THE HASHEMITE KINGDOME OF JORDAN

CIVIL AVIATION REGULATORY COMISSION

Guidance Material

Wildlife Control and Reduction

Issued On the Authority of the Chief Commissioner/CEO of the Civil Aviation Regulatory Commission

Amendment (1)

September , 2018

DOCUMENT APPROVAL

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AMENDMENTS

AMENDMENTS RECORD SHEET

Amendment		Number of Pages	Date Entered	Entered By
Number	Date			
1	Sep 2018	All.	20/9/2018	Hadeel Al-Awaysheh

Table Of Contents

FOREWORD

The prime purpose of this Guidance Material is to provide airport operators with the information necessary to develop and implement an effective bird/wildlife control organization management plan for their aerodrome. Because the risk of bird/wildlife strikes is different at each site, the management will also be different. The seriousness of a bird/wildlife hazard problem is affected by geographic location, attractiveness of the site to birds/wildlife, and air traffic density. This guidance material outlines organizational structures that will effectively deal with the problem of bird/wildlife control.

Birds and wildlife are a serious hazard to aircraft, and this Guidance Material attempts to outline what can and should be done to overcome this hazard. It is not the purpose of this Guidance Material to discuss the relative importance of various hazards but to stress the importance of good organization and planning in the creation of a successful bird/wildlife control program.

REFERENCES

- Aerodrome Design and Operations — JCAR Part (139).
- Aerodrome Service Manual (ICAO Doc 9137) Part-3.

CHAPTER 1

ROLES AND RESPONSIBILITIES WITHIN A BIRD/WILDLIFE STRIKE CONTROL PROGRAM

1.1 GENERAL

As part of aerodrome certification process, aerodrome operators are required to develop an aerodrome manual which includes information on the aerodrome site, facilities, services, equipment, operating procedures and management, including a safety management system.

1.2 ROLE OF THE AIRPORT OPERATOR

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

b) Airport operators, where practicable, should implement a program tailored to local conditions, with assistance from other outside agencies, as required

c) Where practicable, the airport operator should appoint an airport bird/wildlife control coordinator who is responsible and accountable for the airport's bird/wildlife hazard control policy and the personnel engaged in bird/wildlife hazard control. This may include the formation of a local airport bird/wildlife committee that will develop and implement the specific program. It is imperative that personnel responsible for these tasks are able to demonstrate competence, are trained by qualified personnel and are provided with the appropriate resources and equipment to carry out their tasks . (For more details see appendix A)

1.3 ROLE OF THE AIRPORT BIRD/WILDLIFE STRIKE COMMITTEE AND THE AIRPORT BIRD/WILDLIFE STRIKE CONTROL COORDINATOR

a) The airport bird/wildlife strike committee should include those involved in bird/wildlife control, airport planning, maintenance and operations. It should also include air traffic services, flight operators, rescue and firefighting services, security, duty managers, finance, etc. The committee should review strike data

collected and observations of birds/wildlife, assess bird/wildlife risks and summarize trends in order to evaluate and determine what effective control measures should be implemented in order to manage the issues arising.

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

1.4 THE IMPORTANCE OF REPORTING

a) An effective bird/wildlife control program depends upon accurate and reliable reporting. Data may come from sightings, maintenance reports, strike reports and control activities. Reporting must involve pilots and aircraft operators primarily, plus airport ground operations staff, ATC and other aviation stakeholders (e.g. aircraft maintenance organizations). Reviewing and analyzing this data will help identify problems at the airport and indicate the effectiveness of current bird/wildlife strike prevention methods.

b) It is recommended that the bird/wildlife strike reporting procedure should ideally 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 airport personnel and described in the aerodrome manual or associated airport wildlife hazard policy document. All strike reports should be directed to the bird/wildlife strike control coordinator who should forward them to the CARC. However, local operating procedures may differ and such procedures should be clearly set out in the local bird/wildlife management documents and working instructions as appropriate.

c) Accurate and reliable record keeping and a comprehensive reporting procedure provided in an effective bird/wildlife management manual may assist the airport with claims of liability in the event of an aircraft incident resulting from a bird/wildlife strike. Accurate, reliable and internally audited record keeping and reporting can be used to demonstrate that an effective bird/wildlife control program

is in place and that airport management is aware of and takes action to reduce the number of strikes at and, where practicable, in the vicinity of the airport.

d) Airport operators are required to assess the bird/wildlife strike hazard on, and in the vicinity of its aerodrome through the implementation of a national procedure for recording and reporting bird/wildlife strikes to aircraft and the collection of information on the presence of birds/wildlife in the vicinity of the aerodrome which constitute a potential hazard to aircraft operations. Also airport operators are required to fill and forward bird/wildlife strike reports to CARC Using the published Bird Strike reporting form on CARC website shown in Figures 2-1 below.

BIRD/OTHER WILDLIFE STRIKE REPORT

1. Name Of Operator	2. Aircraft Make/Model	3. Engine Make/Model
4. Aircraft Registration	5.Date Of Incident dd/mm/yyyy	6. Local Time Of Incident Dawn Dusk HR MN Day Night AM PM
7. Airport Name	8. Runway Used	9. Location If En Route(Nearest town/reference and governorate)
10.Height (AGL)	11. Speed	

12. Phase Of Flight

- A. Parked
- B. Taxi
- C. Take-off Run
- D. Climp
- E. En Route
- F. Descent
- G. Approach
- H. Landing Roll

13. Part(s) of Aircraft Struck or Damaged

	Struck	Damaged		Struck	Damaged
A. Radome			H. Propellier		
B. Windshield			I. Wing/Rotor		
C. Nose			J. Fuselage		
D. Engin No 1			K. Landing Gear		
E. Engin No 2			L. Tail		
F. Engin No 3			M. Lights		
G. Engin No 4			N. Other		

14. Effect of Flight	15. Sky Condition	16. Precipitation
None Aborted Take-Off Precautionary Landing Engines Shut Down Other:(Specify)	No Clouds Some Clouds Overcast	Fog Rain Snow None

17. Bird/Other Wildlife Species	18. Number of Birds/Other Wildlife seen and/or struck			19. Size of Bird/Other Wildlife Strike seen and/or struck
	Number	Seen	Struck	Small Medium Large
	1			
	2 - 10			
	11 - 100			
	more than 100			

20. Pilot warned of Birds/Other Wildlife Strike yes No

21. Remarks(Describe damage,injuries and other pertinent information)

DAMAGE / COST INFORMATION

22. Aircraft time out of service(hours)	23.Estimated cost of repais or replacement(JD)	24. Estimated other costs(JD) (e.g. loss of revenue, fule, hotels):
Reported by (Optional)	Title	Date dd/mm/yyyy

CARC Form DOASS-6

Provide your email if you want to receive a copy of this report:

Send

Figure 2-1. Bird Strike Reporting Form

CHAPTER 2

ORGANIZATION OF AN AIRPORT BIRD/WILDLIFE STRIKE CONTROL PROGRAM

2.1 GENERAL

An airport should implement a bird/wildlife strike prevention program in order to reduce the risks presented by birds and wildlife at the airport and in its vicinity. The scale and details of this program will vary from airport to airport, but all programs should contain basic information as described below.

2.2 CONTROL PROGRAM

A bird/wildlife strike control program should describe the following elements:

a) Assignment of personnel:

i) a manager who is accountable for developing and implementing the bird/wildlife strikes prevention program.

ii) a coordinator who should oversee the daily activities and analyses the collected data and carry out risk assessments in order to develop and implement the bird/wildlife strike prevention program.

iii) trained and competent staff who should detect and record the presence of bird/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 snarge or an unidentifiable carcass following a strike should also be described in the control program;

b) a process to report, collect and record data on struck and living birds/wildlife;

c) a process to analyze the data and assess the bird/wildlife hazard in order to develop mitigation, proactive and reactive measures. This should include a risk assessment methodology;

d) a process of habitat and land management both on the airport and in its vicinity in order to reduce the attractiveness of the area to birds/wildlife. Where applicable and relevant, this

should include effective grass management techniques and, where applicable, a long/tall grass policy for "on-airfield" areas;

e) a process to expel or remove hazardous birds/wildlife, including by lethal means where appropriate;

f) a process for liaison with non-airport agencies and local landowners, etc., to ensure the airport operator is aware of developments that may contribute to creating additional bird hazards in the infrastructure, vegetation, land use and activities in the airport vicinity (crop harvesting, seed planting, ploughing, establishment of land or water features, hunting, etc., that might attract birds/wildlife); and

g) a process to have regular meetings with all stakeholders of the airport's bird/wildlife strike prevention committee.

2.3 COLLECTING, REPORTING AND RECORDING DATA ON BIRD/WILDLIFE STRIKES AND OBSERVED BIRDS/WILDLIFE

2.3.1 Bird/wildlife detection is necessary and this is best done using mobile patrols with trained, competent and well-equipped staff who are dedicated to the task. Portable equipment is less prone to habituation and should be chosen to deal with the species being targeted.

2.3.2 A record of all wildlife activity or "bird/wildlife log" should be maintained. The log should detail the number, species and location of birds/wildlife seen. It should also contain the action taken to disperse birds/wildlife and the results of this action. The log should be completed at least every 4 hours during daylight hours and then analyzed to identify which species represent a hazard at which times of the day or year, or under which weather conditions, etc. This, combined with strike records, will provide the basis for predicting when certain species may be present to cause a problem. In general, airports will be well served by documenting all activities that are undertaken to reduce the presence of birds/wildlife.

2.3.3 All bird/wildlife strikes must be reported to the airport. It should be a requirement for all staff to report bird/wildlife strikes because it is only by full reporting that an accurate assessment of the real risk is possible. Overall risk does not necessarily stem from the pure total of bird/wildlife strikes. The risk is clearly greater if large flocking birds or large terrestrial mammals are involved than compared with small individual birds. Airport staff should record all details in a consistent manner and airline and other staff should also be encouraged to report all details.

2.4 RISK ASSESSMENT

With a good set of bird/wildlife strike data the airport should conduct a risk assessment using strike data for each species and update these regularly. This will assist in prioritizing efforts and directing

them to the highest risks. A risk assessment should take into account the numbers struck for each species and the severity of damage arising from those strikes. Action should clearly be targeted on those species which occur with the highest frequency and create the greatest damage.

2.5 MANAGEMENT OF INFRASTRUCTURE, VEGETATION AND LAND USE

2.5.1 Airports should systematically review features on, and in the vicinity of, the airport that attract birds/wildlife. A management plan should be developed to reduce the attractiveness of these features and to decrease the number of hazardous birds/wildlife present or to deny them physical access to these areas.

2.5.2 Airport development should be designed such that it will not be attractive to hazardous birds/wildlife and no attraction will be created during construction. This may include denying resting, roosting and feeding opportunities for hazardous birds/wildlife.

2.5.3 A complete perimeter fence of adequate height is the prime method of preventing hazardous wildlife, other than birds, from gaining access to the airfield areas. Fences and gates should be left closed and regularly checked. No food sources should be available to animals on the airport.

2.5.4 Vegetation composition (grass) should be kept at a height that is considered unattractive to hazardous birds/wildlife, while accepting that this may not be applicable in arid locations. The attractiveness of vegetation is a balance between food presence, food accessibility and protection against predators:

a) earthworms, insects, rodents and other animals are present in and on the soil and in the vegetation. The vegetation itself and its seed are food for plant and seed eaters;

b) food accessibility depends on vegetation height and density. Long, dense vegetation will inhibit most hazardous birds/wildlife from moving around, detecting and accessing the food;

c) birds/wildlife safeguard themselves from predators by hiding and/or fleeing. Long, dense vegetation is preferred as a hiding place by agoraphobian species. These species avoid the open space of the runway and short vegetation. On the other hand, claustrophobic species avoid long, dense vegetation and prefer to stay in the open space of the runway and short vegetation where they have a wide view to see predators well in advance to enable them to flee on time; and

d) birds/wildlife feeding on seeds will avoid the airport if its vegetation is mowed during the flowering season. When these flowers attract insects that are attracting aerial feeders (for example swallows, swifts and bee-eaters), the vegetation should be cut before the flowering season in order to maximize deterrence of local wildlife species, and the height and species composition of the vegetation should be managed to minimize food sources.

2.5.5 Agricultural crops, where possible, should be discouraged from the airfield environment since agricultural crops and related activities (ploughing, mowing) will provide food for hazardous birds/wildlife.

2.5.6 Water bodies in many parts of the world can be a particular hazard because they can be very attractive to birds. It may be possible for these to be modified by netting them to exclude birds, fencing them to deny access to birds that walk in, have the sides steepened or made less attractive in other ways. Refuse/garbage dumps can also be very attractive to birds and can cause bird flyways to cross the airport. Preventing food sources from being available either through management or netting/fencing of the facility can be effective to deter birds and other wildlife.

2.6 EXPELLING BIRDS/WILDLIFE

In case hazardous birds/wildlife are still attracted to the airport after the proactive measures of 2.5 have been implemented, it may be necessary to expel them by either trapping or using lethal methods if other techniques have not proved successful and there is a continuing risk of collision with aircraft. If firearms and chemicals are used, they will need to be utilized within national regulations.

2.7 OFF-AIRPORT BIRDS

Any significant bird/wildlife attractants within a defined radius centered on the aerodrome reference point (ARP) should be assessed and a management plan developed to reduce their attractiveness to birds/wildlife. Area of 8 km circle centered on ARP is considered a large enough area for an effective wildlife management plan.

2.8 INTEGRATED APPROACH

An integrated approach is needed to coordinate the relevant organization's activities on the airport and ensure communication takes place between them. It is especially important that quick communication is possible between those involved in bird/wildlife dispersal and air traffic control. Upon receipt of notice of a specific wildlife threat, air traffic control should issue appropriate warnings to aircraft operating on, and in the vicinity of, the airport. Aircraft operators should also be part of such an integrated approach by being prepared to implement the guidance in Chapter 3 upon receipt of the warning of a specific threat.

2.9 STAFF TRAINING

2.9.1 Airport wildlife control personnel should receive formal training prior to their initial engagement as wildlife controllers. Staff need to be trained, competent and equipped for detection and dispersal tasks. Each airport operator may have varying wildlife management requirements due

to varying ecosystems, topography, geographic location, habitat, hazard, risk and resources. Detailed and specific instructions. due to these variables, the following are guidelines to help plan training content for the training of airport personnel involved in airport wildlife control. Airport operator should include procedures for the training of staff involved in wildlife control in their wildlife management programs.

a) Overview Theoretical Training
   1. Aerodrome overview
   2. Aerodrome certification
   3. Aerodrome licence
   4. Aerodrome procedures
   5. International regulations
   6. National regulations
   7. Environmental regulations
   8. Aerodrome safety management system
   9. Promulgation of information
   10. Health & Safety overview
   11. Accident & incident reporting/ investigation.

b) Familiarization Practical Training
   1. All aerodrome operational procedures & standards.
   2. Landside overview
   3. Airside safety
   4. Airside security
   5. Apron driving
   6. Airfield training
   7. Radio telephony
   8. Runway incursion training
   9. Protection of NAVAIDs
   10. Low/reduced visibility program
   11. On the job training
   12. Recurrent refresher training
   13. Familiarization program.

c) Specification Specific Wildlife Training
   1. Detailed theoretical aspects of wildlife programs
   2. Integrated approach to all elements of habitat/wildlife programs
   3. All practical elements required to support programs
   4. Familiarization program
   5. Equipment training & procedural use of all equipment

6. Defined on the job training
7. Recurrent refresher training
8. Administration program in respect of the specific Record keeping
9. On/off field program

2.9.2 Training administered to any person for the purpose of conducting airport wildlife control should be documented and records retained for a sufficient period as directed by the airport's wildlife control program or as necessary to satisfy periodic reviews, internal audits and competence checks.

2.9.3 Training of airport wildlife control personnel should be conducted by qualified airport wildlife control personnel or specialists with proven experience in this field.. The minimum qualifications for personnel appointed to provide training in wildlife management at the airport should ultimately be determined by the airport operator, but they should, at a minimum, be able to demonstrate proven competence in the field of work and produce evidence that they have completed a formal course of instruction, including "training the trainer", and/or a CV which demonstrates an equivalent level of relevant experience in the field.

2.9.4 Formal courses in wildlife/bird hazard management may be available from universities, military establishments, government entities, various educational institutions and commercial agencies and organizations.

2.9.5 Successful completion of an airport wildlife training course should be demonstrated by taking a written and/or practical test and attaining an agreed pass score. A written certification should be provided to those who pass the test. If a published training procedure is not provided by the trainer, the certificate should attest to the subject areas the trainee has successfully completed.

2.9.6 Different airports may require different levels and types of initial and ongoing training due to the nature of the specific wildlife hazards in the local area and due to the size and complexity of the airport operations, including the type of aircraft and frequency of air traffic movements. At a minimum, initial training should address the following general areas:

a) an understanding of the nature and extent of the aviation wildlife management problem and local hazard identification;

b) an understanding of the national and local regulations, standards and this guidance material related to airport wildlife management programs ;

c) an appreciation of the local wildlife ecology and biology, including (where applicable) the importance of good airfield grass management policies (also known as "tall" or "long grass") and the benefits to wildlife control they can deliver;

d) the importance of accurate wildlife observation and identification, including the use of field guides;

e) local and national laws and regulations relating to rare and endangered species and species of special concern, and the airport operator's policies relating to them;

f) policies and procedures concerning collection and identification of wildlife strike remains;

g) long-term (passive) control measures, including on- and off-airport habitat management, identification of wildlife attractions, vegetation policies, aeronautical NAVAID

h) short-term (active) tactical measures, using well-established, effective wildlife removal, dispersal and control techniques;

i) documentation of wildlife activities, control measures and reporting procedures (the airport wildlife management plan);

j) firearms and field safety, including the use of personal protective equipment; and

k) wildlife strike risk assessment and risk management principles and how they integrate with the airport's safety management system.

2.9.7 Additionally, wildlife control personnel should be fully aware of the conditions and terms of the operations of the airport's airside environment. Where this is not relevant, the wildlife control personnel should receive appropriate training, including:

a) airport airside driver training including airport familiarization, air traffic control communications, signs and marking, navigation aids, airport operations and safety, and other matters the local airport operator deems appropriate; and

b) aircraft familiarization, including aircraft identification, aircraft engine design and the impact of wildlife strikes on aircraft systems.

2.9.8 Airport wildlife control personnel must, as part of the airport operator's integrated approach to a safety management system, maintain competence in their role. This may be achieved by annual refresher training or another system of monitoring, accomplished "in-house" or using an external training provider. The airport operator should determine which method is most suitable. If a maintenance of competence scheme or refresher training is not available, airport wildlife control personnel should re-qualify within a period of no longer than three years.

2.9.9 Additionally, the maintenance of competence should include:

a) review of firearms safety;

b) changes in the local environment;

c) changes in the risk management policy;

d) recent wildlife events at the airport;

e) improvements in active and passive measures; and

f) any other matters that the airport operator deems appropriate

CHAPTER 3

AIRCRAFT OPERATORS

3.1 Aircraft operators should be given specific, timely and reliable information which will allow them to adapt their flight schedules in order to ensure the safety of their aircraft, just as they would do to mitigate other hazards such as wind shear, icing and volcanic ash.

3.2 Aircraft operators should inform air traffic control about observed birds/wildlife, either struck or living. If birds/wildlife are observed in the flight path, aircraft operators may choose to request bird/wildlife dispersal and consider adapting their flight operations by changing the route, timing and/or speed where this is possible within the parameters dictated by the air traffic control authorities. Aircraft operations personnel should also coordinate with airport operators and air traffic control to offer alternative departure and arrival options on unaffected runways should a wildlife/bird threat be present on the airport.

3.3 Examples of modified procedures for aircraft arriving at and departing airports with hazardous birds/wildlife on the airport or in its vicinity are:

a) Jets could depart the airport on the ICAO noise abatement departure profile (NADP 1) and turboprops could depart at best angle-of-climb speed until above 3000 feet. Because 95 per cent of bird strikes occur below 3000 feet these procedures would ensure that aircraft climb above 3000 feet as rapidly as possible, while maintaining a relatively slow airspeed, which may decrease the damage in the event of a bird strike.

b) Arriving aircraft should remain above 3000 feet until necessary to descend directly for landing. This may require coordination with air traffic control and modification of local air traffic procedures.

c) When airspeed is reduced in areas of high bird concentration, the slower speeds reduce the kinetic energy of a collision and reduce the likelihood of damage caused by a bird strike.

d) Pilots of jet aircraft that encounter a flock of birds on approach close to the runway may find that the safest course of action is to continue through the flock and land. An attempted go-around will require high engine rotation speed which will increase the likelihood of engine damage by ingestion. Any such procedures are determined by the airline's standard operating procedures in coordination with local air traffic procedures.

3.4 It is recommended that all aircraft operators be required to file the appropriate bird strike report form in the event that they experience a bird/wildlife strike. Wildlife hazards observed (both in the air and on the ground) by aircraft operators should also be reported on the appropriate safety form, including near-miss occurrences.

CHAPTER 4

ASSESSMENT OF THE RISK OF BIRD/WILDLIFE STRIKES

4.1 Before discussing the assessment of the risk of bird/wildlife strikes, it is important to ensure that consistent terminology is used. The words "hazard" and "risk" are often used interchangeably in normal conversation but they have specific meanings in the science of risk analysis:

a) A hazard is defined as a situation that, in certain circumstances, can lead to an event that results in harm. In this context, a hazard is the presence of certain birds/wildlife on or near an aerodrome.
b) Risk is the probability that the harmful event will occur, multiplied by the severity of the harm that could result. In this context it is the probability of a bird/wildlife strike by a particular group of birds/wildlife multiplied by the severity of damage to the aircraft that results.

Risk = (probability of an event) × (severity of harm) and so for bird/wildlife strikes:

Risk = (probability of a strike) × (severity of damage caused).

4.2 It is therefore possible to have a large number of large birds/wildlife close to an airport (a significant hazard) which results in a very low risk if the birds/wildlife never move onto the airfield or fly across the operational airspace. It is also possible to have a large number of small wildlife (typically weighing less than 120 g or 4 oz) that are regularly struck by aircraft but which result in a low risk because of their size and weight, meaning that the level of harm resulting from the strikes is always very low (except when colliding with dense flocks).

4.3 Any assessment of risk therefore needs to estimate the probability that a strike will occur and the likely level of harm that will result. Estimation of harm is relatively straightforward because analysis of various bird/wildlife strike databases around the world shows that there is a consistent relationship between bird/wildlife mass and the level of damage to aircraft. Strikes involving flocks of birds (even small species) are also more likely to result in damage to the aircraft than strikes with single birds. Thus the larger the bird/wildlife and the greater its tendency to be struck in groups, the greater the risk.

4.4 It is more difficult, however, to estimate the likely strike frequency of a particular population of bird or other wildlife because their behavior cannot be predicted with certainty. There are a number of possible approaches to estimating strike probability, which vary in sophistication and in the level of skills and experience needed to apply them.

4.5 The most common form of risk assessment involves the categorization of both strike probability and likely severity into a number of arbitrary levels, usually low, medium and high. Again, this is easily done for strike severity using the mass of the birds/wildlife involved, with a correction for their tendency to occur in groups. Assigning birds/wildlife to a category for strike probability is more difficult and requires some specialist knowledge of the behavior of the species involved and how that behavior is influenced by the environment around the airport concerned. Some airports may have staff that are sufficiently experienced in bird/wildlife behavior to allow them to undertake this work. Otherwise, contracting the services of bird/wildlife strike prevention specialists or local ornithologists may be necessary.

SEVERITY	PROBABILITY				
	Very high	High	Moderate	Low	Very low
Very high	3	3	3	2	2
Moderate	3	3	3	2	2
High	3	3	2	1	1
Low	2	2	1	1	1
Very low	1	1	1	1	1

Figure 5-1. A 5 × 5 risk assessment matrix

4.6 A typical option for risk assessment may involve a numerical approach that uses the number of strikes encountered with different species over the recent past as a measure of the probability of likely future strikes. For this process to work reliably the airport's records must indicate that the majority of strikes that occurred at the airport have been reported, that reporting has been consistent from year to year and that the bird/wildlife species involved have been identified correctly. If these three requirements have not been met, it is better to use one of the more generic risk assessments described above. One such numerical approach involves taking the mean number of strikes recorded for each species in the past five years and using this to assign the species concerned to one of five frequency categories. The mass of the species is then used as a measure of likely severity and the species are assigned to one of five severity categories. The boundaries of these categories can be set by the airport or regulator concerned. The frequency and severity measures are then combined into a 5 x 5 risk matrix (see Figure 5-1) with the different cells of the matrix designated as one of three risk levels.

4.7 The three risk levels require different responses from airport managers as follows.

a) *Risk level 3.* Risk from this species is currently very high. Additional management actions should be implemented for this species as soon as possible.

b) *Risk level 2.* Risk from this species merits further review of available options and action if appropriate. Current risk management for this species should be reviewed and additional steps taken if appropriate.

c) *Risk level 1.* Risk from this species is currently low. No further action is required beyond the risk management measures currently in place.

4.8 It is also accepted that there may be local variations to this matrix, such as:

a) *Green (Level 1).* No further action is required.

b) *Amber (Level 2).* The current residual risk requires a review of available options and possible action.

c) *Red (Level 3).* The current residual risk requires further action to reduce it.

In other words, the actions and assessment need to fit with the reality of what can realistically be achieved within the legislation available and the resources at the airport's disposal. It should be noted that where the risk assessment in a Level 3 indicates "unacceptable" there may be very little the airport can do about managing this risk to entirely remove it, for example, due to the coastal location of the airport, or where the airport is surrounded by conservation areas and the airport operator is unable to access and influence the wildlife hazards due to constraints placed upon the airport by local wildlife legislation.

4.9 The risk assessment matrix may also need to be adapted to cater for the risk posed by multiple strikes, whereby this risk would need to be raised to a high level.

4.10 All of the above techniques are designed to assess the total risk of a bird/wildlife strike at an airport. This is effectively the airport operator's risk exposure. In order to assess the risk to an airline or an individual passenger flying to or from an airport, some account of movement rate needs to be incorporated into the risk assessment. The simplest approach to this is to express strike frequency per aircraft movement or, more conventionally, as strikes per 10,000 aircraft movements. As with the techniques described above, the sophistication with which this strike rate can be interpreted depends upon the level of detailed information available concerning the bird/wildlife strikes that are encountered. If information is limited to the total number of strikes per year then the strike rate per 10,000 movements may simply be categorized as low, medium or high. If bird/wildlife strikes are reliably reported and identified and there is a sufficient data set, then it may be possible to treat the strike rate for an individual species as a measure of strike probability. However, it should be borne in mind that the severity depends on the mass of the species and the flocking behavior.

4.11 Whatever risk assessment technique is chosen, it is essential that the findings are followed up by effective risk management. For those risks that are judged very high (Level 3), a list of available

actions should be developed, in consultation with bird/wildlife management experts where necessary, and the costs and benefits of the various options assessed before a decision is reached on which options to select. It is equally important that the effectiveness of these options is evaluated at appropriate intervals after they are implemented. Repeating the risk assessment process annually to determine if the risk is falling to an acceptable level is recommended.

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

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

4.14 A more thorough discussion of the assessment of risk can be found in SMS DASS Publications.

CHAPTER 5

HABITAT MANAGEMENT AND SITE MODIFICATION

5.1 GENERAL

5.1.1 Birds and other wildlife occur on airport property for a variety of reasons, mainly food, water and shelter.

5.1.2 Modifications to the airport's habitat/environment to eliminate or exclude food, water and shelter can limit the attractiveness of an airport to birds and other wildlife. Habitat management provides the foundation for an airport's bird/wildlife hazard management program because it offers ecologically based, long-term measures for reducing the number of hazardous birds/wildlife at the airport. If direct action against birds/wildlife is chronically necessary, it is usually because habitat management has not yet been fully implemented or further measures are not cost-effective.

5.1.3 Before undertaking activities to manage the environment, it is important to first carry out an ecological survey of the airport and surrounding area to identify sources of food, water and shelter attractive to wildlife on and in the vicinity of the airport. This way, the environmental management plan is able to deal with specific conditions or habitats that are attracting wildlife. A standardized reporting system that documents wildlife species, numbers and location on the airport, as well as strike events, can provide the foundation for an ecological survey. From this ecological survey, prioritization of activities or projects within the plan may then occur. There are many wildlife attractants that an environment management plan can control.

5.2 FOOD

5.2.1 It is difficult to remove all food sources for birds and other wildlife on airports. Because grass is the common vegetation on most airports, grassland management has an important influence on food available to birds.

5.2.2 Wildlife may enter airport lands in order to feed on seeds, vegetation, invertebrates or rodents and other small mammals in grasslands or agricultural crops; on fruits in trees and shrubs; or on exposed food waste from catering services or restaurants. These sources of food are especially attractive to a variety of birds. Agricultural measures like mowing, harvesting and ploughing will attract birds because of the disturbance and exposure of seeds, invertebrates and rodents. Although it is impossible to remove all food sources on airports, the following are suggested measures that can be taken to mitigate the problem:

a) *Agriculture.* Cultivation of airport lands will, no matter what the crop type, attract birds at some part of the life cycle of the crop. Therefore, it is recommended that airport lands not be used for agriculture.

b) *Food waste.* Airports should require wildlife-proof storage of food waste, prohibit bird/wildlife feeding and promote good sanitation and litter control programs.

c) *Waste management facilities (refuse collection, landfill sites and/or garbage dumps).* Refuse dumps that accept putrescible (organic) wastes are highly attractive to various bird and mammal species that are hazardous to aviation. Generally It is desirable that sites be no closer than a 13 km circle centred on the ARP and, in some cases, further —where studies of flight lines of birds attracted to these sites prove them problematic for the airport. If a refuse site in the vicinity of an airport cannot be closed, it likely will be necessary to try to influence the operators to provide control measures at the site to reduce its attractiveness to wildlife. However, this cannot be determined unless a formal assessment of the site is carried out to establish the type of waste and the wildlife species attracted to the locale. Such control could include fencing, netting or overhead wires to prevent access to the active surface and active dispersal of birds using pyrotechnics or other dispersal techniques. Fully enclosed waste-transfer facilities and sites which take only inorganic refuse such as construction and demolition waste generally will not attract hazardous wildlife.

5.3 WATER

Surface water is often highly attractive to birds. Exposed water should be eliminated or minimized to the greatest extent possible on airport property as follows:

a) Depressions and water bodies. Pits or depressions that fill with water after rains should be leveled and drained. Larger water bodies, such as storm-water retention lagoons, can be covered with wires or netting to inhibit birds from landing. Larger water bodies that cannot be eliminated should have a perimeter road so that bird/wildlife-control personnel can quickly access all parts of the water body to disperse birds. Water bodies and ditches should have steep slopes to discourage wading birds from feeding in shallow water.

b) Drainage ditches. When drainage ditches clog up with vegetation or eroded soil and the flow of water is impeded, insect and other aquatic life flourish, thereby attracting birds if remaining unnetted. In order to address such issues, culverting the ditches is recommended. Clearing the ditches at regular intervals is important. They should be graded so that the water will run off as rapidly as possible. Grass and other vegetation should be cut on the sloping banks. Where practicable, the water attractant can be eliminated by replacing ditches with buried drain pipes.

5.4 SHELTER

Birds and other wildlife often seek shelter and breeding sites on airport property in such places as the structural beams of hangars and bridges, in nooks of jetways and other structures, and in trees and shrubs. Some birds, such as gulls and waterfowl, seek the open spaces on airport property for safety while resting. These areas give the birds a clear view of their surroundings in all directions. Deer and other mammals will seek shelter in dense stands of trees and shrubs. The following measures can be taken to deter birds and other wildlife from seeking shelter and breeding sites on airport property:

a) *Structures*. Architects should consult biologists during the design phase of buildings, hangars, bridges and other structures at airports to minimize exposed areas that birds can use for perching and nesting. When perching sites are present in older structures (such as rafter and girded areas in hangars, warehouses and under bridges) access to these sites can often be eliminated with netting. Antiperching 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. 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.

b) Abandoned structures. All unnecessary or abandoned posts, fences and other structures that can be used as perches by raptors and other birds should be removed from airport property. 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 rodents and other wildlife. These areas should be eliminated at airports.

c) Trees and shrubs. Much care must be taken when selecting and spacing plants for airport landscaping. Avoid plants that produce fruits and seeds desired by wildlife. Also avoid the creation of areas of dense cover for roosting by flocking species of birds. Thinning the canopy of trees or selectively removing trees to increase their spacing can help eliminate bird roosts that form in trees on airports.

d) Ground vegetation. Because vegetative ground cover (typically grass) is usually the dominant habitat on an airport, the management of an airport's airside ground cover to minimize its attractiveness to wildlife is a critical activity. However, management of ground vegetation requires expert knowledge about the local ecological conditions because of variations in soil types, rainfall patterns, temperature profiles and wildlife, resulting in site-specific vegetation. The following are suggested methods of reducing wildlife attraction to airport ground cover:

i) Studies in Europe have indicated that maintaining a monoculture of tall or long (150 mm to 200 m high) dense grass can discourage gulls, lapwings and similar birds from landing and feeding on soil invertebrates. However, studies and observations in North America, parts of Africa and Asia indicate that tall grass does not discourage certain large birds such as geese, herons and egrets. Tall, dense grass interferes with visibility and locomotion of the smaller birds. Although rodent populations may increase in tall grass, the density and height of the grass may be managed by effective cutting and clearing methods (also known as "bottoming out") in order to discourage raptors and rodents from feeding. Maintenance of tall, dense stands of grass may require special mowing equipment and other activities to prevent thatch build-up and to keep the grass uniformly tall and free of weeds.

ii) When seeds are the most important food source, the vegetation should be mowed during the flowering season. In case these flowers attract insects that, when airborne, attract swallows and other aerial feeders, the vegetation should be mowed before the flowering season.

iii) Short grass (less than 150 mm) may result in fewer rodents compared to tall grass because of reduced cover and increased disturbance caused by frequency of mowing. However, raptors may be attracted to short grass because any rodents still present are more exposed than in taller grass. Mowing activities may attract birds to feed by exposing invertebrates and rodents. The height of the vegetation and the timing and frequency of mowing on an airport should be oriented to minimizing hazardous wildlife and not to any other horticultural benefits which may arise from the ground cover.

iv) A promising approach to reducing wildlife attraction to airport ground cover, regardless 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 unpalatable to some grazing birds, mammals and insects. Other ground cover, such as Wedelia or Bermuda Grass, may be appropriate for subtropical airfields.

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

CHAPTER 6

REPELLENT TECHNIQUES

6.1 GENERAL

6.1.1 Repellent and harassment techniques should be used to keep hazardous wildlife away from specific areas on or near an airport. The long-term cost-effectiveness of repelling hazardous wildlife does not compare favorably with habitat modification or exclusion techniques. Wildlife will return as long as the attractant is accessible. However, habitat modification and exclusion techniques will never rid an airport of all hazardous wildlife. Repellent techniques are a key ingredient of any wildlife hazard management plan.

6.1.2 Repellents work by affecting the animal's senses through chemical, auditory or visual means. Habituation or acclimation of birds and mammals to most mechanical repellent techniques is a major problem. When used repeatedly, without added reinforcement, wildlife soon learn that the repellents or techniques are harmless and the repellents or techniques are ignored.

6.1.3 When using repellents, four critical factors should be remembered:

a) there is no single solution to all problems;

b) there is no standard protocol or set of procedures that is best for all situations. Repelling wildlife is an art and a science. Motivated, trained and suitably equipped personnel who understand the wildlife on the airport are critical for the successful use of repellents;

c) 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

d) to lessen habituation to repellent techniques:
   1) use each technique sparingly and appropriately when the target wildlife is present;
   2) use various repellent techniques in an integrated fashion; and
   3) reinforce repellents with occasional lethal control (only when necessary depredation permits are in place) directed at abundant problem species.

6.1.4 Advances in electronics, remote sensing and computers have resulted in "intelligent'' systems that can automatically dispense repellents (for example, noisemakers, chemical sprays) when

targeted wildlife enter selected areas. These devices are used to reduce habituation and increase the effectiveness of other repellent techniques. It should be remembered that automated repellents are not a substitute for trained people on the ground, who can respond appropriately to incursions by various wildlife species, and should be considered only when more traditional methods of control and dispersal have proved ineffective.

6.2 WILDLIFE PATROLS AND RUNWAY SWEEPS IN VEHICLES

Patrols of airside areas to disperse birds and other hazardous wildlife are a critical part of an integrated program of wildlife hazard management on airports. Driving a vehicle toward the wildlife may be enough to cause the wildlife to disperse. This is especially true if the driver has been using repellent and removal techniques as outlined below. Regular and continuous patrols and sweeps help wildlife control personnel to learn the behaviour, daily movement patterns and habitat preferences of wildlife on the airport. This information helps identify hazardous wildlife attractants on the airport (for example, low areas that gather standing water after rains) and hence future problems. All wildlife carcasses found during runway sweeps should be collected, identified as to species and documented in a wildlife strike log of carcass remains.

6.3 AUDIO REPELLENTS

Audio repellents for birds

The following are some examples of audio repellents that can be used on birds:

a) *Propane cannons.* Propane cannons (exploders) produce a shotgun-sounding blast. In general, birds quickly habituate to propane cannons that detonate at random or preset intervals throughout the day, and they can scare birds into flight paths creating extra hazard. Thus, to ensure they remain effective, cannons should be used only sparingly and when birds are in specific areas. Reinforcement by occasional shooting of a common bird species with a shotgun may improve the effectiveness of the cannons. Protected birds should be avoided unless the necessary depredation permits are in place. Some systems are designed so that cannons placed around an airport may be detonated remotely, on demand by radio signal, when birds are in the area.

b) *Distress-call and electronic noise-generating systems.* Recorded distress calls are available for birds commonly found on airports in many parts of the world, such as gulls, crows and starlings. Such calls, broadcast from speakers mounted on a vehicle, will often initially draw the birds toward the sound source to investigate the threat. These birds should be dispersed using pyrotechnics or by shooting an occasional bird with a shotgun. Distress calls routinely broadcast from stationary speakers, with no associated reinforcement to provide added fear

or stress, have little utility. Birds habituate rapidly to electronic sound generators that produce various synthetic sounds from stationary speakers.

c) *Shell crackers and other pyrotechnics.* There are various projectiles, fired from breech-loaded shotguns or from specialized launchers, that provide an auditory blast or scream as well as smoke and flashing lights to frighten birds. Some of the newer cartridges have ranges of up to 275 meters. Pyrotechnics, when used skillfully in combination with other harassment techniques and limited lethal reinforcement (shooting with a shotgun), are useful in driving birds off an airport. Pyrotechnic devices require that a person fire the projectile. This targeting of specific birds helps teach them to associate the pyrotechnic with a threat (person).

d) *Ultrasonic devices*. Ultrasonic (sound above the range detected by humans) devices are not proven to be an effective bird repellent. Bird species hazardous to aircraft are unable to hear ultrasonic frequencies, and therefore it is considered that these devices are largely ineffective as bird deterrents. Their use against mammals in airport environments is also largely unproven.

Audio repellents for mammals

Propane cannons are the most commonly used audio repellent for deer. However, deer rapidly habituate to propane cannons. Therefore, except for short-term emergencies (a few days), propane cannons should not be relied upon to repel deer and other mammals from runways. Other electronic noise-generating devices have also proven ineffective at repelling deer or other mammals for more than a few days. Pyrotechnics also provide only short-term repellency for mammals.

6.4 VISUAL REPELLENTS

Visual repellents for birds

The following are some examples of visual repellents that can be used on birds:

a) Most visual repellents are simply a variation on an ancient theme, the scarecrow. Visual repellents such as hawk effigies or silhouettes, eye-spot balloons, flags and Mylar reflecting tapes have shown only short-term effectiveness and are not suitable as long-term solutions to an airport's bird problems. Most short-term success achieved with these devices is likely attributable to "new object reaction" rather than to any frightening effect produced by them. In a test in the United States, 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 the eye-spot flag was repellent to the birds. However, within 24 hours the

pigeons returned. From then on the pigeons behaved in a normal fashion and showed no interest in, or reaction to, the flag.

b) Dead birds in a "death pose" has proven effective in repelling birds from local areas. Recent experiments and field demonstrations showed that a dead turkey vulture (freeze-dried taxidermy mount with wings spread), hung by its feet in a vulture roosting or perching area, caused the vultures to abandon the site. Trials using dead gulls and ravens suspended from a pole have shown promising results in dispersing these species from feeding and resting sites. The dead bird should be hung in a "death pose" for maximum effect. Live birds ignore or are attracted to dead birds lying supine on the ground or in the roost. Needed permits should be obtained before using protected birds as dead-bird deterrents. Research is under way to determine if artificial dead-bird effigies can be developed that will be just as effective as the taxidermy mounts. However, in the United Kingdom the suspension of dead crows and rooks from poles to deter crop feeding has been shown to be effective only for a period of a few hours to a few days, after which birds will resume normal behaviour.

c) Hand-held laser projectors projecting a one-inch diameter red beam have been used successfully during trials in Europe to disperse birds such as Canada geese, double-crested cormorants and crows from night-time roosting areas in reservoirs and trees. Hand-held laser projectors are effective at long ranges (over 0.4 km) and have also shown some effectiveness in dispersing birds from hangars. Based on trials in France it was decided that automated, continuous-scanning, green-laser projectors could be used, without any safety problem, on civil and military airfields. However, the use of laser equipment is not universally accepted, and to some extent its effectiveness remains unproven. During trials, daylight conditions reduced or eliminated the effectiveness of lasers. The use of lasers in an airport environment requires caution. JCAR Part 139 Appendix E, recommends setting up a laser-beam free flight zone, a critical flight zone and a sensitive flight zone around aerodromes. Guidance on how to protect flight operations from the hazardous effects of laser emitters is contained in the JCAR Part 77.

Visual repellents for mammals

Visual repellents such as flags and effigies have proven ineffective in repelling mammals. Red lasers (see above) were ineffective in dispersing deer.

6.5 THE USE OF TRAINED FALCONS AND DOGS TO REPEL BIRDS

6.5.1 Since the late 1940s trained falcons and other birds of prey have been used intermittently on various airports in Europe and North America to disperse birds. The advantage of falconry is that

the birds on the airport are exposed to a natural predator of which they have an innate fear. The disadvantage is that a falconry program is often expensive, needing many birds that must be kept and cared for by a crew of trained, motivated personnel. The effectiveness of falconry programs in reducing bird strikes, in comparison with more conventional techniques, has been difficult to evaluate and, as important, wildlife management by these techniques requires a dedicated team of motivated, trained and competent personnel.

6.5.2 The following is considered to be a comprehensive summary of good operating practices for falconry use on airports:

a) properly trained birds of prey of the right species for the job, 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, year-round, daily operations are usually needed;

c) several falcons are needed to have at least one bird always ready to fly;

d) a staff of at least two full-time, well-trained personnel are needed to capture, train, work and care for falcons. It should be noted that this practice may not be permitted in many parts of the world, where only captive-bred birds may be used, and indeed falconry is banned in some States; and

e) access to a full range of other techniques is also required.

6.5.3 The use of trained dogs, especially border collies, to chase geese and other birds from golf courses, airports and other sites is a recent development. The successful use of border collies to repel birds requires a high degree of dedication and commitment by the handlers. As with falcons, the advantage is exposure to a natural predator. The disadvantages are:

a) a trained person must always be in full control of the dog;

b) most dogs respond well only to a single handler;

c) the dog needs care and exercise every day; and

d) a dog will have little influence on birds that are flying over the airport.

6.6 RADIO-CONTROLLED MODEL AIRCRAFT TO REPEL BIRDS

6.6.1 Radio-controlled (RC) model aircraft, a relatively new technological innovation that provides both visual and auditory stimuli, have been used occasionally to harass birds on airports. If used precisely by competent and trained operators, limited trials have shown that RC aircraft can be used

to herd birds away from airport runways, but their effectiveness remains largely unproven. Some RC aircraft, for example, have been designed to mimic the appearance of a falcon and to even fire pyrotechnics remotely.

6.6.2 Using RC aircraft in a busy airport environment requires highly trained operators and a thorough risk assessment, with written procedures, in coordination with other stakeholders such as ATC. Before using RC aircraft, it is important that operators ensure that the radio frequencies used are compatible with other radio uses in the airfield environment, particularly flight crew, airfield operations and air traffic control.

6.7 NON-LETHAL PROJECTILES TO REPEL BIRDS

Paint balls and rubber or plastic projectiles, fired from paint-ball guns and twelve-gauge shotguns respectively, have been used to reinforce other dispersal techniques. A high-quality paint-ball gun should be used to ensure accuracy and velocity. Paint-ball guns are typically fired at 6 to 30 metres from the target wildlife. There are several types of rubber or plastic projectiles (slugs, buckshot, pellets, beads) for use in a shotgun. The proper distance from the bird for firing varies by projectile and species of bird. Personnel should be trained in the safe use of firearms and the particular projectiles to be used. The objective is to shoot from a great enough distance for the projectile to cause temporary pain, but not injury, to the bird struck. However, the use and effectiveness of projectiles are largely unproven and would not be permitted by some States or airport operators due to health and safety regulations.

CHAPTER 7

BEST PRACTICES FOR BIRD/WILDLIFE MANAGEMENT PROGRAMS ON AERODROMES

7.1 GENERAL

While there is considerable information available concerning the techniques that can be used to deter birds and other wildlife from aerodromes and thus control the wildlife strike risk, there is little guidance available on the effort that is necessary to achieve effective control. The effort required will vary with the particular airport concerned, the number of hazardous birds/wildlife in its immediate location and the attractiveness of the airport compared to the surrounding habitat. Despite this variability, experience has shown that for bird/wildlife control to be carried out to best effect a particular level of organization and investment is needed in equipment, training and resources.

7.2 SUMMARY OF BEST PRACTICES FOR AERODROME BIRD CONTROL

Note: These best practices should apply to any aerodrome carrying regularly scheduled commercial air traffic, irrespective of the movement frequency or type of aircraft involved.

a) A named member of the senior management team at the airport should be responsible for the implementation of the bird/wildlife control program, including both habitat management and active control.

b) An airport should undertake a review of the features on its property that attract hazardous birds. The precise nature of the resource that they are attracted to should be identified and a management plan developed to eliminate, reduce the quantity of, or to deny access to that resource, as far as is practicable. If necessary, support from a professional bird strike prevention specialist should be sought. Documentary evidence of this process, its implementation and outcomes should be kept.

c) A properly trained and equipped bird/wildlife controller should be present on the airfield sufficiently in advance of any aircraft movement to allow full inspection of vulnerable areas and dispersal of any hazardous wildlife to be achieved. If aircraft are landing or taking off at short intervals (e.g. every 5 minutes) there should be a continuous presence on the airfield

throughout daylight hours. The bird controller should not be required to undertake any duties other than bird/wildlife control during this time.

d) Airport bird/wildlife controllers should make record entries ***at least*** every 30 minutes (if air traffic is sufficiently infrequent that bird patrols are more than 30 minutes apart, an entry should be made for each patrol carried out).

e) Bird/wildlife incidents should be defined in 3 categories:

1) Confirmed strikes: Any reported collision between a bird or other wildlife and an aircraft for which evidence in the form of a carcass, remains or damage to the aircraft is found.

2) Unconfirmed strikes:
   i) Any reported collision between a bird or other wildlife and an aircraft for which no physical evidence is found.

   ii) Any bird/wildlife found dead on an airfield where there is no other obvious cause of death (e.g. struck by a car, flew into a window, etc.).

3) Serious incidents: Incidents where the presence of birds/wildlife on or around the airfield has any effect on a flight whether or not evidence of a strike can be found.

f) Airports should establish a mechanism to ensure that they are informed of all bird/wildlife strikes reported on or near their airport.

g) The total number of bird/wildlife strikes should never be used as a measure of risk or of the performance of the bird/wildlife control measures at an airport.

h) Airports should ensure that the identification of the species involved in bird/wildlife strikes is as complete as possible.

i) Airports should record all bird/wildlife strikes including as far as practicable the data required for the standard IBIS reporting form.

j) Airports should conduct a formal risk assessment of their bird strike situation and use the results to help target their bird management measures and to monitor their effectiveness. Risk assessments should be updated at regular intervals, preferably annually.

k) Airports should conduct an inventory of bird/wildlife attracting sites within a 8 km circle centered on the ARP, paying particular attention to sites close to the airfield and the approach and departure corridors. A basic risk assessment should be carried out to determine if the movement patterns of birds/wildlife attracted to these sites mean that they cause, or may cause, a risk to air traffic. If this is the case, options for bird/wildlife management at the site(s) concerned should be developed and a more detailed risk assessment performed to determine if it is possible and/or cost-effective to implement management processes at the site(s) concerned. This process should be repeated annually to identify new sites or changes in the risk levels produced by existing sites.

CHAPTER 8

INCOMPATIBLE LAND USE AROUND AIRPORTS

8.1 Land Use and Environmental Control guidance material contains valuable guidance on land-use planning in the vicinity of aerodromes. Included in this guidance is a table in Appendix 2 providing land-use guidelines for the avoidance of bird hazards in the vicinity of aerodromes. Familiarity with the guidance in Land Use and Environmental Control, is highly recommended.

8.2 It has long been recognized that land use around the airport can influence bird and other wildlife strikes to aircraft. Birds/wildlife can be attracted to areas near the airport and in turn go to the airport for food, water, resting or shelter. Some birds may also be struck outside airport property, over a land use that attracts them.

8.3 The concept of compatible land-use planning is an outgrowth of the focus of attention on the environmental relationship between airports and their community neighbors. This planning concept is relatively simple and the results can be impressive, but the implementation requires careful study and coordinated planning. Land use around airports can influence restrictions on aircraft flights as well as affect aircraft safety. To successfully deal with land-use issues, a comprehensive wildlife management plan including coordination among the Civil Aviation Regulatory Commission, airport operator, aircraft operators and the surrounding communities should be implemented.

8.4 Some communities and airports have reached the point where the effect of land-use planning guidelines may be minimal. However, there are still instances where their use will result in more compatible airport and community development. Implementation may take the form of aviation system plans, legislation for compatible land uses, easements or land zoning.

8.5 In applying the guidelines on incompatible land use, one must consider the location of the proposed land use in relation to the airport. The location of attractive land use beyond the recommended distance could still create flyways over the airport or through flight paths at the airport. In some cases more than one possible use of an area may have to be considered to ensure that bird hazards will not be increased at or near the airport.

CHAPTER 9

EVALUATING THE WILDLIFE CONTROL PROGRAM

9.1 Wildlife hazard prevention should be an integral part of the aerodrome safety management system.

9.2 The following questions are directed at airport management, specifically those responsible for the implementation and maintenance of the airport wildlife control program. The questions are designed to assist in determining if there is an effective bird/wildlife control program in place at an airport. If the answers to these questions are negative or unclear, a wildlife control program should be established in order to improve aircraft safety.

9.3 Local risk assessment

a) Has a bird/wildlife strike reporting procedure been implemented at the airport?
b) What is the bird/wildlife strike rate at the airport over the last five years (with or without damage to the aircraft)?
c) Is there a procedure to collect regularly information about birds/wildlife, both dead (carcasses) and living?
d) Has a means for positively identifying carcass remains been established?
e) How many reports from pilots are related to intrusions of wildlife, other than birds, over the last five years?
f) Has a list of bird/wildlife attractants at and surrounding the airport been completed?

9.4 Wildlife control program

a) Is there a wildlife control officer responsible for the management of wildlife on the airport?
b) Has a land-use plan been established with regard to effective land use on and off the airport as it pertains to the wildlife control program?
c) What ecological measures are implemented to reduce wildlife attractiveness at the airport and in the vicinity?
d) Is there a habitat management program on the airport?
e) Are garbage dumps forbidden around the airport? If yes, within what distance are they forbidden?
f) Is the airport fence suitable to prevent hazardous animal incursions?
g) Which scaring methods are implemented at the airport?
h) Have staff been employed and trained specifically to scare off birds/wildlife at the airport?

CHAPTER 10

EMERGING TECHNOLOGY AND COMMUNICATIONS PROCEDURES

10.1 GENERAL

a) There is a variety of existing and new technologies available, such as Avian Radar, to predict and detect birds potentially hazardous to aircraft operations and provide information to reduce the risk of these hazards. Such technologies and procedures are particularly important in dealing with the significant hazards posed by birds beyond the boundaries of airports.

b) airports should use proven available technologies and explore new technologies to advance predictive and real-time detection, avoidance and dispersal of hazardous birds/wildlife on and around airports.

10.2 PREDICTIVE AND REAL-TIME BIRD AVOIDANCE SYSTEMS

a) A number of States have developed predictive and real-time bird avoidance systems for use by civil and military aircraft. Examples include the European BIRDTAM system, Bird Avoidance Models (BAM) used by several States, and Avian Hazard Advisory Systems (AHAS) developed for the United States military. Use of historical ornithological data and near-real-time data from weather and/or national defence radars form the basis of these systems. Data from numerous sources and new applications of existing technological systems are underutilized in most States and can be further developed for reduction of bird strike hazards.

b) Dedicated remote-sensing systems, primarily using bird detection radars, are in use and under development at a number of civil and military airports in several States. These systems provide real-time detection capability and can provide three-dimensional information on birds on and surrounding airports. Other systems, such as infrared and satellite imagery, can potentially provide similar detection capabilities.

10.3 COMMUNICATIONS PROCEDURES

a) Data from predictive models and remote-sensing systems should be shared with all entities

responsible for reducing bird/wildlife strike hazards, including airport operations staff, air traffic control, airlines, pilots and regulators. Communications procedures and regulatory oversight are necessary to ensure timely information exchange and proper responses to hazard advisories. Data from models and remote-sensing systems can be supplied at varying levels of detail to different agencies. For example, airport operations/wildlife control staff will need detailed and specific information on the level of hazard and the specific time and location of the detected or predicted hazard to appropriately respond with control or dispersal equipment. Air traffic control staff will need to be advised only when threshold levels are exceeded. Pilots will be provided information to allow alteration of operations or flight paths or to increase situational awareness of potential hazards.

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

c) Airport operations/wildlife control efforts will be enhanced and timeliness improved with additional resources dedicated to detecting and directing efforts to areas of concentrated hazards.

d) Clear and precise procedures should be developed for air traffic control, and controllers should be trained such that they are able to give specific and timely information to pilots and wildlife control crews to avoid identified hazards. Operational standards for procedures and training protocols should be uniformly developed and implemented among States. It is important that ATC be involved in local discussions and invited to comment and review wildlife hazard management plans and participate in local bird strike committees.

e) Pilots have the authority to alter flight operations when hazard advisories are issued by ATC or other agencies based on observed, remotely-sensed or other data. Training in procedures for such altered flight operations based on these data should be provided by airlines and developed and monitored by State regulatory agencies.

APPENDIX (A)

ROLES AND RESPONSIBILITY

Title	Key WHMP Responsibilities
Airport Manager	□ Implementation of this WHMP; □ Acquisition of the various permits; □ Provision of training and awareness programs; □ Review and submission of the annual strike reports and two year updates.
Assistant Manager	□ Coordinating, supervising and the overall management of the WHMP; □ Nomination of the key Wildlife Management Officer (WMO); □ Co-ordination of training, safety assurance; □ Ensuring that the necessary equipment is available.
Wildlife Management	□ Maintenance of the Wildlife Management Log (e.g., including strike data, details on wildlife numbers and activity
Officer (WMO)	□ WHMP measures undertaken, firearm use details; □ details on the use of lethal reinforcement and monthly summaries); □ Co-ordination of the monitoring program; □ Preparation of the annual strike report; □ Ensuring that Airport operations are consistent with the requirements of the WHMP; □ Ensuring that the appropriate permits are current and present on-site; □ Undertaking deterrent activities; □ Ensuring all activities are undertaken following standard practices and

	safety protocols; and □ identification of equipment, resource and training needs.
Back-up to WMO	□ Filling in for WMO during vacations, lunch, sick time etc.
Air traffic Control (ATC)	□ Informing wildlife hazards controllers, environmental dept. and operations dept. in case of observing any of these birds and/or wildlife gathering on/in airport vicinity or when receiving any relevant notification from pilot. □ Warning pilots in case of wildlife observations (risky operating environment) and hazards expectation. □ Report any unsafe conditions including hazardous wildlife on or in airport vicinity to the appropriate airport personnel anytime they are observed. □ Actively attend the local wildlife hazard control committee meetings and any other relevant meetings.
Safety Department	□ Receiving all wildlife strikes and events with the aim of risk assessment formation to ease the future forecasting based on accurate database and risk assessment strategy. □ Actively attend the local wildlife hazard control committee meetings and any other relevant meetings
Maintenance **Department**	□ Periodical inspection of the wildlife attractants (such as ponds, transfer stations and water treatment facilities) or airport infrastructure (such as fence) which ease the wildlife invasion. □ Corrective maintenance actions and preventative maintenance actions to be taken for wildlife hazards management and control verification.
Environmental	□ Receiving wildlife strike reports from the wildlife hazard coordinator or wildlife hazards controllers.

Department	□ Wildlife existence notification receiving from ATC and then verification of wildlife hazards controllers moving to the place of wildlife existence. □ Database formation including wildlife species, numbers, sizes, date and time of existence, local movements, behaviours, the most suitable way of dispersing, etc... □ Wildlife hazards management plan evaluating for effectiveness and verification of its compliance with the original wildlife hazard assessment (Ecological study). □ Preparing under direct supervision of aerodrome operator for the local wildlife hazards control and management committee and other relevant meetings. □ Follow-up decisions and recommendations taken by the mentioned above committee.
Other governmental municipalities (such as agriculture offices/corporations, solid waste and sewage disposal offices / corporations, state national environmental offices, natural reserves corporations, defense, representatives of the major airlines using airport, even the private sectors located in airport vicinity and others)	□ Advance cooperation and coordination with airport management regarding land use planning for those located in airport vicinity □ Exchange information on research and development in airport wildlife control. □ Providing and updating much relevant information for those in the aviation community.