Aerodrome Safety Publication

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WILDLIFE HAZARD MANAGEMENT AT AERODROME

CONTENTS

Aerodrome Safety Publications are published by the CAAS for purposes of promulgating supplementary guidance materials to the Standards and Recommended Practices (SARPs) in the Manual of Aerodrome Standards. The publications are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with SARPs. Aerodrome Safety Publications may explain certain regulatory requirements by providing interpretive and explanatory materials.

1 Purpose

1.1 The purpose of this Aerodrome Safety Publication (ASP) is to promulgate supplementary guidance material to aerodrome operators on wildlife hazard management at aerodromes. This ASP provides guidance on what is acceptable to demonstrate compliance with the regulatory requirements in Section 13.2.4 of the Manual of Aerodrome Standards (MOAS).

1.2 The appendices provide guidance to aerodrome operators in establishing a wildlife hazard management assessment and programme at their respective aerodromes. Appendix A contains a sample flowchart on the sequence of events that should happen and the recommended forms to use after a wildlife strike or sighting. Appendix B includes a brief description of the risk management related to a wildlife hazard management programme and some suggested factors to be considered for risk assessment matrix. Appendix C contains some techniques used by airports worldwide to effectively deter/reduce the wildlife population within the aerodrome. Aerodrome operators may choose to use these appendices to develop their wildlife hazard management programme.

2 Applicability

2.1 This ASP applies to all aerodrome operators certified under paragraph 67 of the Singapore Air Navigation Order (ANO). Aerodrome operators should examine each item carefully, by considering the size, complexity and scope of operations at the aerodrome to determine what applies.

3 Cancellation

3.1 This ASP supersedes ASP 07/2017.

4 Effective Date

4.1 This ASP takes effect on 15 March 2018.

5 Introduction

5.1 Wildlife such as birds has been a potential hazard to aircraft since the beginning of air travel. Bird strikes were a minor risk in the early days as there were few aircraft in the sky traveling at relatively low speeds. Damage to aircraft was, therefore, limited to shattered windshields, dented leading edges, and some damage to the fuselage. The cost of repairs was small and aircraft operators and aerodrome authorities accepted wildlife strikes as a normal hazard of flying.

5.2 With time, the speed of aircraft increases and engine noise levels dropped with the development of newer generation turbine engines. Aircraft simply

became too quick and too quiet for birds to sense and avoid. Birds inadvertently became a serious threat to aircraft safety as strikes became more frequent and more serious.

5.3 Birds however are not the only wildlife problem for aircraft. Animals such as dogs wandering onto runways can create serious problems for departing and landing aircraft. Other than economic cost of wildlife strikes, the cost in human lives lost when aircraft crashes as a result of strikes amplifies the need for effective management of the wildlife strike problem.

5.4 A good wildlife hazard management programme depends on good reporting. Data may come from wildlife sightings, maintenance problems, wildlife strikes and wildlife control activities. Review of this data identifies problems at the site and may indicate the effectiveness of current wildlife hazard management.

5.5 A wildlife strike has occurred when:

(a) A pilot reports a wildlife strike; or
(b) Maintenance personnel report that aircraft damage is due to a wildlife strike; or
(c) Aerodrome personnel report seeing a wildlife strike; or,
(d) Aerodrome personnel find wildlife remains on airside areas on or in the vicinity of a runway and no other cause of death is identified; or
(e) An animal's presence on the aerodrome had a significant negative effect on a flight (i.e. aborted takeoff, aborted landing, high-speed emergency stop, aircraft and aircraft left pavement area to avoid collision with animal).

6 Wildlife hazard assessment

6.1 Each aerodrome location presents a unique habitat that influences the type and population of wildlife species present. It is therefore essential that the aerodrome operator identify the most appropriate and effective measures to manage them effectively.

6.2 A wildlife hazard assessment provides the basis for the development, implementation, and refinement of a wildlife hazard management programme. It also identifies wildlife trends at the aerodrome and how the fluctuations in wildlife's behavior and abundance may affect aviation safety, with particular emphasis on wildlife strikes to aircraft. Based on the results of the assessment, specific measures or recommendations could be formulated to mitigate wildlife risk at the aerodrome.

6.3 The assessment should be conducted by a suitably qualified person with demonstrated expertise in wildlife hazard management and for a 12-month

period so that an accurate assessment of the wildlife species observed on, and in the vicinity of the aerodrome at various times of the year can be evaluated and assessed.

6.4 Details of the assessment should include but not limited to the following:

a) Identification of the wildlife species, including migratory species observed, their numbers, locations and movement patterns of the wildlife at different times of the year;
b) Wildlife strike records and analysis;
c) Airport and aircraft operational procedures;
d) Identification, description and location of wildlife attractants on and in the vicinity of the aerodrome; and
e) Mitigating actions for reducing wildlife hazards

6.5 General observation data and other information related to airport and aircraft operations regarding wildlife hazards for instance aeronautical information publications, wildlife strike reports should be gathered and assessed to see if the information provided is adequate. In addition, the assessment should also take into account the size of wildlife species observed relative to the type of aircraft that normally operates at the aerodrome to assess the associated wildlife risk. Specific information regarding the wildlife hazards instead of a blanket advisory should be issued by the aerodrome operator.

6.6 Assessment of air traffic control's involvement in identifying potential hazards as observed or relayed by pilots or airport personnel could include determining whether wildlife dispersal is coordinated with air traffic control such that hazards are not inadvertently increased by dispersing wildlife into the path of aircraft movements. 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. In addition, air traffic control should provide the wildlife hazard management team access to maneuvering areas, and also communicate with them during the implementation of mitigation measures to ensure dispersal paths are observed and de-conflicted with aircraft movements.

7 Wildlife hazard management programme

7.1 Aerodrome operator should develop and implement a wildlife hazard management programme tailored to local conditions to reduce the identified wildlife risks on and in the vicinity of his aerodrome. The aerodrome operator could also use the results from the wildlife hazard assessment to refine its wildlife hazard management programme. Though the scale and details of the programme may vary from airport to airport, it should contain the following information:

(a) Roles and responsibilities of wildlife hazard management officers;

(b) Training programme for wildlife hazard management officers;
(c) Process for reporting, collecting and recording wildlife data;
(d) Analysis of wildlife strike data;
(e) Risk management and mitigation;
(f) Evaluation of wildlife hazard management programme
(g) A list of all wildlife attractants at the aerodrome;
(h) A list of all wildlife attractants in the vicinity of the aerodrome; and
(i) Techniques to curb the increase in the wildlife population
(j) Liaison with relevant agencies on land use developments in the vicinity of the aerodrome.

8 Roles and responsibilities of wildlife hazard management officers

8.1 The roles and responsibilities of personnel are important elements of the aerodrome operator's safety management system and contribute to the effectiveness of the wildlife hazard management programme.

8.2 Senior management, or their designate, should be responsible for the overall management of the wildlife hazard management programme on a long-term as well as a daily basis at the site-specific level. This should include the nomination of the Wildlife Hazard Management Officers, coordination of training, safety assurance and ensuring that the necessary resources are available.

8.3 Wildlife hazard management officers should ensure that patrol of the fence line i.e. the boundaries of the aerodrome, is done regularly. Any washouts, breaks, or other holes in the fence should be fixed as soon as they are discovered to prevent other wildlife species, especially dogs from entering the airside.

The wildlife hazard management officers should be responsible for:

(a) Surveillance of wildlife activities on and in the vicinity of the aerodrome;
(b) Establishing and maintaining the wildlife management log (e.g. strike data, details on wildlife numbers and activity; wildlife control measures undertaken, firearm use details; details on the use of lethal reinforcement and monthly summaries);
(c) Filing of autopsy, wildlife strike and wildlife sighting reports;
(d) Reviewing and analysing wildlife strikes/wildlife sighting reports ;
(e) Coordinating the wildlife monitoring program (e.g., including wildlife hazard consultant, control tower, airfield inspection team and external agencies/contractors including aircraft operators);

(f) Preparing the wildlife strike report and submit to the Aerodrome and Air Navigation Services Regulation (AAR) Division for inclusion in the ICAO Bird Information System (IBIS);

(g) Ensuring that aerodrome operations are consistent with the requirements of the wildlife hazard management programme;

(h) Periodic review and updates of the programme;

(i) Ensuring that the appropriate permits required for conducting deterrent activities such as culling of wildlife and handling of firearms are current and present on-site;

(j) Undertaking deterrent activities;

(k) Ensuring all activities undertaken follow strictly to the aerodrome Safety Management System (SMS) guidelines;

(l) Identifying equipment, resources and training needs of relevant personnel; and

(m) Provision of training and awareness programmes.

8.4 In addition, the aerodrome operator should form a wildlife hazard management committee to discuss wildlife issues. This committee should be attended by representatives from the various divisions involved in wildlife control, airport planning, maintenance and operations. It should also include air traffic services, aircraft operators and other external agencies/contractors that may affect wildlife control. The forum can be used to review wildlife strike/wildlife sighting reports, safety indicators, and periodic activity records to determine effective control measures to curb wildlife activity on and in the vicinity of the aerodrome. It is also a channel to discuss and to make inter-divisional decisions arising from the wildlife activity issues.

9 Training programme for wildlife hazard management officers

9.1 It is imperative that wildlife hazard management officers are able to demonstrate competence, are trained by qualified personnel and are provided with the appropriate resources and equipment to carry out their jobs.

9.2 Aerodrome operator should include the procedures for the training of officers involved in wildlife hazard management in their wildlife hazard management programmes. The following areas of training and levels of skill are suggested for officers involved in the wildlife hazard management programme:

(a) Bird Identification

9.3 There are many species of birds that reside in or migrate through Singapore. Some species are present in an area all year and others only in migration (around September to April). All these species have unique vocalizations, behaviours and habitat preferences. Knowledge of these unique characteristics is useful to the officers in field identification. Thus, to become an expert in field identification of all bird species at a location requires many years of training and practice. Bird species may also be different in different aerodromes, making bird identification more challenging for the officers. Officers require basic training, including on-the–job training so that they can identify these bird species found in the aerodrome.

9.4 Binoculars are essential for detailed, close-up observation. They are also useful for the detection and identification of birds at a distance.

9.5 Every officers should also be equipped with a wildlife identification field guide, to be carried in the vehicle while on patrol. As a learning aid, officers should be encouraged to make annotations in their field guides regarding behaviour or appearance next to identified wildlife.

(b) Biology and behaviour of bird species

9.6 In addition to learning to identify the birds on an aerodrome, officers should have some understanding of the biology and behaviour of these species. Understanding the daily movement patterns between roosting, feeding and loafing areas in relation to the aerodrome of the species of bird is one of the examples. This information will make the job of the officers more interesting and useful in anticipating problems and deploying control measures more effectively.

(c) Other wildlife species identification

9.7 Other wildlife species commonly found in Singapore aerodromes are dogs, cats, snakes and tortoises. Officers should be trained to identify, not only by sight but also by signs (e.g. tracks, trails in grass and fecal material).

(d) Documentation and Strike Reporting

9.8 A key component of a wildlife hazard management programme is to develop a system to document the daily activities of the wildlife hazard management officers involved, log information about wildlife numbers and behavior at the aerodrome, and record all wildlife strikes. Reporting is necessary as a source of data for analysis. This information is extremely useful during evaluations of the wildlife hazard management programme and when revisions to the plan are proposed. Such evaluations could be annual or when there is a wildlife strike with aircraft damage or a sudden increase in wildlife strikes. Officers should be instructed on the

importance of documentation and trained to record such information in a standardised format.

9.9 Appendix A shows a sample of the flowchart of the reporting procedures for reporting wildlife strikes and wildlife sighting by airside personnel and their respective forms. Aerodrome operators should have their own reporting procedures in place.

(e) Wildlife strike risk assessment, risk management principles and how they integrate with the airport's safety management system.

9.10 An understanding of the methods used for evaluating wildlife strike risk and how this can be applied to the aerodrome environment.

(f) Passive and active dispersal techniques

9.11 An understanding of how to disperse wildlife and the benefits and advantages of using different active and passive management techniques on an aerodrome and the applicability of techniques to different situations including safety aspects relating to the equipment and methods used.

9.12 To ensure that the wildlife hazard management officers maintain competence, annual refresher or another system of monitoring should be implemented by the aerodrome operator.

10 Collecting, reporting and recording wildlife data

10.1 All wildlife strikes should be reported to the aerodrome operator so as to obtain an accurate assessment of the wildlife risk. Wildlife management hazard officers should record all details in a consistent manner. Airline and other airport staff should also be encouraged to report all details of the strikes.

10.2 Daily wildlife surveys should be conducted to monitor the wildlife species and their habitats in the aerodrome so as to manage them effectively. The frequency of surveys should correlate to the severity of the wildlife hazard and the timing of the monitoring should be such to provide a complete coverage of wildlife activity as appropriate to the aerodrome. A record of the number, wildlife species and location of wildlife seen should be maintained. It should also contain the actions taken to disperse the wildlife and the results of this action.

10.3 In addition to monitoring wildlife in the aerodrome, the aerodrome operator should also conduct wildlife monitoring in the vicinity of the aerodrome to cover any obvious concentrations of wildlife and/or sources of wildlife attraction (i.e. habitat, migratory routes, feeding and breeding areas) which could contribute to the risk at the aerodrome.

10.4 The outcome of the wildlife monitoring should be recorded and the records should be maintained to provide details of the wildlife populations and behaviour over time. This, combined with the 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 wildlife.

11 Analysis of wildlife strike data

11.1 The review of wildlife strike data identifies problems at the site and may indicate the effectiveness of current wildlife control measures. It is important to note that due care must be exercised while interpreting the data collected. The straightforward total number of strikes at an airport may not be a good indicator of risk, and examination of the data by species struck and the distinguishing of multiple from single strikes are critical. If an increase in recorded strikes is attributable to an increase in incidents caused by encounters with single small wildlife, whereas the number of strikes involving large wildlife species and/or flocks of wildlife is falling, then this may well be indicative of both better wildlife control and better reporting of strikes.

11.2 Actual wildlife strikes may not provide the whole picture. The recording (via routine safety reports of occurrences) of potentially hazardous wildlife activities or near miss events can also be very useful. Such data should also be analysed to give a better conclusion on the wildlife activity on and in the vicinity of the aerodrome.

11.3 Wildlife strike database should be analysed to determine a number of trends including but not limited to:

(a) Wildlife species that create problems overall and at particular locations;
(b) Problematic times of the day and year;
(c) Yearly strike trends by location;
(d) Phase of flight when strikes are most likely to occur;
(e) Types of aircraft most likely to be struck;
(f) Parts of the aircraft most likely to be struck;
(g) Effects of strikes on aircraft;
(h) Percentage of strikes that are damaging and affect flight;
(i) Costs associated with strikes; and
(j) Altitude at which strikes occur.

11.4 It may also be important to periodically summarise information from the daily wildlife activities log and wildlife strikes records to provide baseline data for analysing and evaluating the wildlife hazard management programme. A logical approach is to conduct monthly summaries which

are then incorporated into a quarterly or semi-annual report. These summaries do not need to be complex but must reflect the level of activity for the common control techniques deployed. For example, monthly summaries of runway sweeps to disperse birds, distress call deployments, number of wildlife removed may be useful.

12 Risk management and mitigation

12.1 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 wildlife on or near an aerodrome.

12.2 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 wildlife strike by a particular group of wildlife multiplied by the severity of damage to the aircraft that results. Risk is also influenced by the type of aircraft and their operations.

12.3 Risk assessment is an important part of a wildlife hazard management programme because it serves to ensure that wildlife management activities are directed at the species that create the highest risk, in a prioritised fashion.

12.4 Appendix B shows some suggested factors that should be included into a risk assessment matrix that could be used for the wildlife hazard management programme. Aerodrome operators are strongly encouraged to have their own risk assessment put in place. They should, at the same time, exercise due care to see what applies at their aerodrome, especially the different species of wildlife found on or in the vicinity of the aerodrome.

12.5 The risk assessment would need to estimate the probability that a strike will occur and the likely level of severity that it will result. Based on analysis of various wildlife strike databases around the world, there is a consistent relationship between wildlife mass and the level of damage to aircraft. In addition, strikes involving flocks of birds (even small species) are also more likely to result in damage to the aircraft than strikes with single birds.

12.6 The most common form of risk assessment involves the categorisation of strike probability and likely severity into arbitrary levels for instance low, medium and high. Strike severity can be estimated based on the mass of wildlife involved, with a correction for their tendency to occur in groups. For strike probability, it would require some specialist knowledge of the behaviour of the wildlife species involved and how that behaviour is influenced by the environment around the airport concerned. A typical option for risk assessment may involve using the number of strikes with different wildlife species over the recent past as a measure of the

probability of likely future strikes. However, for this to work reliably, all or most of the wildlife strikes need to be reported consistently from year to year, with wildlife species involved identified correctly.

12.7 Once the risk assessment is completed, the aerodrome operator has to develop mitigating measures to deal with the risks identified. Aerodrome operators should ensure that the measures are reviewed periodically so that the level of effectiveness is maintained at an acceptable level defined by the aerodrome operator. Guidance material on risk assessment is contained in ICAO Safety Management Manual Doc 9859.

13 Evaluation of Wildlife Hazard Management Programme

13.1 The following questions are designed to assist in determining if there is an effective wildlife hazard management programme in place at an aerodrome.

(a) Has a wildlife hazard management programme been developed?
(b) Has the wildlife hazard management programme been implemented?
(c) What is the wildlife strike rate at the airport over the last five years (with and without damage to the aircraft)?
(d) Is there a procedure to collect information about wildlife, both dead (carcasses) and living?
(e) Has a wildlife hazard management officer at site been appointed and responsibilities assigned?
(f) Has a training programme been developed to train those involved in the wildlife hazard management programme?
(g) Has a wildlife hazard management forum been established with well-defined responsibilities?
(h) Has a reporting procedure been developed covering all aspects of the wildlife hazard management programme?
(i) Has a land-use plan been established with regard to effective land-use on and off the aerodrome as it pertains to the wildlife hazard management programme?
(j) Has a list of all wildlife attractants at the aerodrome been completed and updated?
(k) Has a list of all wildlife attractants in the vicinity of the aerodrome been completed and updated?
(l) Have wildlife hazard management methods been researched and implemented at the aerodrome?

13.2 Wildlife species on and in the vicinity of aerodromes are constantly changing in response to changes in land use, state management policies, and environmental factors. In addition, wildlife might adapt or habituate to control strategies that were once effective, or they might develop new

behavioral or feeding patterns on or near the aerodrome. New wildlife control technologies might become available, or established products or techniques might be withdrawn or banned. There might also be changes in wildlife hazard management and management personnel at an aerodrome.

13.3 Thus, once a wildlife hazard management programme is in place, there is a need to develop a process to evaluate the programme at least annually and update the programme as needed.

13.4 The foundation for these evaluations is the maintenance of consistent records of wildlife hazard management activities and wildlife strikes. Consistent records permit easy compilation of events and activities into monthly and annual statistical and narrative summaries. Once these summaries are available, objective examinations and comparisons can be made of trends in strikes, wildlife activities, control methods deployed, and other factors.

14 A list of all wildlife attractants at the aerodrome

14.1 Wildlife attractants at the aerodrome should be properly identified and reviewed in a wildlife hazard management programme. The aerodrome operator should understand the behaviour of the wildlife and the reasons for them to come to the aerodrome. This would help in eliminating or reducing the number of wildlife strikes and wildlife sightings at these areas.

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

14.3 The following is a list (non-exhaustive) of potential wildlife attractants that may be found at the aerodrome:

(a) Grass/Turf areas;
(b) Water bodies, ditches and drains;
(c) Other food sources such as food and beverages stores, food disposable bins;
(d) Shelter in hangars and in nooks of other buildings; and
(e) Trees and vegetation

15 A list of all wildlife attractants in the vicinity of the aerodrome

15.1 In order to have a successful wildlife hazard management programme, the aerodrome operators should also identify wildlife attractants in the vicinity of the aerodrome and notify the relevant authorities to remove the attractants if necessary. These wildlife attractants are often overlooked as

there may seem to be no direct relationship between the number of wildlife strikes/wildlife sightings and the wildlife attractants found in the vicinity of the aerodrome. This process should be repeated as required to identify new sites or changes in the risk levels produced by existing sites. The following is a list (non-exhaustive) of potential wildlife attractants that may be found in the vicinity of the aerodrome:

(a) Food sources;
(b) Dumping facilities;
(c) Favourable roosting and nesting areas;
(d) Trees and vegetation;
(e) Construction sites; and
(f) Golf courses.

16 Techniques to curb the increase in the wildlife population

16.1 A successful wildlife hazard management programme should also include techniques to curb wildlife from coming to the aerodrome. There are passive and active techniques used all over the world and some of these techniques are listed in Appendix C. Aerodrome operators may use this list as a guide to select the appropriate techniques for their aerodromes.

16.2 In addition, for the long-term, aerodrome operators should be well informed on the latest technique available in the industry and study its suitability and effectiveness. This would mean that the aerodrome operators need the support of the senior management to ensure that the wildlife hazard issue can be holistically addressed.

17 Liaison with relevant agencies on land use developments in the vicinity of the aerodrome

17.1 Aerodrome operator should put in place safeguarding systems to guard against new or increased wildlife hazards caused by developments both on and in the vicinity of the aerodrome. The wildlife hazard management programme should include details of activities employed by the aerodrome operator to control or influence areas beyond the aerodrome boundary as determined by risk assessment and where practicable, could include:

(a) establishment of a process with the relevant agencies for consultation on proposed developments that have the potential to be wildlife attractant in the vicinity of the aerodrome;

(b) means to influence land use and development in the vicinity of the aerodrome such that the wildlife strike risk does not increase and, where practicable, is reduced; and

(c) Procedures to conduct and record the results of off-aerodrome site monitoring visits.

18 Reference

Singapore Air Navigation Order (ANO);
Manual of Aerodrome Standards (MOAS);
ICAO Annex 14, Volumes I;
Doc 9137 – Airport Services Manual, Part 3, Wildlife Control and Reduction;
Doc 9859 – ICAO Safety Management Manual
FAA AC150/5200-33 – Hazardous wildlife attractants on or near airports
UK CAA CAP 772 Wildlife hazard management at aerodromes

19 Queries

If there are any queries with regard to this Aerodrome Safety Publication, please address them to:

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Appendix A – Flowcharts for reporting of wildlife strike and sighting

A sample of the reporting flowchart for wildlife strike and sighting and the recommended forms are as shown below:

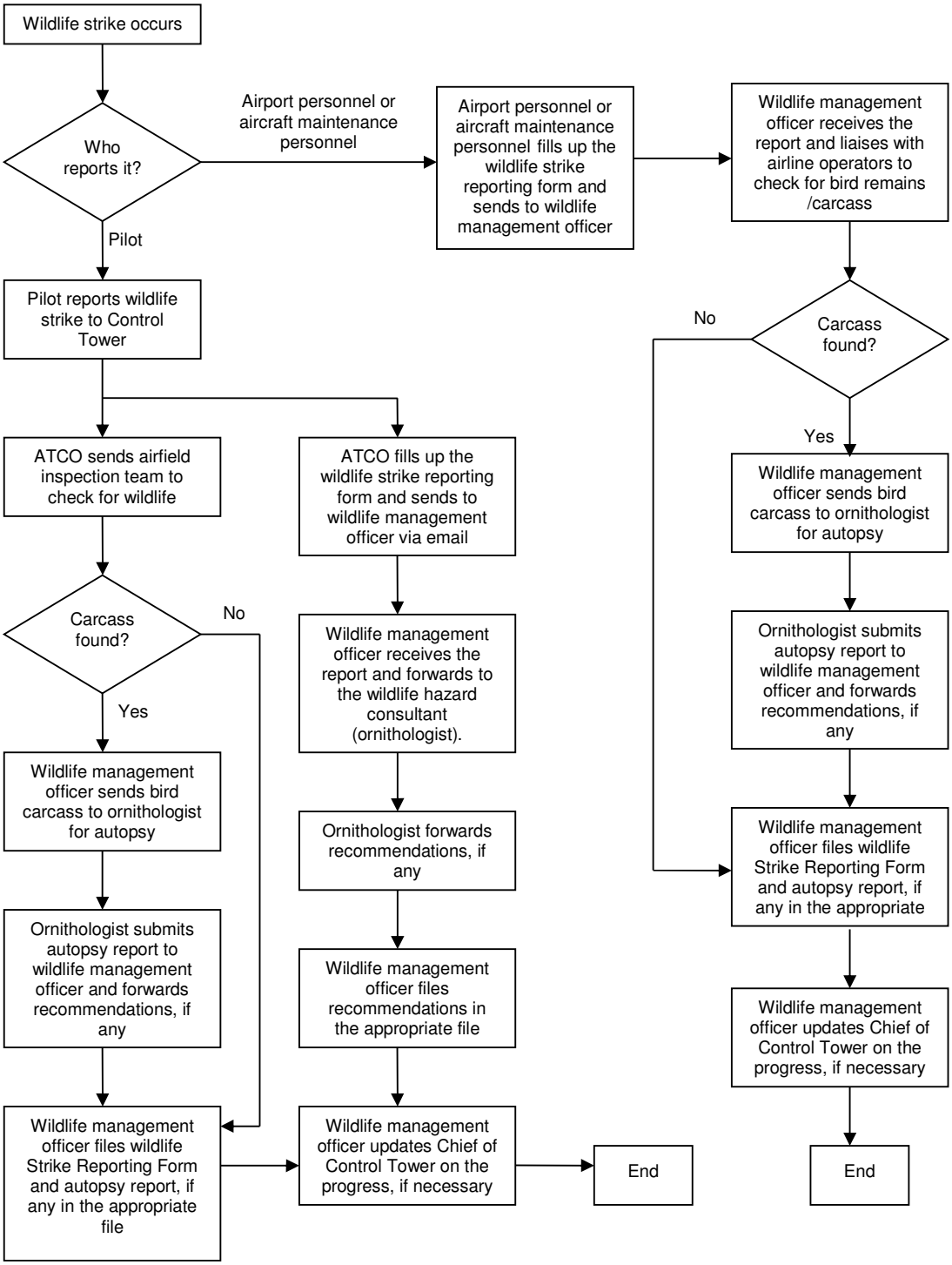

Figure 1: A Sample Flowchart for Reporting of Wildlife Strike

WILDLIFE STRIKE REPORTING FORM

(This information is required for aviation safety)

OPERATOR or CALL SIGN

AIRCRAFT TYPE [ ]

ENGINE TYPE [ ]

AIRCRAFT REGISTRATION [ ]

DATE **Day** [ ] **Month** [ ] **Year** [ ]

TIME OF INCIDENT [ ] **(UTC)** [ ]

Dawn ☐ Day ☐ Dusk ☐ Night ☐

AERODROME NAME [Aerodrome]

RUNWAY USED [RWY]

HEIGHT AGL [Height]

APPROX. GEOGRAPHICAL LOCATION

SPEED (IAS) **kt**

PHASE OF FLIGHT

☐ Unknown ☐ En-route
☐ Taxi ☐ Descend
☐ Take-off run ☐ Approach
☐ Climb ☐ Landing Roll

SKY CONDITION

☐ No Cloud
☐ Some Cloud
☐ Overcast

PRECIPITATION

☐ Fog
☐ Rain

PART(S) OF AIRCRAFT

	Struck	Damage
Radome	☐	☐
Windshield	☐	☐
Nose (excluding above)	☐	☐
Engine No. 1	☐	☐
2	☐	☐
3	☐	☐
4	☐	☐
Propeller	☐	☐
Wing/Rotor	☐	☐
Fuselage	☐	☐
Landing gear	☐	☐
Tail	☐	☐
Lights	☐	☐
Other	☐	☐

Specify: [Specify here]

WILDLIFE SPECIES * [ ]

NUMBER OF WILDLIFE SPECIES **Seen** **Struck**

SIZE OF WILDLIFE SPECIES ☐ Small ☐ Medium ☐ Large

PILOT WARNED OF WILDLIFE SPECIES ☐ Yes ☐ No

LIGHTS USED :

Landing ☐ Yes ☐ No

Strobe Anti-Collision ☐ Yes ☐ No

EFFECT ON FLIGHT

☐ None
☐ Aborted take-off
☐ Precautionary landing
☐ Engines shut down
☐ Other (Specify)

REMARKS

** Send all wildlife species remains to :*

Figure 2: Wildlife strike reporting form

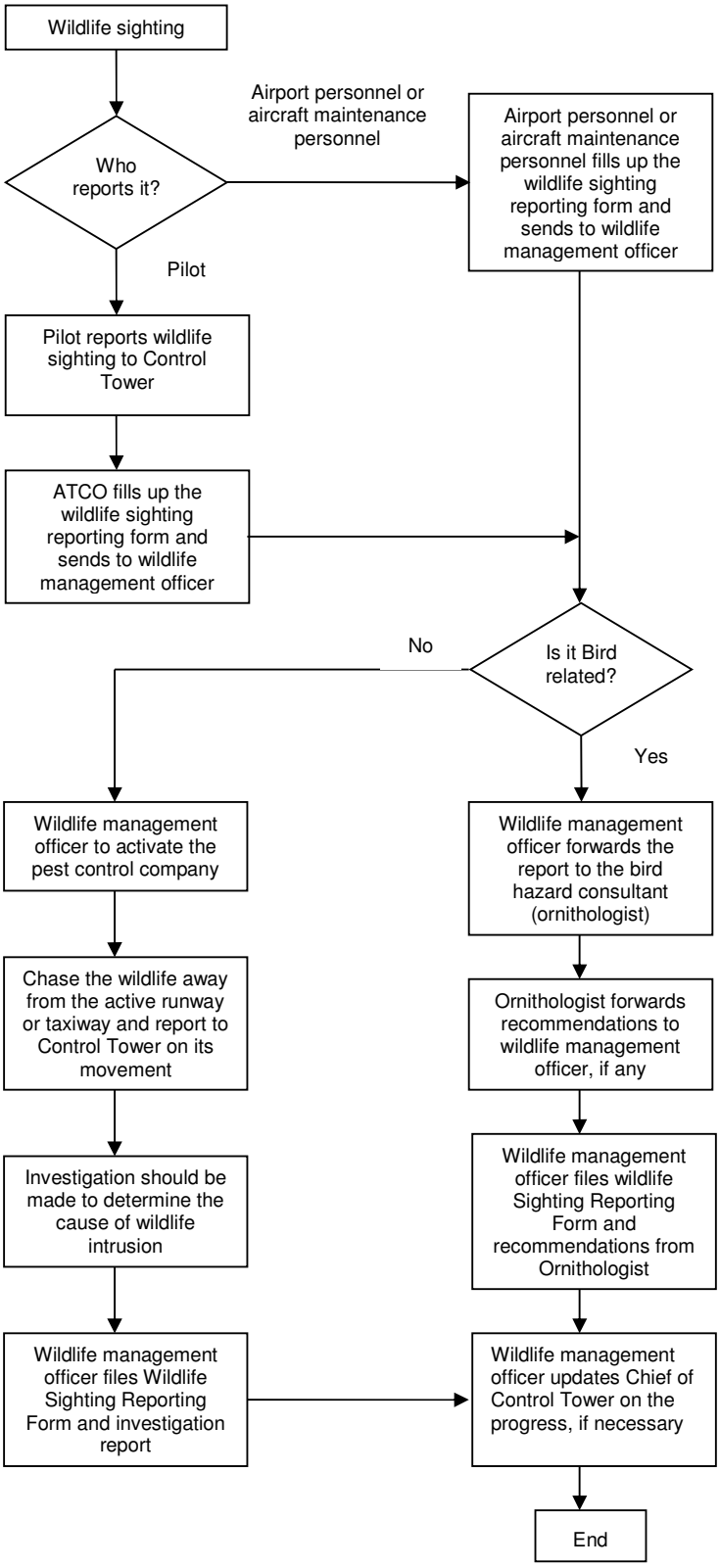

Figure 3: A Sample Flowchart for Reporting of Wildlife Sighting

WILDLIFE SIGHTING REPORTING FORM

(This information is required for aviation safety)

OPERATOR OR CALL SIGN		**AIRCRAFT TYPE**	
ENGINE TYPE		**AIRCRAFT REGISTRATION**	
DATE (UTC)		**TIME OF INCIDENT**	**UTC**
		Day	
RUNWAY USED		**APPROX. GEOGRAPHICAL LOCATION**	
HEIGHT AGL			
SPEED(IAS)			

PHASE OF FLIGHT		**SKY CONDITION**	
		PRECIPITATION	

PART(S)OF AIRCRAFT			
		BIRD SPECIES *	
Radome			
Windshield		**NUMBER OF BIRDS**	**Seen** :
Nose(excluding above)			**Struck**:
Engine No.1		**SIZE OF BIRD**	
2			
3		**PILOT WARNED OF BIRDS**	
4			
Propeller		**LIGHTS USED:**	
Wing/Rotor		**Landing**	
Fuselage		**Strobe Anti-Collision**	
Landing gear			
Tail			
Light			
Other			
Specify			

EFFECT ON FLIGHT		**Remarks**	
Watch Manager Name			
Created By			
Modified By			

Figures 4: Wildlife sighting reporting form

Appendix B – Risk management

NOTE: The purpose of this appendix is to provide aerodrome operators with a recommended list of factors to be considered in the risk assessment of wildlife hazard management programme. Each wildlife hazard management programme is unique to the particular aerodrome and it might require some specific types of risk management and measures to curb the increase in the number of wildlife strikes and wildlife sightings. Aerodrome operators must fully understand these considerations in order to implement the wildlife hazard management programme effectively.

In risk management, aerodrome operators should consider the identification of hazards (which are wildlife-related hazards), its consequences (which may be aircraft damages, loss of lives, etc) and the related risks (in terms of probability and severity) involved. This is in line with the aerodrome Safety Management System (SMS) that shall be put in place by the aerodrome operator – an aerodrome certification requirement.

A risk assessment matrix should be used in a wildlife hazard management programme. Suggested factors that should be considered in a risk assessment matrix are as follow:

(a) Types of aircraft/aircraft classification;
(b) Volume of air traffic movement;
(c) Wildlife species; and
(d) Size of wildlife/wildlife movements.

The probability and severity measures can be combined into a 5 x 5 risk matrix as shown in Table 1 below.

SEVERITY	PROBABILITY				
	Very high	Moderate	High	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

Table 1: A Sample of a 5 × 5 risk assessment matrix

With the risk assessment matrix put in place, the risk indexes should be classified into different categories for example, green, amber and red. An example of such classification and its suggested criteria is as shown in the Table 2:

Category	Suggested Criteria
Red	Risk from this species is currently very high. Additional management actions should be implemented for this species as soon as possible.
Amber	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.
Green	Risk from this species is currently low. No further action is required beyond the risk management measures currently in place.

Table 2: A Sample of Risk Categories

Aerodrome operators may modify this table to suit their own wildlife hazard management programme. It is essential that the actions are followed up, in particularly, for those under the Red region, a list of available actions should be developed in consultation with wildlife management specialist. It is also equally important that the effectiveness of these options is evaluated at appropriate intervals after they are implemented. It is recommended to repeat the risk assessment process annually to determine if the risk is falling to an acceptable level.

More guidance material on risk assessment is contained in ICAO Safety Management Manual, Doc 9859.

Appendix C – Suggested list of techniques commonly used

There are numerous techniques used by different aerodromes all over the world to curb the increase in the bird population. Generally, these techniques can be divided into 2 categories: Passive techniques and Active techniques.

Passive techniques

Passive techniques are generally those that alter habitat or permanently exclude entry (See Table 1 below). Wildlife hazard management officers should know very well which measures are applicable and effective for their aerodrome.

Examples	Suggested Approaches
Grass/Turf areas	• Manage height according to hazards at the airport • Adaptive management, experimental manipulation at individual aerodrome
Buildings	• Ensure entry holes/crevices blocked, screened, netting • Influence design of new buildings, slope ledges • Porcupine wire, electric shocking, sticky caulking • Minimise exposed areas that birds can use for perching and nesting
Open water, ponds, ditches, drains, poorly drained areas	• Drain, improve drainage • Over-wire, netting, BirdBalls™ • Grade slopes steeply, remove vegetation
Shrubs, trees, brush, hedges, woodland	• Remove, including undergrowth and understorey layers • Reduce biodiversity, habitat niches • Thinning the canopy of trees or selectively removing trees to increase their spacing • Avoid plants that produce fruits and seeds desired by wildlife
Infield perching features	• Remove when possible • Apply spikes when required
Waste storage	• All disposal containers must be wildlife proof • Eliminate dumps on the airport
Fencing	• Proper fencing • Regular inspection to fix any washouts, holes
Outdoor picnic areas	• Signage • Provide wildlife proof garbage containers
Aircraft	• Ensure that bird nesting does not occur within parked aircraft

Table 1: A Sample of Passive Techniques

Active techniques

Active techniques fall into two major subgroups. There are:

(a) Dispersal (various kinds of deterrents, hazing); and
(b) Removal (live capture, killing)

Birds often habituate to non-lethal threats within a few weeks, hence in the long-term, dispersal techniques are seldom effective unless a clear and present danger is presented to the birds (e.g. with a dog or live gunshot). Table 2 below shows some examples of active techniques that can be used to deter/reduce birds from coming to the aerodrome.

	Technique
Non-lethal	Pyrotechnics
	Gas cannons
	Report Shells
	Lasers
	Falconry
	Border Collies
	Live trapping
	Chemical – irritants
	Playback of distress calls – remote system
	Playback – mobile
	Flags
	Dead specimen birds
	Chemical - behavioural repellents
	Radio-controlled models
	Hand-held laser projectors
Lethal	Lethal trapping
	Chemical – lethal control
	Chemical – Benomyl/Tersan fungicide
	Earthworm sweeping
	Surfactant water sprays
	Live-ammunition shooting

Table 2: A Sample of Active Techniques