

5.2.14 For example, monthly summaries of pyrotechnics fired, runway sweeps to clear birds, distress call deployments, birds and mammals removed by species, and wildlife strikes by species would be useful. Prepare a short paragraph outlining other significant activities during the month, such as repairing a fence, meetings with aerodrome tenants about wildlife issues (e.g., feeding birds in taxi stand area), or regrading an area to remove standing water.

5.2.15 Prepare an annual report by combining data from the monthly reports. There must be an objective, numerical documentation of wildlife control methods deployed and wildlife strikes occurring on the aerodrome. The use of a computer database program can be extremely helpful in producing these summary reports.

5.2.16 Maintain and annually summarize a record of all training that wildlife control personnel have received. Include attendance at conferences, courses and workshops (e.g., firearms safety), self-study courses, and specialized on-the-job training.

5.3 Review

5.3.1 Periodic evaluations of an aerodrome's Wildlife Hazard Management Plan and the activities undertaken to implement the plan are critical because of the dynamic nature of wildlife hazards and control technologies.

5.3.2 The foundation for these evaluations is the maintenance of consistent records of wildlife control activities and wildlife strikes. The use of standardized formats for keeping these records permits easy compilation of events and activities into monthly and annual statistical and narrative summaries.

5.3.3 Once these summaries are available, objective examinations and comparisons can be made of trends in strikes, wildlife activities, control methods deployed, and other factors.

5.3.4 An example of an objective, standardized format for assessing a Wildlife Hazard Management Plan and its implementation is presented in Appendix B. This format allows an outside biologist or evaluation group to systematically review the actions being taken and make recommendations in areas where improvement is needed. The availability of summary statistics is essential for this assessment.

5.3.5 Finally, the establishment of a Wildlife Hazards Working Group (WHWG) provides an excellent means of improving communication, coordination, and cooperation among the diverse groups involved in wildlife hazard management on an aerodrome.

5.3.6 The WHWG also can provide an important forum for reviewing, evaluating, and improving an aerodrome's wildlife hazard management program.

5.4 Wildlife Hazards Working Group (WHWG)

5.4.1 Wildlife hazard management on an aerodrome often requires communication, cooperation, and coordination among various groups on the aerodrome and with various government agencies and private entities. For many aerodromes, the establishment of a WHWG will greatly facilitate this communication, cooperation, and coordination.

5.4.2 Include a representative from each of the key groups and agencies that have a significant involvement or interest in wildlife issues on the aerodrome in the WHWG. Aerodrome groups might include representatives from security, maintenance, operations, and air traffic control. Include representatives from any facility near the aerodrome that significantly attracts wildlife (such as a landfill or wildlife refuge).

5.4.3 In general, do not exceed 10 people in the core WHWG. This will keep meetings from becoming unwieldy. In addition to regular members, invite people with specialized knowledge, interest, or concerns to the meetings as appropriate.

5.4.4 Typically, someone from aerodrome management chairs the WHWG. The chair can be rotated among various aerodrome departments.

5.4.5 Hold a meeting of the WHWG at least annually to conduct a general review of the overall wildlife hazard management program for the aerodrome and to discuss special issues or problems as needed.

5.4.6 Include the following in the general discussion:

(a) Strike trends and significant strike events.

(b) Source of wildlife causing strike problems.

(c) Wildlife control activities.

(d) Wildlife Hazard Management Plan evaluation.

5.4.7 Special issues to be discussed might include projected impacts of land-use changes on or near the aerodrome, trends in populations or behaviour of various species of wildlife, wildlife removal permits, evaluation of new wildlife control technologies, and clarification of roles and responsibilities.

5.4.8 Special meetings of the entire WHWG or a subgroup might be needed after significant strike events or other developments affecting wildlife hazards if a regular meeting is not scheduled for the near future.

Appendix A

Jamaica Civil Aviation Authority

Wildlife Incident Reporting Form

Date (DD/MM/YY) (UTC):	Time (UTC):	Location (Nearest reference point if en route):	
Operator:	A/C Make/Model:	Engine Make/Model:	A/C Registration:
Runway:	Flight Phase:	Altitude:	Speed (KIAS):
Sky Condition:		Precipitation:	
Part(s) of A/C struck:			
Effect on Flight:			
Wildlife Species and Size:		Number Seen:	Number Struck:
Remarks (Describe damage, injuries, and other pertinent information):			
Reported by (Name and Title):		Report Date (DD/MM/YY) (Local):	
Reportable wildlife incidents include all collisions between aircraft and wildlife, as well as incursions by wildlife which have an adverse effect on any aircraft operating.			

