Safety Regulation Group

Civil Aviation Authority

CAP 772

Birdstrike Risk Management for Aerodromes

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Revision History

Amendment 1 **1 September 2008**

Amendment 1 includes changes as listed below:

Chapter 3 paragraph 2.4	Amended to include updated guidance on the importance of information sharing.
Chapter 4, paragraphs 3.3.7 to 3.3.11	Updated to include details of the Wildlife & Countryside Act, with regard to Licences for the purpose of using lethal methods to control birds.
Chapter 5	Complete new chapter, giving guidance on definitions, birdstrike reporting, the importance of species identifications, data management and information sharing.

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Introduction

1 The UK, as a signatory to the Convention on International Civil Aviation, Chicago 1944, has adopted many of the provisions specified in Annex 14 to the Convention. Annex 14, published by the International Civil Aviation Organization (ICAO), includes standards and recommended practices (SARPs) that address the risk of a birdstrike and a potential increase of the birdstrike risk due to the presence or development of bird-attractant features on, or in the vicinity of, an aerodrome.

2 Under the heading "birdstrike hazard reduction", Annex 14 Volume 1 (4th Edition Amendment 9) states that "*the birdstrike hazard on, or in the vicinity of, an aerodrome shall be assessed through:*

a) the establishment of a national procedure for recording and reporting bird strikes to aircraft; and

b) the collection of information from aircraft operators, airport personnel, etc. on the presence of birds on or around the aerodrome constituting a potential hazard to aircraft operations."

3 Annex 14 also states that "*when a birdstrike hazard is identified at an aerodrome, the appropriate authority shall take action to decrease the number of birds constituting a potential hazard to aircraft operations by adopting measures for discouraging their presence on, or in the vicinity of, an aerodrome*." Annex 14 goes further by stating that "*the appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any such other source attracting bird activity on, or in the vicinity of, an aerodrome unless an appropriate aeronautical study indicates that they are unlikely to create conditions conducive to a bird hazard problem*."

4 The term "*in the vicinity*" is taken to be land or water within 13 km of the aerodrome reference point, and "*garbage disposal dumps*" refers to landfill sites (i.e. the disposal of waste by landfill) as defined under relevant UK legislation. An "*appropriate aeronautical study*" is taken to be a study that focuses on the potential flight safety implications at the relevant aerodrome(s) that an existing or proposed bird attractant development may cause. Such a study should consist of the overall assessment of the ambient birdstrike risk at the aerodrome and a site-specific risk assessment relating to any development or site in the vicinity. An "*appropriate authority*" is deemed to be an authority that has the power to take action in a particular situation. A further explanation of risk assessment factors is detailed in Chapter 3.

5 In the UK, the aerodrome licence holder shall take all reasonable steps to secure that the aerodrome and the airspace within which its visual traffic pattern is normally contained are safe at all times for use by aircraft (Article 128(5) of the Air Navigation Order (ANO) 2005). The licence holder is therefore responsible for the development and implementation of birdstrike risk control measures. This document provides guidance on how the risk of a birdstrike at, or in the vicinity of, an aerodrome may be assessed and what risk reduction measures may be taken to comply with the licensing criteria specified in CAP 168, *Licensing of Aerodromes*, which are based on ICAO Annex 14 SARPs. Birdstrike risk management is an integral part of the aerodrome operator's safety management culture and its safety management system (SMS).

6 The reporting of birdstrikes in the UK is mandated by Article 143 of the ANO, and is described in Chapter 5.

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Chapter 1 The Management of the Birdstrike Risk

1 Principles and objectives

1.1 As with other forms of aviation risk, the management of the risk of a birdstrike involves specialist knowledge and specific measures. These measures are aimed at deterring birds from flying on and in the lower flightpaths in the vicinity of the aerodrome and primarily include the use of risk assessment, aerodrome habitat management, bird control procedures and safeguarding. However, the birdstrike risk is not uniform across all types of aerodromes and flight operations, and therefore it is essential that the most appropriate measures are identified and adopted to suit the local situation. Effective techniques in risk assessment, bird control, habitat management and safeguarding exist that can reduce the presence of birds on aerodromes and the risk of a birdstrike.

1.2 The basis of all birdstrike risk management policy and action is the planning and the effective use of human resources, procedures and diligence which reflects the principles of safety management that an aerodrome operator is required to apply to aspects of aircraft operations within its responsibility.

1.3 The objective of birdstrike risk management is to implement a birdstrike risk management policy and those measures necessary to reduce the birdstrike risk to the lowest practicable level.

2 Bird Control Management Plan

2.1 The aerodrome operator should develop a Bird Control Management Plan (BCMP) to assess the birdstrike risk, and to define and implement the appropriate bird control measures to reduce or mitigate the risk. The plan should also record the results of birdstrike risk assessments that are conducted and specify the birdstrike risk mitigation measures that are in place. The measures should relate to the threat posed by each identified risk and, due to the relative unpredictability of bird activities, should be responsive to changes as the risk rises or falls. Those measures may include the bird control techniques detailed in this and other authoritative documents[1].

2.2 For aerodrome operators, the emphasis should be to minimise the presence of flocks of birds on, or in the vicinity of, the aerodrome as much as possible. However, this may be difficult outside the aerodrome boundary. Nevertheless, an awareness of bird attractant activities taking place, such as farmers ploughing fields, and constructive dialogue with the landowner should permit timely and effective action to be carried out.

2.3 A BCMP should, at minimum, include details of:

a) The roles and responsibilities of aerodrome management and bird control personnel;

b) The policies and procedures for:

i) risk identification and assessment;

1. Other useful references include:
International Birdstrike Committee, *Recommended Practices No.1 Standards for Aerodrome Bird/Wildlife Control,* Issue 1, October 2006.
Airports Council International (ACI) *Aerodrome Bird Hazard Prevention and Wildlife Management Handbook*, 1st Edition, 2005.

ii) on-aerodrome bird control, including when low visibility operations are in place;

iii) the recording of bird control activities;

iv) reporting bird control issues;

v) bird control performance monitoring, measurement and improvement systems;

vi) personnel training and appraisal;

vii) recording and analysis of birdstrike reports;

viii) the logging of bird species and data analysis;

ix) recording the results of birdstrike risk assessments that are conducted;

x) obtaining permissions for control measures, as necessary; and

xi) the periodic assessment and review of the birdstrike risk recording and information system, bird control procedures and associated activities;

c) details of the birdstrike risk assessments that are conducted and the birdstrike risk mitigation measures that are in place;

d) the means to ensure that flocks of birds, whether resident or visiting, do not habituate[2] on the aerodrome, achieved through the deployment of effective habitat management and bird dispersal and control measures to reduce bird activity on the aerodrome (see Chapter 4); and

e) the activities employed by the aerodrome operator to control or influence areas in the vicinity of the aerodrome to minimise the attraction to birds, including the:

i) establishment of a safeguarding process with the local planning authority for consultation on proposed developments that have the potential to be bird attractant within 13 km of the aerodrome;

ii) means to influence land use and development surrounding the aerodrome so that the birdstrike risk does not increase and, wherever possible, is reduced;

iii) means to help encourage landowners to adopt bird control measures and support landowners' efforts to reduce birdstrike risks; and

iv) procedures to conduct, and record the results of, site monitoring visits.

2.4 The BCMP should be referred to or included in the Aerodrome Manual and made available to audit by the CAA.

2. Cease to react to meaningless stimuli. Habituation is one of the simplest forms of learning shown by all animals.

Chapter 2 Roles and Responsibilities

1 Introduction

1.1 The roles and responsibilities of all personnel, including those applicable to bird control, are important elements of the aerodrome operator's safety management system and a contribution to the effectiveness of the BCMP. All personnel should have a thorough understanding of their roles within the plan and be able to collaborate actively with other organisations on and off the aerodrome, such as air traffic control and local landowners. The roles and responsibilities of personnel associated with bird control duties undertaken on a typical aerodrome are described in this chapter. The roles and responsibilities may be adjusted to suit an aerodrome's specific bird control circumstances.

2 Aerodrome Manager

2.1 Although the aerodrome licence holder has overall accountability for bird control, responsibility for bird control and the implementation of the BCMP at the aerodrome may be delegated, usually to the aerodrome manager or another senior person in the airside operations function. The core responsibilities of such a person, with respect to the BCMP, are to:

a) assess the birdstrike risk level;

b) determine policy and produce the BCMP;

c) provide resources for the implementation of BCMP;

d) implement the BCMP; and

e) ensure that the BCMP reference or inclusion in the Aerodrome Manual is correct.

2.2 The aerodrome manager's role should involve tasks that include the:

a) monitoring and acting on habitat changes on and in the vicinity of the aerodrome and development of appropriate management and control activities;

b) implementation of habitat management/long grass policy maintenance programmes in accordance with the BCMP, and to introduce modifications to the maintenance programmes as necessary;

c) analysis and interpretation of log records of bird control activities, birdstrike reports and bird count data;

d) regular survey of bird concentrations and movements in the local area and liaison with local bird watchers for additional information;

e) liaison with local landowners on mitigation action;

f) liaison with local landowners, farmers and gamekeepers to obtain intelligence on farming plans, game conservation, etc.;

g) monitoring of the effectiveness of any mitigation measures in place;

h) identification of potential birdstrike risks by collating local ornithological and other data;

i) seeking of advice and assistance from outside specialists on matters requiring expertise not available at the aerodrome; and

j) production and promulgation of reports on the development of BCMP and on specific topics, safety briefs and birdstrike risk warnings as required.

3 Bird Control Co-ordinator

3.1 Whilst a senior manager has overall responsibility for bird control, a technical specialist, such as a bird control co-ordinator, may undertake day-to-day management and efficient implementation of the BMCP. In more detail, this role will involve key duties such as to:

a) advise the aerodrome manager on all matters relating to birds and birdstrike prevention, and to assist with the production and development of the BCMP;

b) plan and organise bird control operations in accordance with the BCMP;

c) supervise and monitor bird control operations to ensure that BCMP is implemented correctly;

d) supervise bird control record keeping (log, bird counts, birdstrike recording and reporting, bird dispersal, culling and habitat management diaries, etc.);

e) provide technical supervision of bird control operators, intelligence gathering, and planning;

f) facilitate the active surveillance, bird dispersal, culling and other field tasks;

g) ensure that all necessary passes and permits are current;

h) ensure the supply, safe keeping and correct maintenance of bird control equipment and consumables; and

i) provide a communications channel between the aerodrome policy makers/ providers, bird control operators and other interested parties, such as airline operators and air traffic control.

4 Bird Control Operator

4.1 A bird control operator performs the front line role and may be any suitably trained member of aerodrome staff. This role will involve key duties such as to:

a) maintain surveillance of bird activity on the aerodrome and beyond, to the limit of visibility;

b) implement active bird control measures in accordance with the BCMP to counter any detected birdstrike risk;

c) provide the air traffic service, where applicable, with details of a potential birdstrike risk;

d) record bird and bird control activity;

e) record actual, potential or suspected birdstrikes;

f) advise senior personnel on improvements to the bird control task; and

g) assist with surveys, etc.

Chapter 3 Risk Identification

1 Introduction

1.1 This chapter describes those significant factors that should be considered in an assessment of the birdstrike risk at an aerodrome.

2 Assessment of the Birdstrike Risk

2.1 In order to manage the risk of a birdstrike, the aerodrome operator should develop a systematic method of obtaining information regarding potential birdstrike risks on and in the vicinity of the aerodrome on a regular basis and:

a) assess those risks, in the context of aircraft operations;

b) analyse bird strike records to identify how many birds have been struck and which species;

c) identify and target those birds more likely to cause damage to aircraft, such as flocking and/or larger species; and

d) develop a structured approach to bird control.

2.2 Before any risk assessment can be conducted with any degree of accuracy, the level of ambient birdstrike risk, which is the level and type of bird activity that would occur in the absence of any monitoring or control measures, should be determined. This level provides a measure against which to assess the effectiveness of the plan. Details of existing bird locations and bird movements relative to those locations and the aerodrome will need to be ascertained, both to establish an accurate database and to keep the information flow current. A risk assessment should therefore be conducted initially to provide a quantifiable benchmark and repeated thereafter on a periodic basis such that:

a) each potential birdstrike risk can be assessed in detail;

b) each risk can be quantified in the short and long term, dependent upon bird population and habitat seasonal changes;

c) the potential risks can be assessed on a comparable basis;

d) the continuing risk can be monitored; and

e) control actions can be focused in a structured manner.

2.3 A typical risk assessment process may involve:

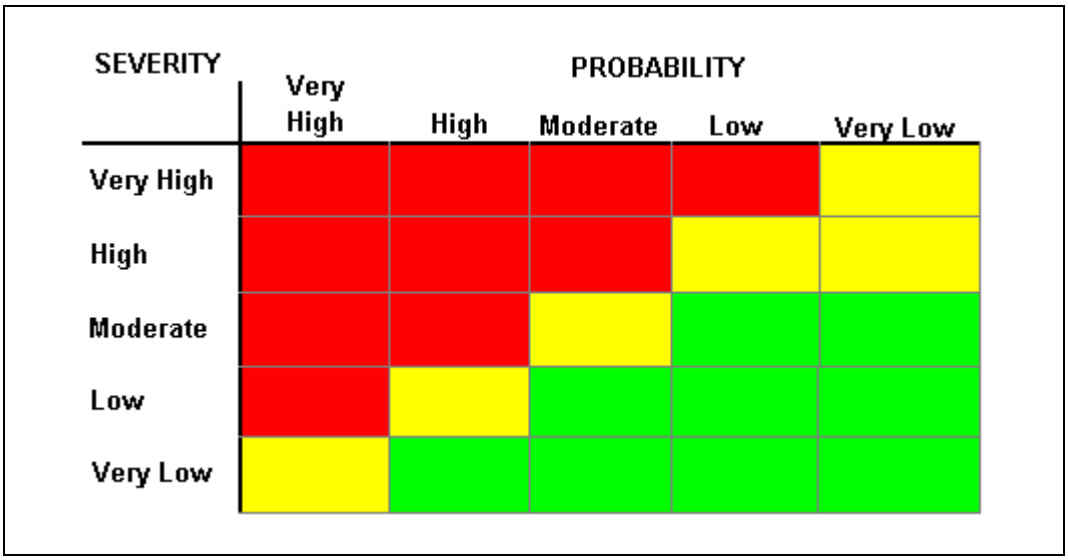
a) a detailed hazard description, identifying bird species and associated habitats that influence the size and behaviour of bird populations in the area;

b) an assessment of the probability of a birdstrike with a particular species, taking into consideration the current mitigation procedures in place and seasonal factors;

c) consideration of the species involved including size and numbers (e.g. solitary or in flocks), an assessment of the likely severity of the outcome of a birdstrike;

d) an assessment of the frequency of serious multiple birdstrikes[1];

e) the determination of the acceptability of the level of risk by summing the probability and severity, based on a probability/severity matrix, such as illustrated in the figure below (where the colours red, yellow and green may depict respectively unacceptable, marginal and acceptable risk);



f) the identification of further risk management options available; and

g) the development and implementation of an action plan to eliminate, reduce or mitigate unacceptable risks.

2.4 Aerodrome operators should be able to develop a comprehensive and sustainable BCMP from the risk assessment process above. However, further review of bird movements and changes in populations, including the effect of mitigation action, and the environment is necessary to re-assess the residual risk once the BCMP is in place. All risk assessments should be reviewed regularly to ensure validity. Birdstrike reports are one useful tool in assessing whether the risk is changing or increasing. All stakeholders at an aerodrome should be encouraged to share data on the birdstrikes occurring on the aerodrome, in the vicinity of the aerodrome or en-route. Analysis of this information will allow the aerodrome operator to establish a more accurate assessment of the current risk, which will allow risk reduction methods to be targeted more effectively.

3 Intelligence Gathering

3.1 Intelligence gathering is an essential component of the birdstrike risk assessment process and involves the monitoring of all potential bird attractants, concentrations and movement patterns, both on and in the vicinity of the aerodrome. In addition to field observations by aerodrome personnel or other specialists who understand the importance of such monitoring and can apply birdstrike knowledge, in the context of the location of a potential bird attractant site and the type and numbers of bird species found there, liaison with local landowners and land users such as local bird watchers and ornithological societies, nature reserve wardens, water bailiffs, gamekeepers, farmers and pigeon fanciers may yield useful information.

1. Where more than 2 birds are struck and more than 10 birds are seen, or when more than 10 birds are struck. Allan J. - *A Heuristic Risk Assessment Technique for Birdstrike Management at Airports*, Society for Risk Assessment Journal, Vol 26 No 3, 2006.

3.2 Aerodrome bird control personnel and their colleagues (who either live locally or commute regularly through the aerodrome's environs) should be encouraged to be generally aware of bird activity and to pass information on to the appropriate personnel.

3.3 Awareness and understanding of bird concentrations and movements can improve the efficiency and effectiveness of bird control on the aerodrome and will determine the amount of effort required to manage the risk and the type of control actions. When assessing attractants, a clear understanding is needed of the direct impact each potential bird attractant site and its proximity to the aerodrome is likely to have on the potential birdstrike risk, having identified and taken into account the bird species involved.

3.4 Surveys should be conducted in the local area in different seasons to identify attractants, concentrations and regular movement patterns. Each potential bird attractant feature or development on the aerodrome and in its vicinity should be assessed. Having identified the potential bird attractants the possible impact should be assessed so that the level of risk presented to flights at the aerodrome can be determined. Such an assessment may include the following factors:

a) location - the proximity to the aerodrome and associated take-off and approach flight paths;

b) the numbers of birds present;

c) the size/species of birds;

d) the site attractiveness - whether it is used as a source of food, a roost or nesting site;

e) the bird flightlines to/from the site - whether flightlines are direct to the aerodrome, across aircraft flightpaths outside the aerodrome boundary, overhead the aerodrome or not across the aerodrome/flightpaths;

f) any control action undertaken by the site operator - actions may range from no action to housekeeping actions only, passive and active bird scaring measures to culling; and

g) daily/seasonal factors - whether the site is a continuous risk (each day and throughout the day), a regular daily risk (once/twice a day), a risk related to specific daily or seasonal activities, or an annual risk.

3.5 Typical factors that should be considered when assessing sites are detailed in the following paragraphs.

4 Bird Attractant Habitats: On-Aerodrome

4.1 The differing landscapes on the aerodrome may create a variety of attractants that need to be identified and assessed, to determine the appropriate prevention or control actions required. The following paragraphs may also apply to sites in the vicinity of the aerodrome.

4.2 Food

4.2.1 Birds require high-energy foods and many species depend on earthworms, snails, slugs, spiders, millipedes, and insects (especially larvae) present in grassland and the underlying soil. Fieldfares, redwings and starlings may occur in large flocks to feed on soil invertebrates on aerodromes. Carnivorous birds may feed on small mammals, such as rodents.

4.2.2 Very few birds eat grass. Only Geese and some other Wildfowl graze grass and, then, only when it is short and in vigorous growth. Therefore, the grass itself is not a bird attractant but other plants among it can attract large numbers of birds. The leaves, flowers and seeds of weeds, such as clovers, *Trifolium spp.*, dandelion *Taraxacum officinale*, chickweeds *Stellaria media* and *Cerastium spp.*, vetches *Vicia spp.* and *Lathyrus spp.*, are food for Pigeons, Game birds, Finches and other small birds. Therefore, consideration should be given to the need to minimise or eliminate such attractants through, for example, the use of herbicides.

4.2.3 Parts of an aerodrome are sometimes let for growing crops. Although tall crops are mostly unattractive to birds, they have the potential to cause a variety of problems immediately adjacent to the movement areas. Activities like ploughing, harrowing and cropping which disturb the soil, and also sludge spraying, manure spreading, seed drilling, ripe crops, harvesting, and hay and silage cutting create feeding opportunities for Gulls, Lapwings, Corvids, Starlings and Pigeons. Such activities inevitably attract birds and will increase the resources required for bird control. Having fed, birds such as Gulls and Lapwings will rest in the vicinity for many hours.

4.2.4 Wastes from in-flight and terminal catering areas, litterbins in car parks and viewing terraces, etc. attract Gulls, Feral pigeons, Corvids, Starlings and other Passerines (perching birds).

4.3 Open Terrain

4.3.1 Flat, open terrain is an inherent characteristic of an aerodrome, which cannot be modified. Expanses of grassland covering large areas between runways, taxiways and aprons and paved surfaces create bird attractions on aerodromes, as do buildings and other installations such as radar towers. The unobstructed view and open space provides security (plus, for flocking species, mutual protection from many pairs of eyes) and affords a warning of potential danger for large flocks. Open terrain attracts all species except those which avoid danger by living in trees or dense cover. However, maintaining the grass sward at an appropriate height can eliminate the open aspect on the grassed areas. The bird attractant aspects of open terrain are relatively simple and well understood, and effective countermeasures are available.

4.3.2 The presence of other, less prominent features such as open drainage ditches, ponds, scrub, bushes and trees, earth banks, and waste food also provide more habitats, for larger numbers of birds and additional species, to exploit.

4.3.3 Attention should be paid to grass reinstatement in areas after aerodrome works.

4.3.4 Seasonal overflow car parks may provide out-of-season undisturbed refuges for birds.

4.4 Landscaping

4.4.1 Landscaping developments include grass, tree and shrub planting and may involve the creation or enhancement of a water feature. Landscaping schemes have the potential to:

a) create dense vegetation that may become a roost;

b) provide an abundant autumn and winter food supply in the form of fruits and berries; and

c) create standing water or watercourses which attract Gulls and waterfowl.

4.4.2 Generally, in terms of bird attraction, landscaping schemes attract smaller concentrations of birds from a smaller area, have less potential for increasing birdstrike risk than developments such as landfills, sewage treatment plants and wetlands, and have much in common with many natural and semi-natural features commonly found around aerodromes. Therefore, the bird attraction and potential

birdstrike risk of most landscaping developments, except for wetlands and starling roosts, is comparatively local in effect, i.e. usually limited to within about 6.5 km (4 miles) of the aerodrome, or less.

4.4.3 Landscapes commonly include trees and shrubs, which may provide food and shelter for nesting and roosting. Finches, Thrushes, Pigeons and Starlings commonly feed on fruits and berries. Finch flocks will only move onto aerodromes where there is a weed seed food source, and native thrushes do not form flocks or visit the open spaces of aerodromes to a significant extent. Thus in the autumn, masses of berries may attract large flocks to the aerodrome and, once the berries are all eaten, the flocks move onto the aerodrome to hunt earthworms, etc. Numerous fruit- and berry-bearing trees and shrubs have the potential to attract birds, including:

Berberis spp Barberry
Cotoneaster
Crataegus monogyna Hawthorn
Aucuba
Buddleia[1]
Callicarpa Beauty Berry
Chaenomeles Japonica
Clerodendrum
Danae Butcher's Broom
Daphne
Euonymus Spindle
Hypericum St John's Wort
Lonicera Honeysuckle
Mahonia
Malus Crab Apple
Ilex aquifolium Holly
Sorbus aucuparia Rowan
Viburnum
Pernettya Prickly Heath
Prunus avium Wild Cherry
Pyracantha Firethorn
Rhus Sumac
Ribes Ornamental Currant
Rosa canina Dog Rose
Sambucus nigra Elder
Skimmia
Stransvaesia
Symphoricarpus Snowberry
Taxus Yew

1. Also known as the Butterfly Bush, Buddleia does not bear berries but is a bird attractant due to the large number of insects it holds.

4.4.4 Oak *Quercus spp*. and Beech *Fagus sylvaticus* in particular provide food for Wood pigeons, which feed on acorns and beechmast extensively in autumn. They also eat the flowers of Ash *Fraxinus excelsior* in spring. Rooks eat acorns and sometimes plant them in the aerodrome grass.

4.5 Nests and Roosts

4.5.1 Many birds nest in trees and bushes. Rooks nest colonially in traditional rookeries in small woods and lines of mature trees but recently they have expanded into a wider variety of smaller trees and man-made structures, such as aerodrome lighting gantries and electricity distribution pylons. Wood pigeons nest in dense bushes, hedgerows and woods.

4.5.2 From late summer through the winter, starlings form large communal roosts in dense vegetation such as thorn thickets, game coverts, young unthinned Conifer plantations, shelter and screening belts (especially of *Cupressocyparis leylandii*) and reed beds. Less dense cover may be used where there is artificial shelter from nearby large buildings.

4.5.3 Buildings and structures with access holes and crevices provide nest sites and roosts, especially for Feral pigeons and Starlings. Pigeons roost and nest on ledges on the exteriors of buildings and inside them.

4.5.4 Derelict aircraft provide nesting and roosting sites for Starlings, Feral pigeons, Stock doves, Jackdaws and Pied wagtails.

4.6 Water

4.6.1 Open standing water and watercourses attract Waterfowl that are nearly all large birds and may also occur in large flocks. Waterfowl resort to water for security and it is usually impossible to evict them with scaring devices. The more open water sites there are on and around an aerodrome, the more complex and frequent will be the movements of Waterfowl between them. There may be more activity at night than during the day.

4.6.2 Wet and waterlogged grass attracts feeding Ducks (especially at night) and nesting Waders, and drainage should be installed or improved, wherever possible. Flooding flushes soil invertebrates to the surface making them very accessible to birds, attracting Ducks, Gulls and Waders.

4.6.3 Larger, permanent waters, such as ponds, balancing reservoirs, etc., attract Ducks, Geese, Swans, Herons, Coot, Moorhen and Cormorants.

5 Bird Attractant Habitats: Off-Aerodrome

5.1 Birds can travel long distances relatively quickly; therefore an environment that does not meet all their requirements can be exchanged for one that does. Birds can establish nesting colonies or overnight roosts at sites remote from disturbance and commute to distant feeding grounds. If feeding sites are widely distributed and numerous (e.g. ploughed fields in autumn), daily dispersion may be diffuse or unpredictable, with the overnight roost the only constant feature. Flying from one site to another may establish bird flightlines that traverse an aerodrome or low level aircraft arrival or departure routes. The aerodrome itself may be the birds' destination.

5.2 A food supply that is concentrated and abundant at only a few sites causes fixed dispersal patterns and more predictable dawn and dusk flightlines. Overnight roosts for birds such as Gulls, Corvids and Starlings tend to be very stable and fulfil a social function as well as providing shelter and security.

5.3 Species that depend on abundant food supplies tend to roost in larger aggregations, and it is thought that the roost assembly provides a mechanism for the transmission of information on the location of food. Awareness and understanding of bird concentrations and movements can improve the efficiency of bird control on the aerodrome. For example, if the dusk return passage of Gulls over the aerodrome to a roost is understood, aerodrome bird control personnel may be able to warn air traffic control at the appropriate time. Similar precautions may be taken for dawn and dusk movements of starlings, or it may also be possible to locate the roost site and disperse the birds to another roosting site. Also, the spring build-up at a local rookery can be predicted and plans made for action to deny breeding success.

5.4 The Coast

5.4.1 Sandy and muddy shores, especially around estuaries, support very large numbers of Gulls, Waders, and, sometimes, Wildfowl. Generally, coastal aerodromes have larger numbers of birds of more species, whose activity patterns are complicated by tide state and more affected by the weather, than at inland aerodromes.

5.5 Landfills for Food Wastes

5.5.1 Wastes from household and commercial premises contain a high proportion of waste food which, in a landfill site, supports very large numbers of Gulls. Most wastes containing food are disposed of by controlled landfilling in which they are compacted into layers around 2 m in depth and covered daily with inert material. This does not limit access by Gulls, which feed as the wastes are tipped, spread and compacted.

5.5.2 Gulls congregating at landfills could contribute to the birdstrike risk to nearby aerodromes in several ways:

a) when not feeding, they spend most of the day on open sites within 6 km (4 miles) or more from the landfill;

b) they commonly soar up to 450 m (1500 ft) or more in clear weather; and

c) they may commute between the landfill and their roost, which may involve crossing an aerodrome or its approach and departure routes.

5.5.3 Corvids and Starlings also feed on landfills but their concentrations and flightlines are more local and less pronounced. They usually present no significant contribution to the birdstrike risk except where the landfill is very close to the aerodrome.

5.6 Sewage Treatment and Disposal

5.6.1 Modern sewage treatment plants, unlike their predecessors, do not attract large numbers of birds because of the lack of open availability of effluent.

5.6.2 If the primary separation of solids from the liquid fraction is in open tanks, Gulls may visit them in relatively modest numbers. Percolating filter beds are breeding grounds for flies, and Black-headed gulls and Starlings may feed on the adult insects.

5.6.3 The effluent from obsolescent or overloaded plants at some estuarine and coastal sites may contain sufficient organic solids to attract large flocks of Gulls to the outfalls. Where discharge is not continuous, but at certain times or tide states, Gulls learn the pattern and congregate at the appropriate times.

5.7 Reservoirs, Lakes and Ponds

5.7.1 Populations of birds with specialised aquatic habits are concentrated on and around freshwater bodies that may be relatively widely separated in the landscape. In addition, large water supply reservoirs (over 10 ha, 25 acres), canal feeder reservoirs, and other large lakes may be used as regular overnight roosts by tens of thousands of Gulls.

5.8 Sand, Gravel and Clay Pits

5.8.1 Mineral extraction does not itself attract birds. However, the large voids created sometimes fill with water either during working (wet extraction) or, when they are worked out, are allowed to flood and restored as amenity lakes or nature reserves.

5.8.2 Sand, gravel and clay pits can sometimes be filled in with water, or their shape can be modified during or after excavation to break up the expanse of open water. Narrow causeways, piers and islands are usually insufficient and may increase the attractiveness to Gulls by providing inaccessible dry land roosting sites. Increasing the extent of shoreline by creating promontories, bays and islands increases the attraction to other waterfowl. Active scaring around dusk may remove a roost if it were to occur.

5.9 Agricultural Attractants

5.9.1 Growing and harvesting crops inevitably attracts birds at some stage. However, the attraction usually arises suddenly and persists for only hours or a few days. The contribution of agricultural activities to the birdstrike risk is mainly confined to local farms.

5.9.2 Livestock can also attract birds. Free-range pig farming, for example, is comparable with a landfill in that the attraction continues for as long as the field is in use. Collared doves and Feral pigeons occur in large colonies wherever grain is accessible, either as spillage or in store. Grazing cattle, sheep and horses keep grass short and maintain suitable feeding conditions for Gulls, Grassland plovers, Corvids and Starlings. Their droppings are breeding habitats for insects whose adults and larvae are also sought by birds.

Chapter 4 Risk Reduction

1 Introduction

1.1 This chapter describes typical birdstrike risk reduction and bird control measures that may be employed to reduce the risk of a birdstrike.

1.2 The aerodrome should be made unattractive for birds by the adoption of all, or a combination of, habitat management and surveillance/dispersal strategies, depending upon the assessed birdstrike risk. These measures are normally within the control of the aerodrome operator; however, bird concentrations near an aerodrome and within its associated airspace may be much more difficult to manage directly, are not easy to influence or are inaccessible to aerodrome bird control personnel. However, local authorities and landowners may co-operate in helping to reduce the birdstrike risk by allowing access and control action or, even, taking action themselves when a bird attractant site has been identified and the risks pointed out. Therefore, beyond the aerodrome boundary the control of bird species and populations is normally based on safeguarding and other methods that involve dialogue and cooperation with planners, developers and landowners. In particular, priority should be given to establishing contact with local landowners, developing working relationships with them and encouraging them to adopt measures to reduce the attractiveness of the site to birds or to mitigate the risk, especially in the immediate approach and departure areas.

1.3 For example, it may be possible to influence the timing of some farming activities to suit aerodrome operations or where seasonal ploughing by local farmers may cause a temporary increase in risk, liaison with the landowner could result in prior warning of the ploughing and allow time to apply the appropriate mitigation.

1.4 Aerodrome personnel employed to carry out bird control activities should be familiar with and competent to deploy the methods used.

2 Habitat Management

2.1 Birds visit places that provide habitats which offer food and/or security for foraging, resting and, sometimes, breeding, depending on the species. Birds will visit for as long as the attractions remain, with fluctuations in numbers and persistence dictated by factors such as migration, weather, breeding success and the effectiveness of the control activities. Not all birds are attracted by the same habitats and in the same circumstances; therefore, habitat management techniques should be aimed at the removal or reduction of these habitats according to the type of birds that are targeted. If the attractants can be identified and eliminated, or minimised, influxes of birds will be similarly reduced. In addition to reducing the attractiveness of the site, it is also important to avoid creating new habitats. The potential habitat provided by a new development may not be obvious or established immediately.

2.2 Food

2.2.1 The attraction of fruit- and berry-bearing plants may be reduced by:

a) eliminating the most attractive species (see Chapter 3, para 4.4.3);

b) reducing the number, distribution and proportion of the plants;

c) using varieties which do not produce berries or, for some, male plants only; and

d) keeping hawthorn hedges trimmed to limit berry production.

2.2.2 Bins and skips should be of designs that exclude birds (e.g. with drop down or swinging lids) and should be emptied before they overflow.

2.3 Roosts

2.3.1 The complete destruction of any plantation is the only immediate and permanent means of removing a roost. However, the attractiveness of a potential roosting site may be reduced by lower planting density (e.g. to 4 m centres or lower), leaving open 'rides' (open lines of trees and shrubs), and thinning out early to ensure the site remains open. This in some cases is not compatible with a screening function, but staggered planting in rows may help.

2.3.2 Dilapidated buildings should be proofed and repaired to prevent access by roosting and nesting birds. Wherever possible, new buildings should be designed:

a) to deny access to the interior and roof spaces;

b) with self-closing doors or with plastic strip curtains or other mechanisms to prevent access by birds;

c) without flat roofs; and

d) with minimal roof overhangs and without ledges beneath overhangs and external protrusions.

2.3.3 All areas of rooftops should be easily accessible to enable action against nesting Gulls, which most commonly colonise large flat or shallow-pitched roofs. However, they will also use steeply sloping roofs where the nests can be lodged behind vents, skylights, etc.

2.3.4 Derelict aircraft should be removed or otherwise rendered inaccessible.

2.3.5 Specialist advice should be sought before taking action against starling roosts, rookeries, breeding Gulls and any birds inhabiting buildings.

2.4 Water

2.4.1 Watercourses and drainage ditches provide cover and food, especially for ducks and herons. Wherever possible, watercourses on the aerodrome should be culverted underground. Where culverting is not possible, effective bird exclusion or control systems such as netting exclosures extending to the aerodrome perimeter should be deployed as necessary to protect new developments and existing water bodies and watercourses. Channels should be maintained free of bank side and emergent vegetation to minimise flooding and damage to nets.

2.4.2 Netting exclosures are the most efficient approach but are practical only for smaller ponds and watercourses. However, an exclosure also removes the need for any other control measures or habitat modification. A less reliable form of exclosure is to 'cover' the open water with reed beds, or Carr (wetland alder or willow woodland) but there are practical problems with establishing and maintaining the vegetation and there exists the possibility of a Starling roost forming.

2.4.3 Drainage of wet and waterlogged grass should be installed, or the site regraded to eliminate hollows that hold standing water.

2.4.4 Appropriate measures should be taken to prevent access to emergency water supply tanks and oil separators on aerodromes.

2.4.5 If large permanent water cannot be eliminated and the water area is sufficiently small, it should be netted over. Wires suspended above the water surface cannot be relied on to exclude birds as most waterfowl can take off and land vertically. A less reliable means of denying bird access to open water is to plant reed beds over the entire area;

however, specialist advice should be sought as reeds cannot tolerate major fluctuations in water level and it may be difficult to accommodate seasonal rainfall.

2.4.6 The following habitat controls can also reduce the attractiveness of the water to birds:

a) the water should be as deep as possible (over 4 m) to minimise bottom growing vegetation;

b) the shape should be as simple as possible (circular or square), with no islands or promontories, to reduce the length of shoreline and reduce nesting sites, especially for Canada geese;

c) banks should be as steep as possible (preferably vertical), with minimal vegetation; to prevent birds from walking in and out of the water;

d) there should be a vertical lip or fence to prevent birds from walking in and out of the water;

e) on smaller lakes, wires suspended above the surface may deter birds that require long take-off and landing runs. The wires should be made visible with tags, to reduce the risk of birds colliding with them and sustaining injury;

f) dense vegetation, which provides nesting cover, and short grass, which is grazed by wildfowl, should be avoided. The water should be surrounded with long grass or a sterile substrate; and

g) the water should not be stocked with fish, and wildfowling is undesirable.

2.4.7 All water features, including those with bird exclusion systems, should wherever possible be sited so that the bird movements they create do not conflict with aircraft, taking into account their locations relative to both aircraft flightpaths and other water bodies in the aerodrome vicinity.

2.5 Landfills and Sewage Treatment and Disposal Sites

2.5.1 A netting exclosure is inherently the most effective and reliable system to control birds at a landfill site and at sewage treatment and disposal sites with open tanks, and its operation is easier to monitor. Netting may not, however, be effective against all birds, for example Starlings, and an active bird control programme should be provided as a back-up. When active bird control is provided, the necessary levels of vigilance and dispersal action need to be sustained to achieve an effective level of deterrence.

2.6 Aerodrome Grass Management

2.6.1 The most effective habitat control measure that can be applied on an aerodrome is the management of the grassed areas. Short grass provides security by enabling smaller birds to see over the wider spaces of the aerodrome for early warning of approaching dangers. It also increases populations of invertebrate animals on which many bird species rely for food. Short grass therefore does not deter most species of aerodrome birds and should be avoided. Conversely, longer grass (typically above 400 mm) that falls over because it cannot support itself also has the potential to attract birds. Grass maintained at a height of 150 to 200 mm (6" to 8") makes it more difficult for birds to locate prey at or below the surface, spoils the security effect, and reduces populations of soil invertebrate food sources. If maintained at this height, bird numbers on the aerodrome can be reduced significantly, particularly waders, small Gulls, Plovers, Corvids and Starlings. This method of grass management is often referred to as a long grass policy.

2.6.2 All grass areas within the aerodrome boundary, including the margins adjacent to runways and taxiways should be included in the grass maintenance scheme. As grass grows according to season, so does the presence of certain bird species; therefore,

grass maintenance should be planned accordingly to deter the targeted birds when necessary. The long grass regime intended to deter the most common birds found on an aerodrome is described in paragraph 2.6.8.

2.6.3 Various types of grass maintenance schemes exist, such as the long grass policy and silaging, and each has its own advantages and disadvantages for aviation use. The licence holder should employ the scheme most appropriate to the aerodrome. The risk assessment should be revisited to identify any additional measures that may be necessary to complement the scheme. For example, a long grass policy should be complemented by dispersal methods to deter other birds that may frequent the aerodrome.

2.6.4 Before a long grass policy is first established, and periodically thereafter, it may be prudent to have soil analyses carried out and any nutrient deficiency made good in spring. When seeking advice from agronomists, who commonly advise farmers on grass crops and pasture and may be unfamiliar with the unique requirements for aerodrome long grass, the need for sustained strong growth of appropriate grass species, rather than a flush of rapid lush grass, should be stressed. General-purpose fertiliser in slow acting granular form, rather than a high nitrogen formulation, is appropriate. In almost all cases, good stands of long grass can be obtained by allowing the existing sward to grow taller. Re-seeding is rarely necessary.

2.6.5 Long grass regimes are usually effective only when the aerodrome bird control organisation is involved in planning, monitoring and regulating the maintenance programme

2.6.6 Long grass maintenance requires activity throughout the year. Several dates are given in the paragraphs below but aerodrome operators should take account of local climatic conditions when planning their maintenance regime.

2.6.7 In some areas, rabbits may be a particular problem. Large populations of rabbits can make it impossible to grow effective long grass, and the rabbit population may need to be controlled accordingly.

2.6.8 **Example Long Grass Policy Maintenance Regime**

2.6.8.1 Mid-March to late May is normally the period of minimum bird activity on most aerodromes, when most species breed; therefore, in mid-March or as soon as the ground will permit without compacting and rutting, dead growth and the accumulated clippings from past topping cuts should be removed. This operation is called "bottoming-out". Bottoming out should not normally be attempted earlier than mid-March as wintering flocks of small Gulls or Lapwings may still be present and will be attracted to the cut areas. If not done, decaying material ("thatch") would exclude light and air, suppressing growth and weakening or even killing the grass, and encouraging pests and disease. Bottoming-out also encourages the grasses to flower by May. Delayed flowering produces fewer and smaller flowers, and hence fewer woody stems to hold the subsequent leafy growth erect through the winter.

2.6.8.2 Bottoming-out involves two processes: cutting the grass uniformly to within 50 mm of the ground; and removing the freshly cut grass together with the accumulated thatch. Typical equipment available for bottoming-out is a flail-type forage harvester and a forager harvester, which has rotating discs or drums with cutting blades. The equipment should dislodge and lift the accumulated thatch for removal directly into an accompanying trailer, thus avoiding a separate operation to collect the loose material, which is a potential foreign object debris (FOD) issue.

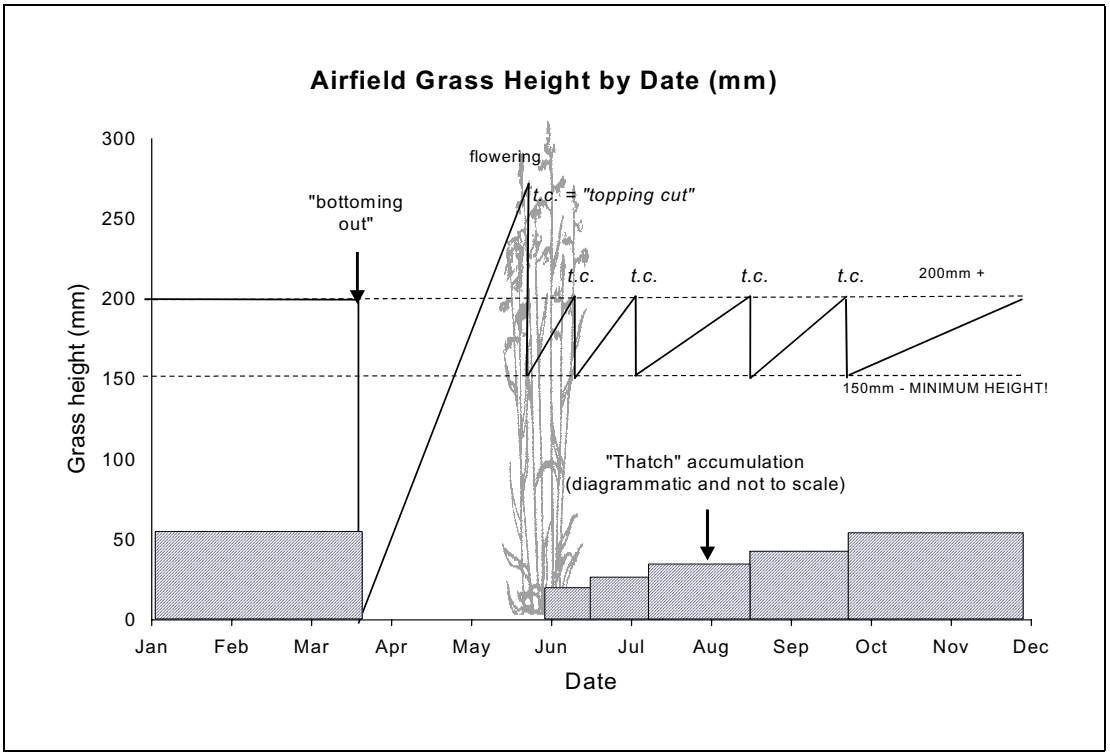
2.6.8.3 Depending on local climate, soil type and grass species, bottoming-out is usually required every 1 to 3 years, or specific areas of the aerodrome may be bottomed-out each spring on a 2 or 3 year rotation.

2.6.8.4 If thatch build-up has been heavy, it may be necessary to harrow, rake and clear again immediately after cutting and clearing and, possibly, to repeat the operation. Similarly, if the ground is uneven, rolling with a heavy roller may be needed.

2.6.8.5 Herbicide, if required, should be applied during Mid-March to late May. Even moderate weed infestation that does not seriously harm grass should not be tolerated as it may attract birds such as Pigeons. However, Pigeons only visit the grassed areas of aerodromes to feed on weeds, which can be removed by the application of appropriate selective herbicides before the weeds set seed.

2.6.8.6 The first topping cut should be taken in late Spring when the majority of grasses have produced flowering heads. The majority of grasses in aerodrome swards produce flowering stems taller than 200 mm; therefore, it will probably be necessary to allow initially the grass to grow to that height or slightly taller. Topping cuts are taken thereafter with a rotary mower set to give a cut between 150 and 200 mm in height. Topping cuts are usually required throughout the growing season. Depending on the thickness of the sward, the grass should not be cut too much in one cut, or the clippings will lie on the surface, exclude light and air, and prevent the grass beneath from growing.

2.6.8.7 After growth ceases in autumn, no further maintenance should be necessary. The accumulation of clippings from topping cuts during the growing season and die-back of the grass due to frost will create a build-up of thatch which will need to be removed at the start of the maintenance cycle (see figure below).



2.7 Optimising a Standard Long Grass Policy Maintenance Regime

2.7.1 The standard long grass policy maintenance regime is devised to maintain aerodrome grass in a way that is less attractive to birds than traditional gang mowing. It is biased towards non-interference with aerodrome operations, rather than bird repellence.

However, the best and most cost effective bird deterrent swards will be achieved where expertise and control is exercised to fine tune maintenance procedures in a manner more sensitive and reactive to local conditions, including:

a) the need for bottoming out every year if thatch build-up is minimal;

b) the frequency of topping cuts as the growing season progresses; and

c) delaying the first topping cut if young birds are present in the grass.

2.7.2 Introducing a flexible maintenance regime requires expertise to monitor and react to grass condition over a short time scale, which may require the availability of funds for maintenance operations to be carried out at short notice as the need arises.

2.7.3 **Potential Effect of Grass Height on Navigational and Visual Aids**

2.7.3.1 The height of the grass in certain areas on the aerodrome may affect the performance of aeronautical navigational and visual aids, especially the instrument landing system (ILS).

2.7.3.2 In damp or wet conditions the radiated signal as received by an aircraft or the signal received by the ILS field monitors may be distorted, affecting both the integrity and continuity of service of the system. The effect of grass on the ILS signal depends on the:

a) type of grass (broad or narrow leaf);

b) height of the grass and density of growth;

c) water content within, or water from dew or rain on, the leaves; and

d) height and type of aerials (transmitting and monitor).

2.7.3.3 The ILS glidepath is probably affected more than the localiser and 100 mm (4") is considered to be the maximum permissible grass height from the glidepath aerial to approximately 5 m beyond the monitors. A grass height of 200 mm (8") could be tolerated beyond this point up to the limit of the glidepath critical area; however, for simplicity it may be preferable to limit the grass height to 100 mm across the whole area. For the localiser, a maximum height of 200 mm (8") should be acceptable. However, sideband reference systems, with reduced height aerials, may need special consideration and 50 mm (2") may be all that can be tolerated in the immediate foreground of those systems with pairs of aperture monitors or with their aerials close to the ground.

2.7.3.4 The height of the grass should not obstruct the display of an aeronautical ground light, sign or other type of visual aid.

2.7.3.5 Aerodrome operators are advised to consult the relevant technical organisation on the issues above.

3 Bird Dispersal on an Aerodrome

3.1 Whilst aerodrome habitat management is an important measure to reduce the birdstrike risk, effective control measures should also be included in the bird control management plan. The following paragraphs identify those methods commonly used to control bird populations.

3.2 **Scaring**

3.2.1 Birds appreciate the potential danger of predators and take positive action to avoid them. Other birds or mammals prey upon most birds; therefore, predators (and, possibly, scarers that mimic predators in some way) have a more sustained aversive

effect than other devices. Bird scaring relies on persuading birds of the presence of such danger.

3.2.2 One of the key elements of effective scaring is to avoid habituation. Any scaring system used needs to be effective over large areas and not ignored by the birds after a limited period. Accordingly, the scaring stimulus should be taken to the target birds and used only when it is required.

3.2.3 Several types of bird scaring devices and techniques exist, some of which are examined in the following paragraphs. Birds react strongly to signals from other birds that indicate danger, distress (when captured by a predator) or death, and habituation does not readily occur. Some birds, typically social species that communicate with each other vocally (such as Gulls, Lapwings, Corvids and Starlings) emit piercing repeated distress calls when captured by a predator. Young birds emit distress calls more readily than adults.

3.2.4 The use of recorded distress calls (bio-acoustics) is considered the most efficient and cost effective method for dispersing birds from aerodromes. However, although a distress call is a warning of potential danger, it is not a scaring device in the conventional sense in that the bird's response is not to depart immediately and quickly. In addition, this method is species-specific and may cause the birds to react defensively rather than disperse. For instance, on hearing a distress call birds may become alert and take flight; approach the sound source and circle overhead or nearby, often emitting alarm calls; dive threateningly at a predator; or just disperse to a less risky location. This inconsistent and unpredictable behaviour pattern demonstrates that a distress call should only be used when no aircraft are operating locally. It may take 10 minutes or more for birds to depart the aerodrome and there is no control over direction of dispersal; therefore, distress calls should only be used to deter birds when there is ample time between aircraft movements, or at the start of the day.

3.2.5 Alarm calls are produced by some species when they sight a predator. The function of alarm calls is to alert other birds to potential danger but, beyond that, any further reaction may depend on the actions of the predator. Thus, alarm calls are not normally used to disperse birds from aerodromes.

3.2.6 It is almost always impractical to use dispersal measures to exclude Waterfowl from water. They feel secure on the water and, if threatened, tend to remain there.

3.2.7 When any bird scaring technique or dispersal method is used, the behaviour of the birds in relation to aircraft movements has to be taken into consideration and care must be taken not to increase the risk of a birdstrike as a consequence.

3.2.8 Dispersal by Distress Signals

3.2.8.1 Birds respond best to distress calls of their own species. They also react well to those of closely related species, but may ignore others. It is therefore important to identify the target birds before attempting to disperse them. With mixed flocks, it may be necessary to broadcast several species' calls in sequence to disperse all the birds.

3.2.8.2 Gulls and Corvids typically react very well to recorded distress calls, Lapwings react fairly well (probably because of their ability to defend nests and young with aggressive flight manoeuvres), but Starlings have the weakest reactions and are difficult to disperse by this method.

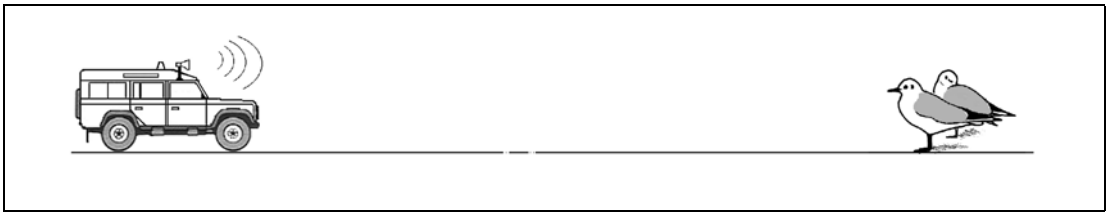
3.2.8.3 Flocks react similarly to recorded distress calls played back in the field by taking flight and approaching the source of the call to investigate. However, in this instance, only the audible stimulus is presented; therefore, if the broadcast is continued the birds will probably continue to fly to and fro for many minutes. When the broadcast is

terminated the likely reaction is to gain height and depart (Gulls and Lapwings), or to resort to trees (Corvids) or water (Gulls) where they are safe. The inability of birds to locate and identify a predator to assess the continuing threat is probably the most important element in causing them to disperse and seek a place that is less of a threat from predators. Birds have individual variations of temperament in the same way as humans. Not all are equally sensitive to distress call broadcasts and very small flocks may not respond, possibly because they do not contain the one or two key nervous individuals that cause the remainder to follow suit.

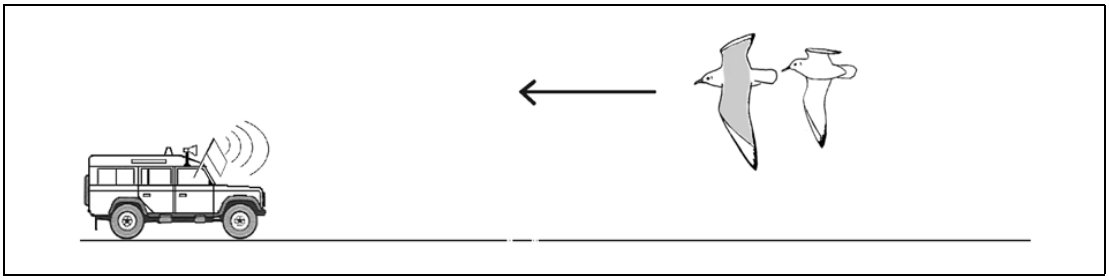
3.2.8.4 Distress calls are commonly recorded on magnetic media or in digital software form. The recording should be clear, with no distortion or significant background noise. If the birds cannot hear the calls properly, they cannot be expected to react appropriately. For each species, the sequence of distress calls should last for at least 10 seconds before repeating, with gaps no greater than 2 seconds in the sequence.

3.2.8.5 The distress call would typically be broadcast from a vehicle, using horn loudspeakers that have a directional beam. The loudspeakers should be mounted, facing forwards, at the front of the vehicle roof to minimise the chances of ground undulations masking the calls. The loudspeakers should be angled slightly downwards (around 2°) so that the centre of the cone of sound is aimed at birds on the ground about 100 m ahead, and to ensure that rainwater drains from the horn. Multiple loudspeakers should be set as far apart as possible or angled outwards slightly (about 15°). The amplifier should have sufficient power (typically 15-20 Watts) to cover the bird control area.

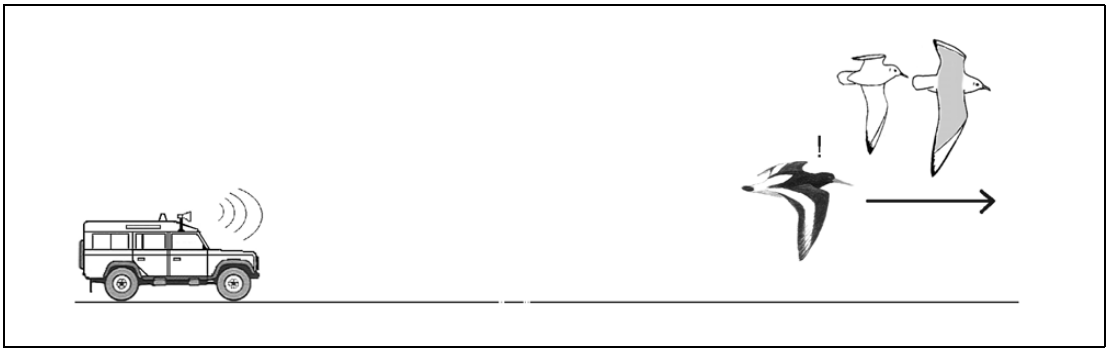
3.2.8.6 The vehicle should be positioned at about 100 m from the target flock. A closer approach may disturb the birds before the broadcast commences; and at longer ranges the calls may not be heard properly, especially if there is background noise from aircraft. The vehicle should be upwind and stationary, to allow the birds to approach and investigate the calls. Driving at speed along the runway with distress calls playing gives no opportunity for the 'approach and investigate' behaviour as by the time birds have taken flight, the stimulus has gone and they re-alight. In this way, the birds have frequent opportunities to hear distress calls (briefly) and habituation will develop as they learn that there are no harmful consequences.



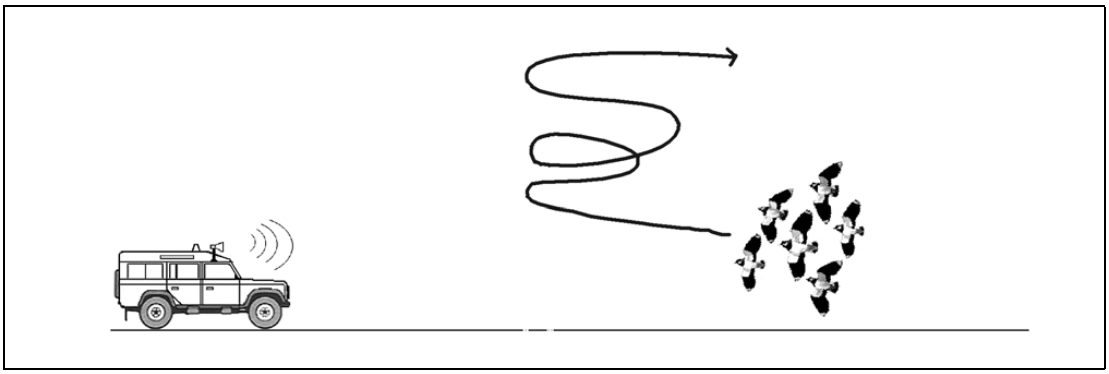
3.2.8.7 The target birds should be identified and the appropriate distress call recording selected. If several species are present, the recordings of the most numerous species should be played first. The birds should become airborne within 20 seconds of hearing the distress calls and approach the speaker. Briefly waving a cloth gives an additional visual stimulus and usually causes the birds to take flight immediately. The cloth should be displayed very briefly: birds have keen eyesight and they will not be fooled for long. Ideally the cloth should be white for Gulls and black for Corvids, which resembles a struggling victim.



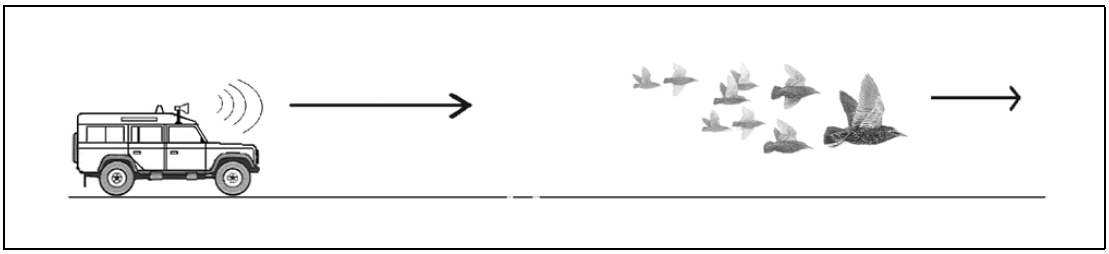
3.2.8.8 Once airborne, the flock will need sufficient time to approach and investigate the source of the calls before the broadcast is terminated. A broadcast should be of about 90 seconds duration. Species that do not have distress calls will sometimes follow the lead of those that do.



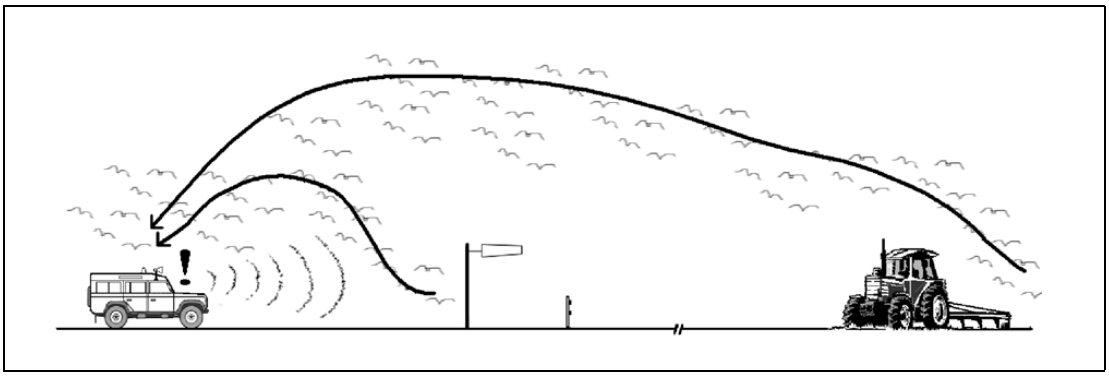
3.2.8.9 Lapwings often take flight and fly around in wide circles at some distance, without approaching, in which case it may be necessary to edge forward and turn the vehicle to keep the flock in the sound beam. In summer, Lapwing flocks may be mostly or entirely composed of juveniles, and react poorly to distress calls.



3.2.8.10 Starlings commonly fly directly away and it may be necessary to follow them slowly to prevent them from re-alighting. Local birds, especially Corvids, after repeated exposure to distress calls, may eventually omit the approach phase of the response and depart immediately on hearing the calls or, even, at the approach of the familiar vehicle. It may be necessary to follow to ensure that they depart the aerodrome.



3.2.8.11 High volume settings may attract birds onto the aerodrome, making the situation worse. It is good practice to start the broadcast at a low volume and increase it until the target birds start to respond.



3.2.9 **Dispersal by a Pyrotechnic Bird Scaring Cartridge (BSC)**

3.2.9.1 Use of a BSC is a common means of dispersing birds at aerodromes both in the UK and abroad. Also commonly known as a 'shell cracker' or 'cracker shell', a BSC is, in its most typical form, a 12 bore shotgun cartridge case with the shot replaced by a projectile containing an explosive charge and delay fuse/light trace, so that the projectile detonates at some distance from the gun. The response is usually an immediate departure away from the detonation so some directional control is possible over birds in flight, and the scaring effect can be projected into areas beyond the firer's reach.

3.2.9.2 Several types of BSC are available. Generally, for use on an aerodrome, the BSC should:

a) have a range greater than 80 m when fired at a 45° elevation (i.e. a flight time of 4 to 5 seconds before detonation) to allow firing from outside the runway strip and to provide a reasonably effective area;

b) detonate between maximum and ½ maximum height when fired at a 45° elevation;

c) produce a loud, sharp 'crack', with a bright flash; and

d) not be a potential fire risk.

3.2.9.3 A trace may enhance the effect of the BSC, especially when used to move a flock in a desired direction, and illustrates the projectile's trajectory, especially when it is deflected by the wind. The trace should be visible in sunlight throughout its flight.

3.2.9.4 Several types of signal pistol with a 12 bore liner and a few purpose-made 12-bore pistols are in use on UK aerodromes. The pistol should be fit for purpose; have a safety catch; and be pressure tested for the type of BSC used. Pistols and BSCs should be transported in appropriate carrying cases and stored in a secure and safe location when not in use.

3.2.9.5 The BSC is the only device commonly available to the bird controller that, within the limits imposed by its range, is more rapidly mobile than the birds. Thus, it enables the direction of movement of target flocks to be controlled. By positioning themselves and aiming the pistol appropriately, a bird controller can place the detonations behind the birds to hasten their departure, and to either side to keep them on track and to hold the flock together. A BSC fired high in the path of an approaching flock will cause it to pause and orbit, even if it cannot be deflected altogether. However, birds will avoid a significant headwind (for Gulls and Lapwings this may be as little as 5 kt) and,

no matter how far they are pursued or how many BSCs are placed behind and to either side of them, they will eventually turn back. Directional control of the birds is aided if the BSC has a bright "tracer" component and adequate range.

3.2.9.6 In many circumstances, it may not be permissible to fire a BSC beyond the aerodrome perimeter but, by firing vertically, its effect can be extended outwards over a considerable distance, including locations such as in the approach path.

3.2.9.7 It is generally much easier to persuade one large flock to leave the aerodrome than several smaller ones. Firing directly into a flock will probably fragment it and the birds may not re-group. This should therefore be avoided, unless the birds have ignored previous dispersal attempts and it is intended to increase the stress level, i.e. to achieve an effect similar to shooting. A very close detonation may be useful to disperse birds that re-group quickly, such as flocks of starlings.

3.2.9.8 If birds linger in flight over the aerodrome after a distress broadcast is terminated, BSCs may be used to hasten departure. However, a bird's behaviour on hearing distress calls is quite different from that of fleeing from a BSC; therefore, a BSC should not be fired during a distress call broadcast.

3.2.9.9 BSC operators should be competent in their use, comply with relevant firearm and munitions legislation, and be provided with appropriate personal protection equipment (PPE).

3.2.10 **Manual Dispersal Techniques**

3.2.10.1 Most birds are very distrustful of man, especially those that are commonly shot as pests (e.g. Corvids and Pigeons) and traditional quarry species (many Wildfowl and Waders). Indeed, the almost total absence of man on foot (and, therefore, recognisable to birds) may be a major factor in making an aerodrome so attractive to birds, despite the noise and risk levels. Birds that do not react to being passed over by the wings of a taxiing aircraft or, even, the bird control vehicle drawing to a halt nearby, will normally immediately become alarmed when a person alights. Even if they do not react by flying up en masse, they will commonly depart, perhaps in small groups, over the course of several minutes, if the person remains visible. Man is a very effective birdscarer, especially in combination with other dispersal techniques, and human-operated bird scaring devices are more effective than 'free-standing' methods.

3.2.10.2 Birds may recognise Raptors that hunt them by features of their wing beats. A particularly effective scaring technique that a person may adopt is slowly raising and lowering the outstretched arms, which may be interpreted by the target birds as the wing beats of a large raptor. The person should be silhouetted against the sky, or a plain background, and facing the target birds. The extended arms should be slowly (about 26-30 beats/min - one beat per two seconds) raised and lowered through a relatively small angle about the horizontal. Flapping the arms rapidly, with exaggerated bending at the elbow and wrist, does not work. Almost all species will react immediately by flying up and directly away. Birds to one side will not react, though birds behind may do so.

3.2.10.3 Arm scares may not cause birds to move very far, but departure is predictably directly away from the person. They are effective against all common species, can be used at short notice, where noise or pyrotechnics are unacceptable because of proximity to people or livestock, or because of fire risk, and have no cost.

3.2.11 **Falconer's Lure**

3.2.11.1 A falconer's lure is a stuffed leather body, usually with a bird's wings and a morsel of food attached, which is whirled round on a cord to attract the attention of a falcon that the falconer wishes to retrieve. Falcons have been used on some aerodromes to disperse birds and it was noticed that the lure itself could disperse flocks of birds. At first, it was assumed that, by association, birds had learned to recognise the lure as a signal that a Falcon attack could be expected. However, it is apparent that use of the lure also has a strong aversive effect on many species where Falcons had never been operated.

3.2.11.2 Although whirling the lure is very effective, throwing it high into the air so that it falls to the ground with wings fluttering, almost invariably causes target flocks to fly up and directly away, at ranges of several hundred metres. The birds react as if the lure represented a bird 'in trouble'. They may even approach to investigate, as with distress calls, if the representation is sufficiently realistic and, as with rag fluttering, the lure also appears to enhance responses to distress call broadcasts.

3.2.12 **Repellents and Passive Deterrents**

3.2.12.1 Repellents and passive bird deterrents rely on aversive stimuli that act through the senses of touch, smell and taste. Tactile repellents effective against birds include; sticky gels and filaments, used against roosting and nesting birds on ledges and beams on buildings, and lines strung over restricted sites, such as marshy areas. All injurious and lethal substances are now unacceptable and illegal. Birds have limited chemical senses and generally can only detect aversive agents when taken into the mouth on food.

3.2.12.2 Birds on aerodromes mostly feed on soil invertebrates or on vegetation. However, invertebrates are generally inaccessible for treatment with a repellent and the areas of vegetation to be treated with chemicals are very large and repeated application would be needed. Moreover, unless research with new non-toxic repellents provides a future viable option, cost and environmental aspects would normally rule out such measures.

3.2.13 **Other Methods and Techniques**

3.2.13.1 Other techniques include the use of Birds of prey, animals (dogs), unfamiliar objects and startling actions (such as brightly coloured windmills and gas cannons) and scarers that mimic predators such as radio controlled hovercraft and model aircraft, imitation hawks and foxes, scarecrows, and kites and balloons.

3.2.13.2 A number of other measures have been used with varying degrees of success, including:

a) flags made from fertiliser bags;

b) brightly painted oil drums;

c) windmills and rotating spinners, sometimes accompanied by painted representations of beating wings, or gongs;

d) plastic tape that vibrates and hums in the wind;

e) reflective balls;

f) magnetic field generators;

g) "ultraviolet" bird scarers; and

h) weighted bird balls on water.

3.2.13.3 Bird scaring techniques using visible lasers are being developed. Although claims are made of their effectiveness, the use of lasers on an aerodrome is subject to requirements specified in ICAO Annex 14 Volume 1 and CAP 736, *Guide for the Operation of Lasers, Searchlights and Fireworks in UK Airspace*. Aerodrome operators considering the use of lasers for bird control purposes should consult the CAA prior to their operational use.

3.2.13.4 All the above scarers should be evaluated for their effectiveness and used accordingly. Some may cease to be effective after a short time because of habituation.

3.3 Lethal Methods

3.3.1 There are several reasons for resorting to lethal control methods:

a) to reduce overall numbers and thus to decrease the problem;

b) for the deterrent effect it has on the surviving birds and to enhance the effect of other control techniques; and

c) to remove individual birds which do not depart in response to scaring action, either because of sickness or disability, or because of aberrant behaviour.

3.3.2 If there is no other satisfactory course of action for preserving air safety, shooting birds is an effective means of control. Special legal provisions exist to license the shooting of certain birds on aerodromes, subject to specified conditions. Trapping requires specialist knowledge and expertise, and the use of stupefying baits is illegal in the UK.

3.3.3 During the breeding season, local birds are vulnerable and accessible to lethal control methods because they must return regularly to nest sites, and it is normally only necessary to kill one member of a pair. Thus, the population may be reduced and production of replacements prevented. However, the shooting of the most populous birds, such as Gulls, Lapwings and Starlings, with the intention of reducing numbers, is not usually effective, even on a temporary basis. Harassment is usually sufficient to prevent Lapwing colonies from becoming established. However, for some species, established breeders can only be removed by shooting. Removing eggs is less effective because Lapwings and some other waders will nest again. However, it may be possible to reduce numbers by taking action to prevent eggs hatching, by either pricking or oiling the eggs. The aim of this is to make the adult birds believe that the eggs will hatch and thus they will remain with the nest. When it is time for the eggs to hatch it is usually too late in the breeding cycle for the adult pair to produce new eggs.

3.3.4 Most shooting is carried out on an aerodrome as a last resort against intractable flocks to deal with an immediate problem, but shooting can also be integrated into a control strategy to reinforce scaring action. If scaring is followed by an actual stressful event such as shooting, birds learn to avoid the scarer more strongly. The effect may be sustained even if shooting is only occasionally added because the birds may simply react to the scaring signal alone and depart quickly.

3.3.5 Non-lethal control methods are limited and only partially successful on Pigeons and it may be prudent to reinforce them with live shooting on aerodromes where Pigeons are numerous. Wood pigeons, especially, are commonly shot in fields to protect crops and, thus, are particularly responsive to shooting. However, this is only a partial and short-term substitute for control of the birds' food supply.

3.3.6 Successful trapping may require special skills and experience and the law may limit some actions; therefore, specialist advice should be sought before traps are introduced onto an aerodrome.

3.3.7 Many species of birds, nests and their eggs, are protected under law through the provisions of the Wildlife and Countryside Act 1981 (as amended). However, general licences are issued to allow certain bird control actions to be carried out that would otherwise be illegal under the legislation, without the need for aerodrome operators to apply for a specific licence (i.e. for the purpose of preserving air safety).

3.3.8 If aerodrome safety management policies and procedures provide for lethal methods of bird control to be utilised in order to control birds on, or in the vicinity of the aerodrome, the aerodrome licence holder must be satisfied that aerodrome bird control personnel act within the provisions of the general licence, and therefore the law. It is the responsibility of individuals to read the conditions attached to a licence to ensure that the bird control activity they are engaged in is covered by the law and complies with any conditions. Failure to comply with the legislation may result in a fine of up to £5000, and/or a 6 month custodial sentence.

3.3.9 General Licences are issued for a range of activities, including to preserve air safety. From 1 January 2008, Natural England became the agency responsible for the management and policy of General Licences.

3.3.10 In England, General Licences may be found on the Natural England website at:

http://www.naturalengland.org.uk/conservation/wildlife-management-licensing/genlicences.htm

In Scotland at:
http://www.scotland.gov.uk/Topics/Environment/Wildlife-Habitats/16330/general-licences

Aerodrome operators in Wales should contact the Environment, Conservation and Management at the Welsh Assembly, at:
http://new.wales.gov.uk/topics/environmentcountryside/consmanagement/?lang=en

In Northern Ireland operators should contact the Northern Ireland Environment Agency at:
http://www.ni-environment.gov.uk/biodiversity/sap_uk/wildlife.htm

3.3.11 Aerodrome licence holders and operators, should ensure that all appropriate personnel engaged in aerodrome bird control and dispersal activities are aware of and conversant with the legislation for their geographical location, to ensure that all bird control activities (both on-aerodrome and in the vicinity) are conducted within the law.

4 Safeguarding

4.1 Safeguarding is the means by which an aerodrome operator assesses the impact that a proposed or existing development may have on the safety of flight operations on, or in the vicinity of, the aerodrome. The aerodrome operator may be made aware of proposed developments and other planning applications. Although safeguarding primarily addresses the potential infringement of flight safety surfaces, the potential for the proposed development to become a bird attractant site and increase the birdstrike risk may also be addressed.

4.2 As outlined in Chapter 3, virtually all land types and land uses (including natural habitats) attract birds in some way. Safeguarding should address developments that, individually or as part of a cumulative process, could become bird-attractants with the potential to increase the birdstrike risk at a nearby aerodrome.

4.3 Planning decisions in the UK are the responsibility of local or central government, or appointed bodies. Aviation interests, and hence the CAA and the aerodrome operator, have no specific power to override a planning decision. However, the aerodrome operator may offer advice to the planning authority such that aviation safety or their commercial interests may be taken into consideration.

4.4 A safeguarding consultation process exists as part of the planning process[1] to address proposed developments with the potential to affect the safety of aircraft operations at certain civil and military aerodromes, designated by the Government as "officially safeguarded aerodromes". The consultation process includes a means to address potential bird attractant developments within a 13 km radius circle of the aerodrome. Safeguarding maps are used to define the 13 km radius circle and are lodged with local planning authorities. The 13 km circle is based on a statistic that 99% of birdstrikes occur below a height 2000 ft, and that an aircraft on a normal approach would descend into this circle at approximately this distance from the runway.

4.5 All licensed aerodromes, other than those designated, should establish their own safeguarding consultation procedures with their local planning authorities.

4.6 The following factors should be taken into consideration when assessing the potential increase in risk:

a) the numbers, including seasonal variations, and types of birds that may be attracted to the development;

b) any proposed landscaping or habitat designs;

c) the distance from the aerodrome;

d) the location of the development relative to aircraft arrival and departure flightpaths and within the visual circuit; and

e) bird movements in relation to the aerodrome; for example, waterfowl move primarily between wetlands and along watercourses. Creating new bodies of water may cause more waterfowl movements and the increase of birdstrike risk.

4.7 Ideally, informal discussions on a potential bird attractant development should take place between applicants and aerodrome safeguarders before the submission of a planning application. This may make it easier to achieve a mutually acceptable outcome with regard to birdstrike risk management.

4.8 Where an assessment shows that the birdstrike risk may increase or could increase under certain conditions in the future, and the licence holder and developer are unable to agree a solution, an aerodrome operator could object to the planning application on safety grounds. Aerodrome operators may use local knowledge of bird populations and activities or an appropriate precedent of a similar safeguarding case to support the objection. The aerodrome operator may request that the objection cannot be withdrawn until measures to ensure there will be no increase in risk are implemented. It may be possible to modify a development (e.g. exclusion of food wastes from a new landfill) or impose planning conditions that require specific action to exclude birds or reduce their numbers (e.g. an effective BCMP). Where a safeguarding case is resolved through the imposition of planning conditions, it may be appropriate for the conditions (and a BCMP) to be subject to a legal agreement between the planning authority and the developer or property owner, or its successors.

4.9 The BCMP should identify the aerodrome personnel holding responsibility for the assessment of a proposed development with the potential to attract birds.

1. For England and Wales, a joint Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosives Storage areas) Direction, came into force on 10 February 2003 (ODPM Circular and NAFW Circular1/2003 refers); and in Scotland an essentially identical Scottish Planning Series Planning Circular 2/2003, was issued with the same effective date. Annex 1 of the Circulars describe the formal consultation process and Annex 2 the various safeguarding aspects.

4.10 After planning permission has been granted, the aerodrome operator should monitor the development for compliance with any planning conditions that are imposed and report any alleged breach or non-compliance to the appropriate authority.

4.11 Although the designation and classification of national and internationally protected sites, such as Sites of Special Scientific Interest (SSSIs), do not require planning permission, the creation of new conservation sites commonly involves a number of different habitats and is usually associated with other developments that require planning permission and, as applicable, safeguarding consultation. Many nature reserves are created to protect particular florae or invertebrate communities, which do not represent a potential to increase the birdstrike risk; however, others, such as estuaries, may be major bird sites. It is essential that the aerodrome operator establishes contact and works closely with agencies charged with the management of sites, such as the RSPB, etc.

4.12 Further guidance on safeguarding is provided in CAP 738, *Safeguarding of Aerodromes*.

Chapter 5 Birdstrike Reporting

1 Introduction

1.1 In accordance with Article 143 (Mandatory Reporting of Birdstrikes) of the Air Navigation Order, the commander of an aircraft is required to make a report to the CAA of any birdstrike occurrence that occurs whilst the aircraft is in flight within United Kingdom airspace.

1.2 In 2004, the CAA commissioned a study looking into birdstrike reporting for the purpose of assisting the CAA in assessing whether UK birdstrike reporting was as effective as possible. The results of the study provided an informed basis from which to develop CAA guidance and policy associated with birdstrike hazard identification and risk management, information sharing and improvements to birdstrike reporting methods.

2 Definitions

2.1 An industry-wide definition of what constitutes a confirmed, unconfirmed (bird/wildlife strike) or near-miss occurrence has not previously existed. Many aerodrome operators have therefore established their own set of definitions in order to facilitate a consistency of reporting and measurement of on-aerodrome birdstrikes, which are often used to measure key safety performance indicators, as part of their aerodrome SMS.

2.2 In order to assist aerodromes, and to aid standardisation and consistency, the CAA, together with stakeholders, has agreed a set of definitions. These give guidance for the determination of confirmed and unconfirmed birdstrike occurrences (shown in Tables 1 and 2). The definitions shown in Table 1 are based on the best practice standards produced by the International Birdstrike Committee (IBSC) and those adopted by the International Federation of Airline Pilots Association (IFALPA).

Table 1 Birdstrike Definitions – Type of Strike

A. Confirmed Strike	B. Unconfirmed Strike	C. Significant Event
Any reported collision between a bird/wildlife and an aircraft for which evidence in the form of a carcass, or other remains are found on the ground; or damage and/or other evidence is found on the aircraft. Bird/wildlife remains or complete carcass found on an aerodrome where there is no other obvious cause of death should be treated as a confirmed strike and reported as such accordingly.	Any reported collision between a bird/wildlife and an aircraft for which no physical evidence is found (i.e. no damage to the aircraft is evident upon inspection, and no bird remains, carcass or blood smears are evident on the airframe).	Incidents where the presence of birds/wildlife in the air or on the ground, resulted in an effect on a flight but where no physical evidence of an actual birdstrike exists. This includes near-miss occurrences, rejected take-off and go-arounds.

Table 2 Birdstrike Locations

D. On-Aerodrome Birdstrike	E. Aerodrome Vicinity Birdstrike	F. En-route Birdstrike
Any birdstrike occurrence reported by the commander of an aircraft, where the aircraft is believed to be at a height of up to 1000ft during climb out from, and/or below 200ft during approach to the aerodrome.	In the vicinity (within 13km) of an aerodrome, any birdstrike occurrence reported by the commander of an aircraft, where the aircraft is believed to be between 1000ft and 1500ft in the climb and between 1000ft and 200ft on approach.	Any birdstrike occurrence where an aircraft is believed to be beyond 13km from the aerodrome radius in the climb or not below 3000ft on approach.

3 Reporting

3.1 Birdstrikes should be reported to the CAA using any of the methods shown below:

a) Online Birdstrike Reporting (preferred method). Reports should be submitted at http://www.caa.co.uk/birdstrikereporting

b) Birdstrike occurrences may also be reported to the CAA using Form CA1282 (Birdstrike Occurrence) available at www.caa.co.uk/FormCA1282 and Form CA1673 (Occurrence Report) available at www.caa.co.uk/FormCA1673.

c) Submitting an air operator Air Safety Report (ASR). It is recommended that air operators ensure that details of birdstrikes are also provided to the aerodrome operator, as well as being reported to the CAA, within 96 hours of the event.

4 Data Management and Information Sharing

4.1 The improved quality of reporting since the introduction of both mandatory and online reporting has allowed the CAA to provide more reliable data and information to stakeholders.

4.2 Requests for the release of birdstrike data will be considered by the CAA in accordance with Section 6, Part 2, Regulation 9, of the Civil Aviation Authority Regulations 1991. A written request is required and an appropriate charge may be levied for the provision of such data. Where the release of data and information is controlled by legislation[1] and standards, the CAA will comply with those standards and manage the release of such data accordingly.

4.3 Requests for the release of birdstrike data should be submitted on a Data Request Form, which may be obtained by emailling the CAA's Safety Investigation and Data Department at sdd@caa.co.uk

4.4 The CAA will publish general dis-identified statistics of birdstrike occurrences in the UK, on the CAA website. The CAA is also obliged to send an annual return of all birdstrike data each year to ICAO for inclusion in their IBIS[2] database.

4.5 Aerodromes and their stakeholders should, wherever possible, share information on birdstrikes locally. The aerodrome BCMP should contain a process to facilitate this.

1. Section 23 CAA Act and Section 44 Freedom of Information Act
2. Doc 9332 - Manual on the ICAO Bird Strike Information System (IBIS)

5 Species Identification

5.1 For the purpose of ensuring accurate reporting and to aid risk assesment, it is essential that bird species information is provided when a report is sent to the CAA. It is therefore important that every effort is made by the reporter to establish an accurate identification of the species of bird or wildlife that has been involved in the occurrence.

5.2 The aerodrome BCMP should clearly set out the procedures employed by operators in order to establish an accurate species identification following a birdstrike. When this is carried out by local aerodrome bird control personnel, the BCMP should detail how their training and competence is achieved and maintained. Where species identification cannot be achieved locally, the BCMP should detail what other means might be utilised (i.e. by employing the services of specialist bird remains identification organisations such as Central Science Laboratory[3]).

3. Contact Central Science Laboratory by email: remainsid@csl.gov.uk

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Chapter 6 Aerodrome Ornithology

1 Introduction

1.1 To assess the risks that they represent and to adopt effective control measures, bird control personnel should be able to identify correctly, and be familiar with the ecology and behaviour of, all birds commonly encountered on the aerodrome. This chapter provides guidance on the biology and behaviour of some of the more common birds that may be found on UK aerodromes.

1.2 The CAA recommends that aerodrome operators seek specialist advice if necessary to help ensure that bird control operatives possess the skills and knowledge of bird species identification to enable them to discharge their duties effectively.

2 Bird Identification

2.1 Each bird species has a unique shape and plumage, as well as unique behaviour patterns and actions. Published field guides usually include practical information on how to observe and record the various field characteristics of a bird that enable it to be identified. When deciding upon which field guide to obtain, the following attributes should be considered:

a) good field guides cover the different groups of birds in a generally accepted taxonomic sequence, as follows (some smaller groups omitted): Divers, Cormorants, Herons, Wildfowl (Swans, Geese and Ducks), Birds of prey, Game birds, Waders, Gulls and Terns, Pigeons, Owls, Swifts and Passerines;

b) field guides that illustrate birds with photographs or paintings of birds in varied poses should be avoided, because they probably will not include all the plumage variations within a species that may be encountered, making identification more difficult;

c) coloured paintings with birds in similar poses, and with plumage variations for each species described or illustrated, are more useful for identification;

d) illustrations of similar species from similar viewpoints showing all parts of the birds to best advantage and enabling easy comparison between species are better, e.g. side view standing plus in-flight views showing wing patterns and with plumage differences clearly indicated: male, female, juvenile, breeding, winter, etc;

e) important differences between species must be made clear. If such identification points are not well illustrated or described, there will probably be similar problems with other birds; and

f) the text should provide information on at least the following: size, characteristic behaviour, comparison with similar species, habitats (winter and breeding), movements, populations (including seasonal changes), food, voice and nesting behaviour.

3 Bird Biology

3.1 Each bird species fills a niche in nature, and its behaviour varies with season, time of day, weather and other factors. Their way of life is based on mobility: some species migrate to exploit seasonal food abundance and to avoid harsh winters; some species

commute daily between safe roosts and feeding grounds; and some take flight to avoid predators.

3.2 In comparison with a human, birds' eyes are relatively large compared to their body and their eyesight is at least twice as sharp. They also communicate vocally and have good hearing over about the same range of frequencies as humans. Therefore, they are unsusceptible to ultrasonic devices. Most birds have little or no sense of smell.

3.3 Birds have not adopted the mammalian strategy of retaining young to develop to an advanced stage inside their bodies, prior to birth, because of the weight penalty. Being warm-blooded, eggs must be incubated in order to complete their development and hatch. Birds have thus evolved a system of nest building and parental care of young.

3.4 Birds observed in the field are almost always engaged in some activity that provides information about them. Song and call notes are often characteristic and, with experience, enable identification and even detection of unseen birds. Habitat and season are good indicators of species likely to be encountered, for example swallows are common everywhere in the UK during the summer but are absent in winter.

4 Specific Bird Behaviour

4.1 Gulls

4.1.1 Ecologically, Gulls fall into two broad groups: 'Small gulls' (Black-headed and Common); and 'Large gulls' (Herring, Lesser and Great black-backed). When inland, small gulls feed predominantly on soil invertebrates on aerodromes, farmland, playing fields etc; and resort more to landfills where food wastes are tipped when natural food is unavailable in hard weather. Large gulls are much more dependent on landfills when inland but many remain on the coast throughout the year. When not feeding, flocks spend long periods loafing on open undisturbed sites and commonly use aerodromes for loafing early in the day.

4.1.2 The Black-headed gulls feed on soil invertebrates by sight in short grass, and loaf especially on runways and taxiways. This behaviour usually peaks with maximum food availability in mild wet weather in September, late winter, and early spring. The Black-headed gull takes earthworms, slugs and snails from runways/taxiways in very wet weather, bibio flies in spring, flying ants on hot summer days and cranefly in August and September. Ploughing fields nearby causes short-term influxes, with birds attracted by the availability of invertebrates. It breeds mainly on marshes and moors and, therefore, on few aerodromes. Like the Black-headed gull, but in smaller numbers, the Common gull arrives later in the south, and often feeds on higher ground. This species is often very persistent when feeding on aerodromes, and sometimes chases and robs other gulls of food.

4.1.3 The Herring gull is less common than Small gulls on inland aerodromes, which they use mostly for loafing and pre- and post- roost assemblies. The Herring gull breeds on some coastal aerodromes. Yellow-legged gulls are sometimes confused with Herring gulls, but are distinct and can be separated with the aid of a good field guide. Note that the general licence to kill or take certain birds to preserve air safety does not cover Yellow-legged gulls. As for the Herring gull, the Lesser black-backed gull uses aerodromes mostly for loafing and pre- and roost assemblies. They may also breed on coastal aerodromes.

4.1.4 The Greater black-backed gull is less numerous and more solitary than other gulls. It rests without feeding for long periods, and is a generalist predator and scavenger.

4.2 The Lapwing and Golden Plover

4.2.1 Lapwings prefer open habitats with low or sparse vegetation, especially grassland, such as aerodromes. Hence Lapwings may centre their activities on them for much of the year. In lowland Britain, numbers are usually at a minimum during the breeding season, the breeding population having declined significantly since 1970. Flocks begin to build in June or July as local birds disperse from breeding sites and, in particular, continental birds arrive in the UK. Some aerodromes provide attractive habitat to small numbers of Lapwing during the breeding season, but can attract substantial flocks of non-breeding birds towards the end of the summer. At this time, they may appear lethargic and reluctant to disperse because of the energetic strain of moulting. Once harvesting and ploughing are under way from August, making soil invertebrates particularly accessible, Lapwing numbers on aerodromes decline as they exploit these seasonal feeding opportunities. They remain relatively scarce on aerodromes until October or November when large flocks reappear with influxes of continental birds. Unless hard weather settles in, wintering numbers can remain high until spring migration in February and March. However, prolonged frozen ground or snow cover prevents Lapwings from feeding and they are forced to move to seek better conditions further south or at the coast.

4.2.2 Golden plover are slightly smaller than the Lapwing and much more difficult to detect on aerodromes because of their cryptic coloration. They are less common than Lapwing but wintering flocks can be very large and dense. Golden plover frequent similar habitats to Lapwings during the winter and use aerodromes in much the same way, often forming mixed flocks. Feeding birds run, pause and up-end like Lapwings. Golden plover occur on aerodromes at night.

4.3 Waders

4.3.1 The Oystercatcher is primarily a coastal bird and specialist cockle predator but it will feed on other shoreline and soil invertebrates. On the coast, activity patterns are strongly influenced by tide state: repeated influxes onto an aerodrome can occur if no suitable roosting sites remain on mudflats or salt marsh around high tide. Oystercatchers are also often active at night. On coastal aerodromes they will nest on gravel islands surrounding lights and marker boards, breaking up paved surfaces, French drains and disturbed ground such as rabbit excavations. 'Piping parties', vociferous display flights, and mobbing of potential nest predators make nesting Oystercatchers very obvious.

4.3.2 The Curlew occurs on mudflats and grassland, often in large flocks in winter, mostly around the coast but inland in smaller numbers throughout lowland Britain and Ireland. The Curlew nests on moors (up to 600 m above sea level) and farmland throughout much of Britain and Ireland, but breeding numbers have declined significantly and Curlews are absent from most of SE England and scarce in SW England. Nesting Curlews defend a large territory against other Curlews and, therefore, aerodromes rarely have more than one or two pairs. They are very obvious and present a potential birdstrike risk when displaying or defending nests against crows and potential predators but at other times are remarkably inconspicuous. They rarely alight on paved surfaces when nesting.

4.3.3 Other Waders may appear on coastal aerodromes, especially when on migration in spring and autumn.

4.4 Corvids

4.4.1 Rooks are gregarious and feed on soil invertebrates, grain and seeds, and roots on farmland and aerodromes. They find much of their food by vigorously probing the upper soil horizons. They nest colonially in mature tall treetops (rookeries), where they

return for security, although new colonies may appear in smaller trees. Their lack of interest in runways is probably partly responsible for their rarely being involved in birdstrikes, despite their relative abundance on aerodromes. Dawn and dusk flightlines and pre-roost assemblies may increase the risk of a birdstrike occurring. Their foraging range is restricted to a few kilometres from the rookery when nesting. Consequently, the presence or absence of Rooks on aerodromes in the breeding season depends on the size and proximity of the local rookeries. British and Irish rooks (numbering around 1 million pairs in the UK) are largely sedentary but continental birds boost the UK winter population, especially in the east.

4.4.2 Carrion crows are involved in very few birdstrikes. Although continuously and almost universally present on aerodromes, they occur in small numbers and, being resident, apparently establish routines that help them avoid aircraft. However, their habit of feeding on carrion on runways and the occurrence of nomadic flocks create a potential birdstrike risk, which cannot be ignored. They feed in a wide variety of habitats, including aerodromes. Their diet includes carrion, small mammals and birds, eggs, shore animals, soil invertebrates, grain and fruit. On aerodromes, birdstrike carrion or dead insects around runway lights may attract them to runways. They will drop hard-shelled prey on runways and taxiways to break it open.

4.4.3 The Hooded crow replaces the Carrion crow in north and west Scotland and Ireland. There are intermediate plumages where the races overlap. Habits are similar to the Carrion crow.

4.4.4 Although common on aerodromes, Jackdaws are involved in very few birdstrikes. However, they associate commonly with Rooks and significant numbers may nest and/or roost in hangars. Jackdaws are very gregarious, often in mixed flocks with rooks on farmland and aerodromes. Their diet is similar to Rooks', but on grassland Jackdaws feed on surface-dwelling invertebrates, rather than digging for prey. They also take small mammals, eggs and chicks. They roost communally, again, often with Rooks in woodland. They nest in cavities in hollow trees, buildings (including hangars), aircraft hulks, chimneys, quarries and cliffs. The Jackdaw is an abundant resident, with numbers being swelled by continental birds during winter.

4.5 Waterfowl

4.5.1 Waterfowl include the wildfowl (Ducks, Geese and Swans) and also Herons, Cormorants, Grebes, Rails, etc. Some, such as Geese and Swans, are large birds and can present a significant risk to aircraft. However, provided that any water habitats on aerodromes are effectively managed to exclude waterfowl, their main occurrence is restricted to flightlines across the aerodrome.

4.5.2 The numbers of non-native Canada geese have increased rapidly since the 1950s and flocks may occur on or near aerodromes. Canada geese are gregarious in winter, roosting on lakes and ponds, and travelling several kilometres daily to feed on farmland or short grass. Pairs are widely dispersed on islands in lakes, rivers and gravel pits in the breeding season. Canada geese tend to be site faithful, with females tending to return to their natal areas to nest each year. Flocks of feral, non-migratory Greylag geese have also established in parts of the UK, especially southern and eastern England.

4.5.3 Wild Grey geese commonly winter in Britain, notably in northern and eastern areas. Both wild, migratory Greylag and Pink-footed geese feed on farmland in large flocks, returning year on year to well-defined areas centred around roosts on lakes or estuaries. They often fly to roosts after dark and may stay airborne for extended periods if disturbed.

4.5.4 Mute swans mainly frequent rivers, lakes and small ponds, although they move onto farmland to feed, especially during winter. Flights are mainly confined to movements between roosting and feeding areas.

4.5.5 A variety of species of Duck breed and/or winter in Britain. Many are relatively large, heavily built birds that tend to fly in very close formation, and with the potential to cause damage to aircraft if involved in a birdstrike. By far the most numerous species is the Mallard, frequenting rivers, lakes and small ponds, and often feeding on fields and aerodromes (when flooded), often at night.

4.5.6 The Heron, despite being a predator of fish and amphibians, can sometimes be found hunting mice and voles on aerodromes. The Moorhen and Coot are Chicken-like birds that graze near water, sometimes, in the case of Coot, in large flocks.

4.5.7 The Cormorant nests at both coastal and inland colonies, with numbers supplemented during the winter months by continental birds. Inland, it feeds on ponds, lakes and rivers where fish are plentiful, and roosts communally on lakes, in trees and on power cables.

4.6 Pigeons

4.6.1 In recent years, Wood pigeons have been involved in a sharp increase in birdstrikes, with the seasonal distribution reflecting their pattern of visiting aerodromes. Wood pigeons are most numerous on well-wooded farmland, feeding on cereals, clover, peas and other crops, weeds, acorns and beechmast. They visit aerodromes mainly in summer, when weeds in long grass are flowering and seeding, and in late winter in search of clover leaves after acorn crops are exhausted and stubble fields gleaned bare or ploughed under. Outside the breeding season there are communal roosts in larger woods but flightlines are not well defined and temporary, reflecting changes in feeding area. They fly between the roost and feeding fields (up to around 10 km, but further in areas with less arable land) throughout the day. Feeding flocks are larger in the mornings. Later in the day, some birds return to the roost or perch in trees near the feeding fields, especially in the longer autumn and spring days.

4.6.2 Stock doves are often misidentified as Wood pigeons or Feral pigeons. Birdstrikes involving Stock doves tend to be concentrated in the early summer when they are attracted by weeds to aerodromes. Similar to the Wood pigeon, Stock doves occur as pairs or in small flocks, often with Wood pigeons. Their food includes weed seeds, and Stock doves are particularly attracted to aerodrome long grass with many wild flowers, especially vetches. Stock doves will lie and 'sunbathe' on runways and taxiways.

4.6.3 Pigeons are known to live on aerodromes, roosting and nesting in warehouses and hangars. In such sheltered environments, they can breed year-round. They are involved in birdstrikes all year round. Racing pigeons may especially be a birdstrike risk between April and August.

4.6.4 The Collared dove has become widespread and numerous in Britain since its arrival from the continent in the 1950s. It is common in towns, suburbs, parks, farms and granaries but less so on aerodromes.

4.7 Starlings

4.7.1 Although the Starling is involved in a small percentage of birdstrikes, their large and dense flocks can present a birdstrike risk, especially when flocks combine prior to joining a roost around dusk. Breeding numbers have declined significantly since 1970, due probably to changes in agricultural practice. Most strikes occur during and after the breeding season when flocks of juveniles are difficult to disperse from aerodromes. Starlings are omnivorous opportunists, taking a wide range of food

including worms, insects, seeds, fruit, cereals, household scraps and other wastes. However, grassland is the most important feeding habitat and, on open land and aerodromes, flocks busily probe the ground with partly open bills. They progress over the ground with a characteristic 'rolling' motion in which birds from the rear periodically take flight and move to the leading edge of the flock. Thus, they appear to be able to overcome at least in part the problem of detecting predators when foraging in aerodrome long grass. Starlings sometimes 'shadow' livestock to prey on disturbed invertebrates and flies, and also 'hawk' for flying insects when they are abundant (e.g. cranefly, ants).

4.7.2 Starlings roost communally outside the breeding season. In summer, roosts may be small and scattered but, with the autumn immigration of large numbers of continental Starlings, roosts become large and stable and can contain tens or hundreds of thousands of birds. Typical roosting habitat is dense vegetation (not necessarily tall but usually difficult to penetrate): thorn thickets, game coverts, young unthinned conifer plantations, reedbeds etc. Large roosts also occur in town centre buildings, hangars, on bridges, dockyard cranes, and almost anywhere with an abundance of sheltered, inaccessible perches. Starlings may travel long distances between roost and feeding areas. They start to return to the roost about an hour before sunset. Flocks join up and increase in size en route and have been shown on radar to be up to several miles long as they approach the roost area. Very large pre-roost gatherings occur in fields and treetops nearby (giving rise to the false idea that they roost in tall trees). Birds, which have assembled some distance from the roost, may make the final flight and enter en masse. In clear weather, massed flocks perform aerial manoeuvres, wheeling to and fro like smoke, over the roost for up to half an hour. These displays and entry into the roost are usually in the period between sunset and the end of civil twilight. Radar studies have shown that the first departures are consistently within a few minutes of sunrise: from about sunrise minus 20 minutes in winter to plus 10 minutes in summer. Starlings leave the roost in a series of bursts at intervals of about three minutes. Depending on numbers, there may be only one or two, or more than a dozen, of these bursts. Thus, it may take 30 minutes or more for a roost to be vacated. Departures in all directions (reflecting the wide availability of starlings' favoured grassland feeding habitat) result in a series of concentric expanding rings of flocks which thin out into fragmented arcs with increasing distance. This pattern shows up on surveillance radars as 'ring angels' and can be used to locate starling roosts. This display can only be seen for a few minutes at dawn.

4.7.3 Starlings nest between April and July (1-2 broods) in holes in trees, buildings and occasionally aircraft. Where suitable sites are numerous (e.g. a group of hangars) many pairs may be feeding young simultaneously. If prey species are concentrated in patches in the aerodrome grass, groups of foraging parents may have the superficial appearance of a flock. However, as individuals come and go independently, the group does not behave as a typical flock, and can be virtually impossible to disperse.

4.7.4 Starling roosts can be dispersed by scaring action for several hours at dusk on several consecutive nights. Considerable effort and resources (and specialist advice) may be required to evict Starlings from roosts, and the dispersal action itself could increase the birdstrike risk depending on proximity to an aerodrome or flightpaths.

4.8 **Raptors**

4.8.1 There is a common but false belief that wild Birds of prey keep other species away from aerodromes and that their presence on an aerodrome may be beneficial. Birds of prey are dependent on abundant prey, and will therefore be attracted to aerodromes with abundant small mammal or bird populations.

4.8.2 Flocks of smaller birds often mob Raptors and the prolonged disturbance they cause could increase the birdstrike risk on the aerodrome.

4.8.3 The Kestrel is a small falcon, which hunts mice and large insects on farmland, aerodromes and in a variety of open habitats. Its preferred prey is especially abundant in permanent grassland and the Kestrel is, therefore, common on aerodromes and alongside motorways. It is the only Raptor that habitually hovers motionless on rapidly beating wings.

4.8.4 The Sparrowhawk is a small short-winged hawk that hunts low over the ground, often using hedgerows or other linear obstacles as cover, to flush out small birds, which it catches with a rapid burst of speed.

4.8.5 The Buzzard is a much larger bird of open country moors and hills throughout west and northern Britain, now gradually recolonising areas of southern and eastern England from which it been lost. It soars on long broad wings and takes carrion, rabbits and other small ground-dwelling animals.

4.9 Game Birds

4.9.1 Numbers of Pheasants vary locally with the intensity of rearing and release by neighbouring estates. The Pheasant roosts overnight in woods and thickets ('coverts') and generally walks onto fields and aerodromes to feed. It can sustain flight for only a few seconds, usually to escape danger.

4.9.2 The Grey and Red-legged (French) partridges are both squat, ground-living birds, often on arable land in small flocks ('coveys'). They roost on the ground and are also active at night. They are very difficult to detect and flush from aerodrome long grass.

4.10 Swift, Swallow and Martins

4.10.1 Swifts, Swallows and Martins (house and sand) are summer visitors, which feed on flying insects. Flocks congregate where prey is concentrated by the wind, or where they arise: aphids over bean and cereal fields, midges over water, froghoppers and cranefly over grass.

4.10.2 The Swift nests in holes in buildings and only alights at the nest. Small flocks engage in screaming chases. It ascends to height to spend the night on wing - 'vesper flights' visible on radar over towns where breeding populations are concentrated. Swifts do not respond to dispersal action.

4.10.3 The Swallow nests on ledges and beams in buildings. Flocks alight on runways and taxiways mainly in autumn. Flocks of Swallows and Martins feeding in flight usually resist attempts to disperse them but can sometimes be moved on when resting on the ground.

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