Appendix B

This appendix describes a system for objectively assessing the implementation of wildlife hazard management plans at aerodromes. Five assessment categories, each with a list of elements to be evaluated, are used to indicate how well airport wildlife hazard management plans are being implemented.

Category 1: Management functions related to wildlife hazards on or in the vicinity of the aerodrome.

Category 2: Bird control on or in the vicinity of the aerodrome.

Category 3: Mammal control on or in the vicinity of the aerodrome.

Category 4: Management of habitat and food sources on aerodrome property related to wildlife hazards.

Category 5: Land uses and food sources off of airport potentially related to wildlife hazards on airport.

The elements described in Categories 1-4 are assessed as to the degree that management programs are being implemented. The elements in Category 5 are rated as to the degree of hazard posed. Elements within each category are not intended to cover every possibility – they can be modified or expanded to meet situations unique to an airport.

During an assessment, each element in Categories 1-4 is examined and classified as one of the following:

S = Satisfactory. If an assessor finds that an airport has initiated action to reduce wildlife hazard according to plan and is on schedule, the action would be considered "satisfactory".

U = Unsatisfactory. If no measures have been taken or inappropriate measures taken, the assessment would be "unsatisfactory".

NI = Needs improvement. If implementation of a control measure is behind schedule or only partially accomplished, the assessment would be either "needs improvement", or "unsatisfactory", depending on the seriousness of the hazard.

NA = Not applicable. If it is apparent that certain listed techniques or items are not applicable to the airport, the assessment would be "not applicable".

If an assessment is either "NI" or "U", a comment by an assessor is required on the Assessment Summary Form (last page).

Elements in category 5 are scored on a scale from 0 to 3 where:

0 = not present;

1 = present but no wildlife problems noted or anticipated;

2 = site attracts some hazardous wildlife creating possible or potential problem, site should be monitored; and

3 = site creates significant wildlife hazard for airport, action should be taken.

Aerodrome	Date	Assessment Page 1 of 6
CATEGORY 1: Management functions related to wildlife hazards on or in the vicinity of the aerodrome.		

Code	Items	Assessment			
		S	NI	U	NA
1.1	Acquiring wildlife control permits from government agencies				
1.2	Arranging for wildlife hazard assessments and other studies, as needed, to evaluate hazard potential of wildlife attracted by habitats, land uses, and food sources on or in vicinity of airport.				
1.3	Developing Wildlife Hazard Management Plan based on Wildlife Hazard Assessment and other studies and factors.				
1.4	Defining and delegating authority and responsibility for Wildlife Hazard Management Plan.				
1.5	Supervising, implementing, and coordinating airport Wildlife Hazard Management Plan.				
1.6	Evaluating Wildlife Hazard Management Plan at least once/yr.				
1.7	Training personnel responsible for implementing airport Wildlife Hazard Management Plan, especially field personnel.				
1.8	Operating wildlife patrol system with a trained field staff, conducting surveillance/inspections of critical airport areas, and effecting wildlife control when needed or requested.				
1.9	Establishing a communication capability between wildlife control and ATC personnel.				
1.10	Maintaining a system for warning pilots about wildlife hazards (e.g., NOTAMS, ATC, Radar observations).				
1.11	Ensuring that airport habitats are managed to reduce or eliminate wildlife attractions.				
1.12	Ensuring that airport policy prohibits feeding of wildlife and exposure of food wastes.				
1.13	Interacting with local jurisdictions and landowners about zoning, land use, and the resolution of wildlife hazard problems in vicinity of airport.				
1.14	Maintaining log book with daily record of wildlife control activities, wildlife activity, and reported wildlife strikes and wildlife remains found on runways identified by species.				
1.15	Reporting all wildlife strikes to the JCAA.				

Aerodrome	Date	Assessment Page 2 of 6
CATEGORY 2: Bird control on or in the vicinity of the airport.		

Code	Items	Assessment			
		S	NI	U	NA
Disperse, deter, exclude, repel					
2.1	Bird patrols in vehicle				
2.2	Bioacoustics (distress calls)				
2.3	Electronically generated noise				
2.4	Propane cannons				
2.5	Pyrotechnics				
2.6	Shooting to scare				
2.7	Netting hanger rafters, ponds etc.				
2.8	Perching deterrents (e.g., stainless steel needles)				
2.9	Overhead wires for ponds, ditches, roofs etc.				
2.10	Chemical repellents				
2.11	Falconry				
2.12	Dogs				
2.13	Radio-controlled aircraft				
2.14	Thinning or eliminating roosting trees and shrubs				
2.15	Grass management				
2.16	Scarecrows				
2.17	Dead bird effigies				
Remove					
2.18	Chemical capture				
2.19	Nest and egg destruction				
2.20	Poisoning				
2.21	Predators to remove eggs				
2.22	Shooting				
2.23	Trapping and relocation				

Aerodrome	Date	Assessment Page 3 of 6
CATEGORY 3: Mammal control on or in the vicinity of the airport.		

Code	Items	Assessment			
		S	NI	U	NA
Disperse, deter, exclude, repel					
3.1	Cattle guards				
3.2	Fencing				
3.3	Vehicle patrols				
3.4	Propane cannons				
3.5	Pyrotechnics				
3.6	Rodent-resistant sheathing on electrical cables				
Remove					
3.7	Controlled hunting				
3.8	Den destruction				
3.9	Fumigation				
3.10	Kill trapping				
3.11	Live trapping and relocation or euthanasia				
3.12	Rodenticides				
3.13	Shooting				

Aerodrome	Date	Assessment Page 4 of 6
CATEGORY 4: Management of habitat and food sources on airport property related to wildlife hazards.		

Code	Items	Assessment			
		S	NI	U	NA
Agriculture/vegetation management					
4.1	Agricultural crops				
4.2	Ploughing, mowing, harvesting				
4.3	Landscaping				
4.4	Brush, shrubs, wood lots				
4.5	Misc. nesting sites (e.g., trees)				
Waste management/sanitation					
4.6	Feeding birds and mammals				
4.7	Food waste storage				
4.8	Garbage dumps				
4.9	Litter				
4.10	Sewage treatment ponds/lagoons/outfalls				
4.11	Weeds, construction debris, junk yards				
4.12	Animal carcasses				
Water sources					
4.13	Aquatic vegetation				
4.14	Canals, ditches, creeks, waterways				
4.15	Low areas on pavement/ground that collect water				
4.16	Retention ponds				
4.17	Water fountains				
Miscellaneous attractants					
4.18	Earthworms along runways				
4.19	Insects hatches from vegetation or soil				
4.20	Seed-producing vegetation.				
4.21	Flat roofs				
4.22	Structures				

Aerodrome	Date	Assessment Page 5 of 6
CATEGORY 5: Land uses and food sources off airport potentially related to wildlife hazards on airport.		

Code	Items	Score	Comments
Agricultural			
5.1	Agricultural crops		
5.2	Aquaculture facilities		
5.3	Livestock feedlots		
5.4	Grain storage or grain mills		
Commercial/recreational land uses			
5.5	Drive-in theatres, amusement parks etc.		
5.6	Restaurants		
5.7	Picnic areas, parks		
5.8	Marinas		
5.9	Golf courses		
5.10	Flat roofs		
Waste management			
5.11	Garbage barges		
5.12	Garbage dumps		
5.13	Garbage transfer stations		
5.14	Fish processing plants		
5.15	Sewage lagoons, outfalls		
Water sources			
5.16	Retention ponds		
5.17	Canals, creeks, ditches		
5.18	Reservoirs, lakes, natural ponds		
Nesting/loafing/feeding areas			
5.19	Wildlife refuges/nature preserves		
5.20	Misc. nesting sites		
5.21	Roosting trees		
5.22	Marshes, swamps, mud flats		

Aerodrome	Date	Assessment Page 6 of 6
SUMMARY FORM (Wildlife Hazard Assessment): Comments are required for all elements in Categories 1-4 assessed as "Unsatisfactory" or as "Needs Improvement" or with a score of 2 or 3 in Category 5.		

Manager or wildlife supervisor:	Phone:
	Fax:
	Email:
Assessor:	Phone:
	Fax:
	Email:

Assessor's comments for elements rated "unsatisfactory" or "needs improvement" in Categories 1-4 or for elements scored 2 or 3 in Category 5.

Element code	Assessment code	Comments

Assessor's general comments:
