Civil Aviation Authority

Wildlife hazard management at aerodromes

CAP 772

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Foreword

This document does not constitute a CAA ‘requirement’. The content and status of the CAP is provided as information, specialist advice and supplementary guidance material in support of EC Regulation 139/2014 and associated (EASA) Acceptable Means of Compliance and Guidance Material. The guidance expands upon the related material provided by EASA and reflects good practice and accepted standards currently supported and implemented by stakeholders, reflecting PANS Aerodromes (Doc 9981), ICAO Airport Services Manuals (Doc 9137), International Birdstrike Committee (IBSC) Standards and the ACI’s WHM Handbook.

Aerodromes subject to UK CAA national aerodrome licencing requirements may use this guidance material to demonstrate a means of compliance to support the applicable wildlife hazard management requirements stated in CAP 168.

The term 'in the vicinity' (or aerodrome surroundings) is interpreted to mean land or water within 13 km of the aerodrome reference point and to landfill and waste disposal sites as defined under relevant UK legislation. It is important to note that 13km (as a distance to safeguard for *wildlife hazard* purposes) is not a specific requirement in this context.

An 'appropriate authority' is deemed to be an authority that has the power to take action in a particular situation.

Acknowledgments

The CAA previously contracted the Food & Environment Research Agency (now known as ‘Animal and Plant Health Agency’) to assist and provide specialist subject matter expert advice during the formulation of this revised guidance. The CAA further recognises the subject matter expert advice input provided by the following stakeholders:

- The Airport Operators Association
- Birdstrike Management Ltd
- AWM Ltd
- Aerodrome Habitat Engineering
- Ecology & Habitat Management Ltd
- Mulholland Landscape Consultants
- STRI Aviation/Landsafe International
- Avian Safe
- DeTect

- Robin Radar
- Bird Control Group

Background

Although ICAO and EASA now refer to the subject matter as ‘wildlife’ (defined as animals/mammals and birds), for simplicity and consistency and in order to avoid confusion throughout the majority of this document the term ‘birdstrike’ is used. Where direct quotes from ICAO or EASA references are quoted, ‘wildlife’ may be used.

This document focuses primarily on risks posed to aircraft by birds as they are the greatest risk from wildlife according to historical UK CAA occurrence data.

Where issues regarding wildlife hazards other than birds are presented the stakeholders should seek specialist advice from the relevant authorities and agencies.

Certification Standards for airframes and aircraft engines provide modern commercial aircraft with a measure of resistance to birdstrike damage. This is, however, proportionate to the size and type of aircraft, with light or general aviation type aircraft and helicopters currently having no birdstrike certification standards for windshields or airframes.

Aviation safety agencies, regulators and associated stakeholders worldwide have produced guidance, standards, manuals and policy documents to help aerodrome and aircraft operators in managing and mitigating bird and wildlife strike risks, these may all be referenced and adopted as applicable.

Chapter 1

Standards, recommended practices and requirements

The UK, as a signatory to the Chicago Convention on International Civil Aviation, has adopted the standards and recommended practices (SARPs) specified in Annex 14 (Volume 1 Aerodrome Design and Operation), published by the International Civil Aviation Organization (ICAO).

The guidance in this document is also based on requirements and recommendations in the following documents:

- Article 10 of EC Regulation 139/2014[1]
- EASA (ADR.OPS.B.020 Wildlife strike hazard reduction)
- Chapter 5 of CAP 168 Licensing of Aerodromes

Wildlife and conservation laws

When addressing the hazard posed by both birds *and* wildlife, stakeholders must ensure their actions are lawful. Specific licences are required for some wildlife control activities in order to preserve air safety which would otherwise be illegal under the 1981 Wildlife and Countryside Act. The agencies responsible for them are:

- Natural England
- Scottish National Heritage
- Natural Resources Wales
- Northern Ireland Department of Agriculture, Environment and Rural Affairs

A those involved in any wildlife control activities lethal or otherwise must ensure they are familiar with any restrictions that may apply to aviation related wildlife control and management activities issued by the relevant licensing authorities, as noted above.

Generally, a species specific licence may be issued by the relevant agency when:

- There is a genuine problem to resolve or need to satisfy for which a licensing purpose is applicable;
- There are no other satisfactory alternative options;
- The licensed action will contribute to resolving the problem or meeting the need;

[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2014:044:0001:0034:EN:PDF

- The action to be licensed is proportionate to the scale of the problem or need;

The aerodrome Accountable Manager must be satisfied that any aerodrome wildlife control personnel (‘in-house’ personnel or contracted third parties) act within the provisions of any relevant licence. Ultimately, it is the responsibility of individuals to ensure compliance with the law and to be aware that failure to comply with the relevant legislation could result in fines of up to £5,000 and/or a 6 month custodial sentence. In Scotland proceedings may be taken against the aerodrome in respect of an offence, whether or not proceedings are also taken against an individual.

Natural England and their equivalents may consider the impacts of ‘on-aerodrome bird control’ and related activities on adjacent areas that have been designated for protecting wildlife. Sites of Special Scientific Interest (SSSI) for example are protected by the Wildlife and Countryside Act 1981 and the Countryside and Rights of Way Act 2000. Aerodromes whose land contains an SSSI or whose actions could impact on a nearby SSSI should therefore consult with the relevant agency before carrying out wildlife control activities.

Bird control and dispersal activities undertaken by the aerodrome that are not included within the existing provisions of an SSSI and which may damage an SSSI’s natural features cannot be undertaken without consent from Natural England or equivalent. A significant number of SSSI’s are also included in European or internationally protected designations such as Special Areas of Conservation, Special Protection Areas and Ramsar sites under the Habitat Regulations 2010 (as amended). Many of these are classified as 'Natura 2000' sites under European legislation. Aerodromes operating adjacent to or in close proximity to designated nature conservation sites should discuss their bird/wildlife control management plans with the relevant conservation agencies to ensure that any planned wildlife hazard control activities meet the requirements of the relevant legislation.

Natural England provides useful guidance concerning 'Sites of Special Scientific Interest’ for land owners and occupiers.

Chapter 2

Wildlife hazard management plans

Principles and objectives

The reduction of birdstrike can be split into three areas:

- Identify hazards
- Evaluate management options
- Develop strategies to manage risk

Strategies should focus on deterring birds from flying in the same airspace as aircraft on and in the near vicinity of the aerodrome, and primary control options should include:

- Aerodrome habitat management
- Active control procedures
- Safeguarding

Each aerodrome location presents a unique habitat that influences the type and population of bird species present. It is therefore essential that the most appropriate and effective measures are identified and adapted to suit local conditions.

Wildlife hazard management plans

Wildlife hazard management plans (WHMP) should:

- Assess the wildlife hazard on, and in the vicinity of, the aerodrome;
- Establish a means and procedures to minimise the risk of collisions between wildlife and aircraft;
- Notify the appropriate authority if a wildlife assessment indicates conditions in the surroundings of the aerodrome are conducive to a wildlife hazard problem.[2]

As a minimum, a WHMP's should include details of:

- Persons who are accountable for developing and implementing the risk assessment programme, overseeing the control activities, analysing data and carrying out risk assessments;

[2] EASA (ADR-OPS B.020 Wildlife Strike Hazard Reduction)

- Risk assessment methodologies that are to be conducted and the risk mitigation measures that are in place;
- Policies and procedures for reducing wildlife strike risks on the aerodrome including:
    - Processes for effective on-aerodrome habitat management;
    - Flexible use of a range of deterrent, dispersal and control measures to prevent habituation from occurring;
- Details of any relevant permissions or licences for control measures;
- Recording of control activities;
- Reporting control issues to aerodrome management and airside or flight safety committees;
- Recording and analysis of strike reports;
- Logging species, observations, intelligence and subsequent data analysis;
- Policies for bird control during hours of darkness and low visibility operations.

The WHMP should be referenced or included in the aerodrome manual and made available to the CAA for audit and compliance monitoring purposes.

Measures detailed in the plan should relate to the threat posed by each identified risk, but should also include details on how measures may change due to changes in bird and wildlife activities; for example, dealing with seasonal change or following collection of wildlife data. The measures should include the wildlife control techniques described in this or other authoritative documents, at the aerodrome operator's discretion.[3]

Whichever technique or tools are used, priority should be given to reducing the presence of large and/or flocking birds and, where practicable, to managing other congregations of birds that present a threat to aircraft safety whether on or off-aerodrome.

Safeguarding systems

Safeguarding systems need to be put in place to guard against new or increased wildlife hazards caused by developments both on and in the vicinity of an aerodrome. They should

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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;
- ICAO Doc 9137 (Airport Services Manual);
- PANS Aerodromes (Doc 9981)

include details of activities employed by the aerodrome operator to control or influence areas beyond the boundary of the airfield, in the vicinity of the aerodrome (up to 13 km and in some instances beyond, or less than 13 km, as determined by risk and effectiveness of interventions) and where practicable, could include:

- Establishment of a process with the local planning authorities for consultation on proposed developments that have the potential to be wildlife attractant within 13 km of the aerodrome;
- Means to influence land use and development surrounding the aerodrome such that the strike risk does not increase and, where practicable, is reduced;
- Means to help encourage landowners to adopt wildlife control measures and support landowners' efforts to reduce wildlife strike risks, via land use agreements; and
- Procedures to conduct and record the results of off-aerodrome site monitoring visits.

Record keeping

It is essential to record all wildlife control activities undertaken both tactically and strategically as determined locally, routinely, hourly, daily or per shift basis, details of which should form part of the WHMP. This intelligence and data can also be used in order to:

- Evaluate the effectiveness, performance and success of risk management programmes;
- Identify areas requiring attention;
- Highlight key risk periods;
- Provide a record of activities that were being undertaken in the event of an incident and assist with any follow-up investigation.

There is no standard or agreed list of details that must be collected, but the following may be a useful guide:

- Name of the personnel on duty;
- Shift start and finish time;
- Time for each activity or record;
- Location of activities;
- Species details of the bird or other wildlife observed and/or dispersed;
- Numbers of each species seen, including nil returns;

- Dispersal action taken;
- Reaction of wildlife to dispersal;
- Direction of dispersal.

For airports with an aircraft movement every 15 minutes or more, the International Birdstrike Committee recommends recording bird control actions as they are undertaken, but also that a record is added to the log at least every 30 minutes, even when no active control took place or where no bird or wildlife observations were made.

Review and evaluation

Procedures to monitor and evaluate the performance and effectiveness of wildlife control strategies might include:

- Wildlife control performance monitoring, measurement and improvement systems;
- Personnel training, competence assessment and appraisal;
- Trend analysis.

An analysis of bird and wildlife strikes and observations should be undertaken periodically (at least annually) and after any significant strike event has occurred as part of the risk assessment process. Recording information is essential to provide evidence that active bird control is in place in the event that an incident occurs, and equally provides an opportunity to assess and evaluate fluctuations in wildlife occurrences in different areas of the airfield.

Chapter 3

Roles and responsibilities

The roles and responsibilities of all personnel are important elements of the aerodrome operator's safety management system and contribute to the effectiveness of the wildlife/birdstrike management plan.

Where aerodrome bird or wildlife control is provided by third party service delivery companies there should be auditable oversight mechanisms in place, such as a service level agreement and formal arrangements that ensure trained, assessed and competent personnel are employed and that the overall performance of the activity is both compliant and is able to demonstrate measureable safety performance indicators and improvements.

In accordance with EASA ADR.OR.D.010 the aerodrome operator shall ensure that when contracting or purchasing any part of its activity, the contracted service, equipment or systems conform to the applicable requirements. The aerodrome operator is therefore obligated to ensure that the Competent Authority (CAA) is given access to the contracted organisation in order to determine continued compliance with the applicable requirements.

Contracted organisations should have a thorough understanding of their roles and responsibilities as set out in the formal arrangements and wildlife hazard management plan and be able to work effectively with other organisations as required, both on and off aerodrome, such as air traffic control and local landowners etc.

The roles and responsibilities may be adjusted to suit an aerodrome's specific hazard and control circumstances. The following subject headings describe the type of roles and responsibilities that may be typically included in a wildlife hazard management plan.

Bird control manager/co-ordinator

The aerodrome operator has overall accountability for wildlife hazard management at the aerodrome, but responsibility for wildlife control and the delivery and implementation of the management plan at the aerodrome is typically delegated to a coordinator, airside service delivery or compliance manager. Their primary objectives should be to:

1. Ensure that personnel understand how to assess and determine wildlife hazard and strike risks; understand the hazard management plan and have adequate resources to implement the plan;
2. Manage implementation of the plan via internal audit and periodic review;
3. Review statistical analysis of strike records;
4. Ensure the results of strike analysis are communicated to management and stakeholders as appropriate;

5. Monitor habitat changes on and in the vicinity of the aerodrome, and develop and implement appropriate management and control activities;

6. Ensure adherence to habitat management, airfield grass policies and associated maintenance programmes;

7. Understand the implications of not managing wildlife strike hazards effectively and not following the plan and initiating any necessary changes;

8. Analyse and interpret records (shift logs) of control activities, strike reports and on and off-airfield observations and intelligence;

9. Understand the need for periodic surveys of bird and wildlife concentrations and movements in the local area (up to or beyond 13 km as determined by aerodrome management policies);

10. Work with, for example, local landowners, farmers, gamekeepers, local nature reserve managers and racing pigeon organisations in order to influence and raise awareness of bird hazard matters;

11. Consult and engage with aerodrome planning development and engineering departments regarding safeguarding proposals, and engage with planning applicants where a proposed development has potential to change risk (e.g. restoration of mineral extraction sites);

12. Monitor the effectiveness of any bird and habitat management measures via quality audit or similar process;

13. Identify potential wildlife strike risks through collation of local ornithological reports and survey data;

14. Seek advice and assistance from outside specialists on matter requiring expertise not available at the aerodrome;

15. Produce reports on specific bird hazard issues, safety briefs and issue warnings to pilots via NOTAM, ATIS or AIP as necessary;

16. Ensure wildlife control record-keeping (recording observation counts, strike recording and reporting, dispersal, culling and habitat management diaries, etc.) are correctly recorded in a manner that can be easily interrogated and audited;

17. Ensure that all necessary training, passes, permits and licences are current;

18. Ensure the supply and safe keeping of equipment, including firearms and lasers.

Aerodrome bird/wildlife control personnel

Control personnel (or Bird Control Units, BCU) are responsible for the direct delivery of control duties on the aerodrome and enacting the management plan to counter any wildlife

presence on the airfield that presents a potential risk to aircraft flight safety. As such, the wildlife control personnel's duties should include:

1. Maintaining surveillance of wildlife activity on the aerodrome and around the aerodrome boundary;
2. Implementing wildlife control measures in accordance with the plan to counter any detected wildlife strike risk;
3. Providing information to air traffic control with details of potential wildlife strike risks and management activities as they occur;
4. Recording and reporting all confirmed, unconfirmed, near-miss or suspected wildlife strikes;
5. Advising the aerodrome certificate/licence holder and/or the accountable manager of habitat control issues on the airfield and identifying improvements to the wildlife control process; and
6. Assisting with wildlife/bird surveys and gathering and recording intelligence.

Chapter 4

Risk identification

Assessment of wildlife strike risk

The aerodrome operator should develop and maintain a systematic method of obtaining information regarding hazardous wildlife species and their habitats to manage them effectively. This should include:

- Assessing the hazards in the context of aircraft operations;
- Analysis of strike records to identify how many of each species have been struck over specific periods of time;
- Identification of species more likely to cause damage to aircraft, such as flocking birds and larger, heavier species, such as waterfowl;
- Development of a risk assessment methodology to inform the control programme in accordance with policies set out in the management plan.

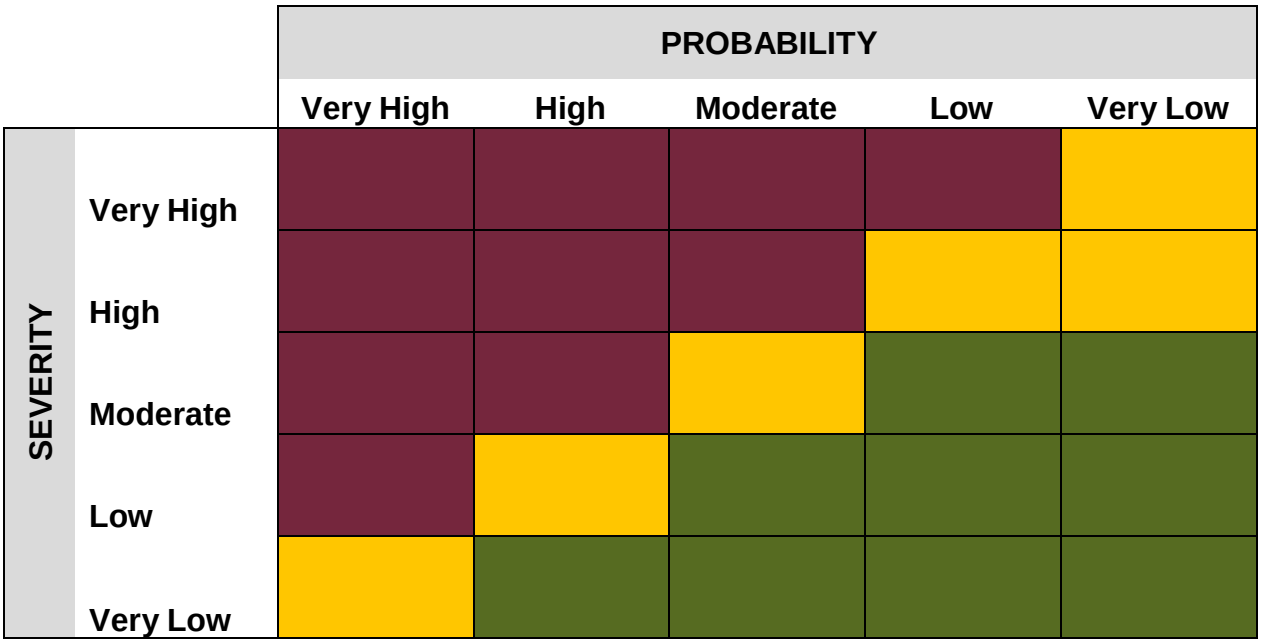
Details of existing wildlife locations and wildlife movements both on and off the aerodrome should be recorded to provide a baseline and allow resources to be targeted effectively, and a risk assessment should then be carried out. The record and risk assessment should include:

- Detailed information of wildlife, identifying species, size, numbers and habitats that influence wildlife population and behaviour, and likely aircraft damage in the event of a wildlife strike;
- Risk information that can be quantified in the short and long term, dependent upon wildlife population and seasonal changes, including an assessment of the frequency of serious multiple wildlife strikes;
- The potential and continuing risks, so they can be assessed on a comparable basis control actions focused in a structured manner;
- The determination of the acceptability of the level of risk by summing the probability and severity, based on a probability/severity matrix, such as that illustrated in Figure 1 based on published birdstrike risk assessment methodology;[4]
- The identification of management options for, in this example, yellow/amber and red risks;

[4] Allan, J (2006), A Heuristic Risk Assessment Technique for Birdstrike Management at Airports.

- The development, implementation and monitoring of an action plan to eliminate, reduce or mitigate risks.

Figure 1: Example wildlife strike risk assessment matrix



Red: high risk – additional management actions should be implemented for this species as soon as possible.

Yellow/amber: medium risk – current risk management strategies for this species should be reviewed and additional steps taken if appropriate.

Green: low risk – no additional action above that already being implemented for this species is currently necessary.

Probability of a strike

Probability of strike risk for different species can be calculated using, ideally, data recorded from the last 5 year period to provide an annual average number of strikes for inclusion in a matrix. Accurate up to date records are invaluable. Additional to observations by aerodrome personnel, liaison with local landowners and land users such as local bird watchers and ornithological societies, nature reserve wardens, water bailiffs, gamekeepers, farmers and pigeon racers, for example, may also be useful. Specialist wildlife and birdstrike organisations can also help apply wildlife strike knowledge in the context of the location of a potential bird attractant site and the type and numbers of species found there.

Using UK birdstrike data, the following ratings have been calculated:

Figure 2: Probability ratings

	Very High	High	Moderate	Low	Very Low
Number of strikes	>10	3.0 - 10	1.0 - 2.9	0.3 - 0.9	0 - 0.2

Severity

Using UK wildlife strike data submitted to the CAA, severity was calculated by species, based on the percentage of strikes that caused some form of damage to an aircraft. These proportions are provided in Figure 3. Examples of some severity percentages for different species are shown in Figure 4.

Figure 3: Severity (probability of damage to aircraft engines)

	Very High	High	Moderate	Low	Very Low
Number of strikes	>20%	10 - 20%	6.0 - 9.9	2.0 - 5.9	0 - 1.9

Figure 4: Example of species and their damage probability percentages

Species	Damage Percentage	Species	Damage Percentage
Mute swan	42.5%	**Feral pigeon**	6.5%
Canada goose	26.7%	**Black-headed gull**	4.6%
Herring gull	13.0%	**Kestrel**	2.6%
Buzzard	11.4%	**Starling**	2.6%
Lapwing	8.3%	**Swift**	1.2%
Woodpigeon	6.6%	**Skylark**	0.7%

Additional species severity ratings can be calculated using the mean weight of the species concerned. Strikes involving multiple birds have a far higher probability of causing damage to aircraft. Severity ratings should therefore be increased when strikes from multiple birds are being recorded. The severity rating should be upgraded to ‘very high’ when a ‘high’ severity species is recorded involving multiple birds, and ‘moderate’ or ‘low’ rated species should be upgraded after three or more strikes are recorded involving multiple birds, e.g. ‘low’ to ‘moderate’, ‘moderate’ to ‘high’ etc.

Figure 5: Example of calculation for four lesser black-backed gull strikes during the last five years, of which three were multiples

Strikes per year over last 5 years	0.8/year	Low
Probability of damage	11.9%	High

Low x High = Level 2 Risk. Three multiple strikes recorded in last five years raises 'High' to 'Very High' damage probability. Low x Very High = Level 3 Risk; Action plan necessary with annual review.

All species recorded within a risk assessment matrix should be updated following any strike occurrences to ensure validity. On establishing where each species lies within the matrix, the management plan can be used to target resources against the highest risk.

Off-aerodrome wildlife surveys (‘13 km bird circle’)

Off-aerodrome bird monitoring or control to 13 km is not stated in EASA Aerodrome regulation and so this particular guidance may be interpreted to support an aerodrome’s own policy with regard to assessment of the wildlife hazard on, and in the surroundings of the aerodrome.

In order to provide flexibility and proportionality, aerodrome operators may determine to monitor off-aerodrome bird or wildlife activities in different ways to achieve the desired objectives and benefits. Off-aerodrome monitoring practices may be dependent and determined by the size and complexity of the aerodrome itself, the type of operating aircraft; the human resource available, the bird/wildlife hazard presented in the vicinity and results of any risk assessment (as noted in the aerodrome’s wildlife hazard management plan).

However, it is important that the aerodrome wildlife hazard management plan reflects whatever process has been decided upon and that is demonstrably implemented and explains the rationale where an alternative approach or deviation from 13 km has been applied. Ultimately however, it is the aerodrome operator’s responsibility to determine and manage the effectiveness of its off-airfield wildlife hazard ‘safeguarding’ policies, practices and procedures.

Principally, but not exclusively, off-aerodrome bird/wildlife surveys or assessments are carried out in order to identify:

- Wildlife attractants;
- Concentrations and regular movement patterns of hazardous birds at different times of the year;

Such assessments should be carried out routinely, at least seasonally and may include the following factors:

- Location: the proximity to and direction from the aerodrome;
- Site attractiveness: whether it is used as a source of food, a roost site or a breeding site;
- Species and numbers of birds/wildlife present;
- Flight lines of birds to/from a site and whether flight lines are direct to the aerodrome, cross aircraft flight paths outside the aerodrome boundary, or are overhead the aerodrome are all important factors that should be considered;
- The relationship of a site to other sites that attract the same species e.g. the location of a landfill facility that attracts foraging gulls will need to be assessed in relation to local reservoirs or nesting sites that attract roosting or breeding gulls respectively;
- 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;
- Any control action undertaken by the site operator: actions may range from no action to housekeeping actions only, passive and active wildlife deterrence measures, such as proofing and culling; and
- Perhaps most importantly, the schedule of periodic and seasonal visits to sites should be documented so that an accurate assessment of the different risks associated with a site at different times of day or year can be evaluated.

Wildlife attractant habitats: on-aerodrome

Aerodrome environments provide a wide variety of attractants and these should be identified and assessed to determine the most appropriate prevention, controls, reduction and eradication actions. The following may also apply to sites in the vicinity of the aerodrome.

Food

Food resources will vary by species but could include:

- Earthworms, snails, slugs, spiders, millipedes, insects and larvae that are typically present in grassland, thatch and underlying soil;
- Plant species present in the grass such as clovers, Trifolium spp, dandelion Taraxacum officinale, chickweeds Stellaria media and Cerastium spp, vetches Vicia spp and Lathyrus spp, amongst others.
- Plant species that are present within water bodies;

- Small mammals, such as rabbits, voles, mice and rats along with reptiles and amphibians such as newts, toads, frogs, lizards, snakes and fish and invertebrates that inhabit water bodies;
- Wastes from in-flight and terminal catering areas, litterbins in car parks or on aircraft viewing terraces, etc.;
- Scrub, bushes, brambles, nut or berry bearing trees including, but not limited to; barberry, holly, cotoneaster, rowan, hawthorn, wild cherry, buddleia etc.

Different food sources may attract different species at different times of year and should be managed accordingly.

Open terrain

Flat, open terrain, including airfield grassland, runways, taxiways, aprons and paved surfaces, may all create secure areas for birds and some wildlife, as do buildings, lighting structures and other installations such as radar towers.

Evidence in the UK suggests that cutting the airfield grass to an appropriate optimum height can be one of the most effective measures of bird hazard control, often referred to as the Long Grass Policy or ‘LGP’.

The presence of other, less prominent features such as open drainage ditches, ponds, scrub, bushes and trees, earth banks, and waste food also provide further resources for wildlife to exploit and should be managed and secured where possible.

Car parks may also provide refuges for wildlife if they are not busy, as well as providing discarded food sources for birds and wildlife opportunities during busy peak seasons.

Buildings and structures

Aircraft hangars, terminal buildings, airport rescue and fire stations, old aircraft, lighting and signage structures all provide roosting sites, perching opportunities or possible nest sites. Sheltered ledges, access holes and crevices within and underneath such structures can prove ideal nesting locations for feral pigeons, stock doves, pied wagtails and starlings.

Rooftops themselves, including green roofs designed as part of a SUDS, may be attractive to gulls or wading birds such as oystercatchers, for nesting, loafing and roosting.[5]

Rooks, carrion and hooded crows have been known to nest on aerodrome lighting gantries and they should be designed to prevent this or allow nests to be removed easily.

[5] Sustainable Urban Drainage Schemes

Landscaping

Landscaping developments include grass reinstatement, tree and shrub planting and may include the creation or enhancement of water features. Landscaping schemes have the potential to:

- Create dense vegetation that may become a roost;
- Provide an abundant autumn and winter food supply in the form of fruits, nuts and berries;
- Create standing water or watercourses that attract gulls and waterfowl; and
- Result in areas of short grass that provide feeding opportunities for a wide range of hazardous wildlife.

As they can increase the wildlife attraction, any landscaping scheme on the aerodrome should, be avoided and could also set a precedent for safeguarding policies concerning off-airfield developments.

Trees provide food in the form of fruits (acorns, beech-mast etc.) flowers and leaves, and are a place for birds to roost or nest. Where possible, there should not be any trees within airside areas or the airport boundary. If trees are necessary, those that offer minimal resources should be chosen and planted in such a way as to reduce their attraction to birds.

Dense vegetation, such as thorn thickets, game coverts and young un-thinned conifer screening belts, can provide nesting sites for woodpigeons, small passerines (perching birds) and corvids, as well as roosting sites for potentially large flocks of starlings.

Water

Open, standing water, such as balancing ponds, reed beds and watercourses, drainage ditches or river channels, may attract large flocking birds, including ducks, geese, swans, grebes, waders, herons, coot, moorhen and cormorant. The more open water sites there are on and around an aerodrome, the more complex and frequent the movements of waterfowl will be. There may also be more activity at night than during the day.

Wet weather can create water-logging that brings worms and other soil invertebrates to the surface, making them very accessible to foraging wildlife.

Wildlife attractant habitats: off-aerodrome

Both manmade and natural landscaping features off-aerodrome can attract wildlife onto and aerodrome. These can include:

- Landfill sites
- Sewage works

- Building developments
- Drainage schemes
- Reservoirs
- Gravel pits
- Coastal areas
- Rivers and estuaries
- Woodland and agricultural land

If feeding sites are numerous and spread out (e.g. ploughed fields in autumn) bird activity can be unpredictable, with the overnight roosts being the only constant feature. Their flight lines can cross over an aerodrome or low level aircraft arrival or departure routes.

Agricultural activities in fields close to an airport, like ploughing, harrowing and cropping, which disturb the soil, together with sludge spraying, manure spreading, seed drilling, ripe crops, harvesting, and hay and silage cutting, create ideal feeding opportunities for waterfowl, gulls, lapwings, corvids, starling and pigeons that may then cross the airfield. Such activities will increase the resources needed for on-aerodrome wildlife control.

Awareness and understanding of wildlife concentrations and movements can improve the efficiency of wildlife control on the aerodrome. For example, if the dusk return passage of gulls over the aerodrome to a roost is understood, aerodrome wildlife control personnel may be able to warn air traffic control at the appropriate time.

The coast

Sandy and muddy shores, especially around estuaries, have the potential to support large numbers of gulls, waders, wildfowl and fish-eating birds. Coastal aerodromes may therefore have larger numbers of bird species, whose activity patterns are complicated by tide state and affected more by the weather, which could have a significant impact on flight safety and require further specialist assessment.

Landfills for food wastes

Waste from household and commercial premises at open landfill sites can contain a high proportion of food waste which may support large numbers of gulls, corvids and starlings.

Similar waste at open transfer stations or composting facilities can attract similar species of birds.

Gulls congregating at landfills present the following risks:

- When not feeding, they spend most of the day on open sites within 6km of the landfill;
- They may soar up to 3000ft or more in clear weather; and

- Their flight lines between food source and roost may cross an aerodrome or its approach and departure routes.

Corvids and starlings present similar risks, but they generally travel less than gulls (max 16 km to or from a roost site). In some areas, Red Kites can also be abundant at landfill sites presenting a similar risk to large gulls.

Sewage treatment and disposal

Sewage treatment plants can attract large numbers of black-headed gulls, common gulls and starlings. Numbers vary depending on the type of installation and effluent release system.

Reservoirs, lakes and ponds

Water bodies ranging from small ponds to large manmade reservoirs can attract wildlife for food (weed, vertebrate and invertebrate species), roosting (space and security) and nesting sites (often islands or spits). Waterfowl, wading birds, fish eating birds (cormorants, herons, grebes and egrets) and gulls may congregate in large numbers.

Sand, gravel and clay pits

The large voids created by mineral workings sometimes result in ponding. This can create temporary habitats suitable for a range of waterfowl. Similarly, restoration by flooding to provide lakes or nature reserves may provide habitats around an aerodrome.

Agricultural attractants

Growing and harvesting crops inevitably attracts wildlife at some stage. However, the attraction usually arises suddenly and persists for only a few days or weeks and the risk is mainly confined to local farms.

Livestock can also attract birds. Cattle feed, either as spillage or in store, can attract large numbers of collared doves, feral pigeons, starlings and house sparrows. Free-range pig farming can attract large numbers of gulls, corvids and pigeons, and grazing cattle, sheep and horses keep grass short and maintain suitable feeding conditions for gulls, waders, corvids and starlings. Farm buildings may be suitable for nesting species such as feral pigeons.

Chapter 5

Habitat management

The purpose of this chapter is to describe broad guidance on what may be considered as established good practice regarding typical airfield habitat/grass management at UK aerodromes. The various options described and discussed recognise that a “one size fits all” approach is not appropriate given the broad range of environmental, climatic and operational factors that are presented at respective aerodromes across the UK.

Where deemed necessary by the aerodrome operator, appropriately trained, competent and professional habitat management specialist should be contracted to manage aerodrome grass and habitat maintenance programmes. The aerodrome operator should ensure that such specialists and organisations are resourced and competent to undertake the desired task. Ultimately, it is for the aerodrome operator to determine and require evidence of the desired competencies, skills and experience pre-requisites - with the sole objective of ensuing that the aerodrome grass and habitat programme delivers the most effective, performance based and efficient methods of achieving the critical goal of minimising the risk to aircraft flight safety posed by hazardous birds and wildlife.

General habitat management considerations

Effective, performance based, aerodrome wildlife habitat management is a critical and important activity that should yield a continuous reduction in the numbers and types of hazardous bird (and wildlife) on and in the vicinity of the aerodrome. Habitat management techniques should therefore be aimed at the removal or reduction of habitats that attract wildlife that give rise to the greatest risk.

The key objective of habitat management is to proactively and systematically prevent hazardous wildlife from being attracted to the airfield environment in the first place and thereby reduce the reliance on reactive or 'active' bird control methods in order to prevent wildlife strikes.

Aerodrome grassland has the potential to provide food, security and nesting habitats for a variety of birds. Studies and fact based research[6] over many years has determined that grass that is maintained at a height of 200-300 mm with minimal levels of weed infestation has been proven to reduce the presence of upright stems and the majority of hazardous bird species. This method of grass management is often referred to as a 'long grass policy' (or LGP) (Brough and Bridgeman 1980).[7] In the majority of cases throughout the UK, a LGP may prove to be the most effective programme to adopt, however other factors such

6 http://www.int-birdstrike.org/Amsterdam_Papers/IBSC25%20WPA1.pdf

7 T. Brough and C. J. Bridgman (1980) *An Evaluation of Long Grass as a Bird Deterrent on British Airfields*, Journal of Applied Ecology, Vol. 17, No. 2 (Aug., 1980), pp. 243-253

as grass sward type, ground conditions, climate and the nature and variety of local bird populations may ultimately influence the determination and applicability of an aerodrome's grassland policy, therefore additional or bespoke strategies may be required to effectively manage the risk.

Wild flower meadows and grassland managed for silage or hay crops can attract large numbers of birds at various times of year and should be avoided where practicable. Silage cutting often results in a higher percentage of weed seeds and increased deterioration of the grass sward and should be discouraged. Longer grass (typically above 300 mm) that falls over because it cannot support itself also has a greater potential to attract wildlife.

Where aerodrome operators choose to deviate from an established LGP as described in this document, they should do so only after having received advice from an appropriate, trained and competent habitat management specialists, or agronomists with relevant airfield habitat experience. Ultimately however, it is for the Aerodrome operator to determine the suitability and competency skill set of persons and organisations providing expert advice.

The LGP should be extended to include the grass areas or margins adjacent to runway and taxiway edges. As grass grows according to season, so does the presence and prevalence of certain wildlife species and therefore grass maintenance should be planned accordingly to deter and target species when necessary.

Where a LGP is employed, it's primary intention is to reduce the attraction to hazardous birds via a healthy, erect, dense grass sward, which is weed free. This acts to reduce the attractiveness to wildlife that wish to reside on the airfield, reduce security and the accessibility of food that wildlife may feed on. Grass on aerodromes should therefore be maintained at a height of approximately 220- 300 mm where possible and be capable of standing upright during winter months.

The efficacy and performance of the LGP is affected by the general management programme of the grassland sward – notably nutrition, thatch management, pest, weed and disease control. Holistic management of the sward should be determined and prescribed by an appropriate and experienced habitat management specialist.

In addition to the establishment and periodic review of a habitat management programme, the following parameters should be measured, recorded and be subject to periodic quality assurance and performance checks:

- Sward height
- Sward density
- Species composition
- Soil properties (type, texture, nitrogen, phosphorus, potassium and pH)
- Rooting depth

- Weed and moss presence (type and percentage cover)
- Insect presence (populations)
- Surface drainage issues

The frequency of review is ultimately at the discretion of the aerodrome operator however, it is recommended that reviews are undertaken at regular intervals (as a minimum, annually) in order to allow for adequate quality control monitoring.

Prior to the establishment of a LGP, soil nutrient analysis should be taken from key points across the habitat areas so as to gather the relevant intelligence and establish a baseline. Such analysis should be repeated annually as part of a structured review of the performance of the airfield grass and overall habitat in order to form the basis for nutrient input requirements. Any nutrient deficiency should be made good where deemed necessary.

Specialist strains of grasses, designed for airfields that may be more effective at maintaining both 220-300 mm heights and delivering the desirable wildlife deterrent qualities throughout the year may be considered.

Different strains of the same grass species may be necessary to achieve suitable wildlife deterrent qualities for respective aerodromes. Emphasis should be on providing a nutritional programme that aids the production of a sward that repels hazardous wildlife.

Airfield grasslands should be monitored to ensure that the ideal upright species are present in sufficient density to maintain the effectiveness of the sward. Where this is not the case consideration should be given to over-seeding using well established methods (ie killing and removing decaying matter before seeding) to increase the proportion of the desired grass species in the habitat. Consideration should also be given to using direct drill seeding equipment to ensure no seed or arisings remain on the surface.

Grass trimmings (or ‘arisings’) that settle between the stems after cutting may result in ‘thatch’. This can prevent applications such as fertiliser or herbicide from acting effectively and provide a suitable micro-habitat for insects and small mammals.

Thatch should not be allowed to measure more than 35-40 mm from the top of the soil profile. Greater depths than this means deterioration of the sward caused by the weakening of the desirable grass species. Thatch should be removed during on-going habitat maintenance operations to help create a healthy sward.

Rooting depth of the sward should also be measured to ensure that grass plants can achieve full growing potential in any given season. A failure of the root system may necessitate a more detailed review to determine the causes and the suggested remedies.

Long grass maintenance requires activity throughout the year. Several dates are given in the paragraphs and diagram below but aerodrome operators should take account of local climatic conditions for planning their own maintenance regimes.

Methodologies for specific maintenance options – bottoming out

Frequency

Bottoming out is removing the decaying grass down to between 30-40 mm from ground level depending on the contours of the soil surface. This important operation should be carried out with other maintenance operations ie 'harrowing' and soil 'aerating' to enable a five year cycle to be achieved. Advice from the habitat management specialist is recommended to ensure the grassland thatch build-up is closely monitored.

Timing

Bottoming out should take place in early spring when bird activity is at its lowest and as soon as ground conditions are sufficiently stable to allow the ingress of heavy machinery. The procedure (detailed below) should be completed in time for the sward to reach the optimum sward height.

Equipment

Forage harvesting is the recommended practice for grass collection. Equipment should be carefully set to penetrate the thatch layer of the sward, thereby removing thatch, moss, less persistent weeds and any decaying vegetation without damaging the crowns of grass plants or creating a bare or excessively open sward.

All arisings should be collected as part of the operation. Leaving grass clippings in situ may create a 'foreign object debris' (FOD) hazard to aircraft and may also smother the habitat causing die-back and creating feeding and loafing opportunities for birds. Additionally, grass arisings may provide undesired food and habitat for invertebrates and small mammals.

Immediately following bottoming out, if required, the ground should be scarified with spiked harrows or equivalent machinery. Arisings from this operation should be raked and collected to prevent sward damage and the attraction of birds or other wildlife, due to decaying organic matter. The purpose of scarifying is to further remove thatch, weeds and other decaying material and in creating a 'clean' sward going into the spring/summer.

Ongoing habitat maintenance

Once the operation is completed, rolling/aerating and/or an application of fertiliser may be undertaken, dependent upon the condition of the sward. The sward should be assessed for surface undulations and the decision to roll and/or apply fertiliser should be made by the habitat management specialist. Rolling can create compaction issues which may inhibit drainage capabilities in certain circumstances and therefore should be carefully considered before being implemented.

Quality assurance

Where necessary, the results of the bottoming out process should be assessed to ensure the following factors are met:

- That bottoming out was undertaken to sufficient depths in order to remove thatch (to a minimum of 30/40 mm from soil surface) in order to create a 'clean' sward;
- That all arisings from the operation are collected;
- That, if required, the sward recovery programme (e.g. fertilizer) was appropriately carried out;
- That ruts and soil compaction created during the operation is rectified as soon as practicable.

Where the ground is waterlogged or in an unstable or unsuitable condition, the aerodrome operator may consider delaying the bottoming-out operation due to vehicle use which could result in rutting of the surface and other potential soil structural damage. Typically, where climatic conditions create temperatures below 6°C, recovery of the vegetation following bottoming-out is very slow and has the potential to delay the effectiveness of the chosen grass policy. In these situations consideration should be given to delaying the bottoming out procedure until suitable conditions prevail. This will ensure the required vegetation height is retained throughout the summer period when juvenile birds are most likely to be present on and around the aerodrome. In exceptional circumstance bottoming-out may be taken in late summer before the final growth spurt of the grasses, which will ensure upright growth by late autumn.

Where damage occurs (to the grass sward such as) through use of equipment on uneven ground it is recommended that these grass areas should be reinstated as soon as the temperatures exceed 6°C.

Failure to remove decaying vegetation (through bottoming-out/habitat maintenance) when it reaches a depth of 35-40 mm may result in slower recovery of the sward and give rise to a potential increase in wildlife activity and increased weed infestations.

When necessary, e.g. due to poor grass swards, aerodrome managers may consider a phased replacement of the grass habitat during the bottoming-out process over a five year period with new upright species. This will ensure that grasses do not fall over during periods of inclement weather and provide a clear base area above the soil surface for arisings to decay and avoid the build-up of future thatch. The suitability of the site to accommodate such species should be given careful consideration prior to sowing.

Mowing – long grass policy

Airside grassland ideally should be maintained between 220-300 mm unless alternative proven strategies are advised by a habitat management specialist. At no point should the

height of cut fall below 200 mm, other than due to the exemptions listed below and during bottoming out.

Deviations from a long grass policy

Helicopter operations

Aerodromes and Heliports predominantly used for helicopter operations may typically adopt a shorter grass policy regime, maintaining swards at between 50 and 100 mm in take off, landing and low level operation areas of the airfield. Perimeter grasslands and areas away from flight situations should still follow standard long grass policy in order to address the bird hazard, as deemed necessary.

Light aircraft (GA) grass landing strips, taxiways and parking areas

The grasses in these areas typically require maintaining at 75 mm throughout the growing season.

It is recommended that regular inspections of these areas are undertaken by appropriately trained habitat management specialists to monitor surface drainage compaction, weeds and grass density issues created by aircraft movements.

ILS glidepath and critical areas

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).

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

1. Type of grass (broad or narrow leaf);
2. Height of the grass and density of growth;
3. Water content within, or water from dew or rain on the leaves; and
4. Heights and types of aerials (transmitting and monitor).

It is not possible to give exact grass heights that would cover all systems and environments. However the following have been shown to be acceptable custom and practice:

- ILS glidepath: grass height of up to 100 mm is considered to be acceptable from the glidepath aerial to approximately 5 m beyond the monitors. A grass height of up to 200 mm is considered to be acceptable beyond this point up to the limit of the glidepath critical area.

- ILS localiser: a grass height of up to 200 mm may be considered acceptable within the critical area. Other heights may also be suitable; however, the advice from the Air Navigation Service Provider (ANSP) should be sought before implementation of any deviation from these grass heights.
- Aerodrome visual aids: aerodrome visual aids should be maintained as short grass for the smallest radius around the object necessary to prevent sightlines being obscured. The use of a 'total kill' herbicide in these areas will create bare ground and bird feeding opportunities and therefore should be avoided. Shorter grass should be maintained at between 50 mm and 100 mm.

Sward specific issues

Unless specialist advice suggests otherwise (or subject to the deviations noted above) an LGP would typically be the adopted policy for most UK aerodromes. In certain circumstances however, the habitat management specialist may determine that the grassland sward present on an aerodrome would not have suitable rigidity to allow it to be successful at optimum LGP heights and therefore in such instances, it may be preferable to alter or deviate grass cutting height regimes in order to retain the most effective repellent properties to birds. Where this is the case, the aerodrome may wish to consider the benefits of a re-seeding programme with an upright stalk species in order to allow the establishment of an LGP.

Cutting operations – timing and frequency

Cutting should commence as soon as sward heights have recovered to within the LGP parameters during the spring growing period. Timing should take into account ground conditions with cutting not undertaken during periods where surface firmness is insufficient to take the weight of machinery. The frequency of cutting should reflect the need to maintain the minimum and where stated, a maximum height, as described in the aerodrome's LGP. This will inevitably vary between sites and be dependent upon growing conditions in any given year.

Cutting operations – equipment and vehicles

Typically, a rotary cutter will be required. Equipment should be maintained appropriately to ensure that quality the cut is not compromised. All equipment should be regularly serviced and mowing blades kept sharp. Equipment should be set up correctly, on the aerodrome, to ensure correct and even cutting heights of 220-300 mm are maintained and that 'turf tyres' are fitted to tractors in order to reduce ground compaction.

Equipment cutting heights should be checked during the cutting process to ensure that the original settings are maintained throughout the entire cut.

Mowing speeds should be appropriate for the condition of terrain. Where uneven ground is present, speeds should be reduced sufficiently to allow units time to adjust to terrain and prevent surface scalping.

Use of growth regulators

Where indicated by the habitat management specialist, growth regulators may be applied to short grass areas of the aerodrome. Growth regulators stunt the vertical growth of a sward yet promote lateral growth, thereby strengthening the base of the sward. The impact of growth regulators is therefore as follows:

- To reduce mowing frequency;
- To reduce the amount of clippings deposited into the sward;
- To strengthen the base of the sward, reducing opportunities for weed establishment.

The use of growth regulators is most appropriate on any short grass areas of the airfield as these are prone to becoming weak and open.

Nutrient application

Fertiliser should only be applied in sufficient quantities if required to maintain the habitat in a healthy and upright condition. Any decision to apply fertiliser to a site should be based on the soil sample results. Soil sampling should, where practicable, be undertaken at the start of each year by an independent soil testing laboratory. Any deficiencies notified, should be addressed during the spring growing period. Fertiliser should be applied using appropriate equipment and during appropriate weather conditions. The appropriate fertiliser specified by the habitat management specialist should be applied in conjunction with the soil testing information. Fertiliser regimes should be tailored to encourage desirable or discourage undesirable species in the sward, however this should not jeopardise the integrity of the sward.

Over-seeding

Where the existing grass species are unsuitable for upright growth at the designated height, aerodrome managers should consider a replacement seeding programme to upgrade the sward with more appropriate species.

In these cases consideration should be given to using specialist strains of grasses designed for airfield use (as recommended by the habitat management specialist) which may be more effective at maintaining 220 mm height for wildlife deterrent qualities throughout the year. Local climate, soil type and drainage properties are important considerations during this process, recognising that there may be local variations within the aerodrome boundary.

Different strains of the same grass species may be necessary to achieve suitable wildlife deterrent qualities for each airport, with habitat management specialist advice necessary to ensure satisfactory establishment. The emphasis is on providing a nutritional programme that aids the production of a stiff stemmed upright sward rather than on rapid

soft leaf growth, which is ultimately detrimental to the effectiveness of the grasses as a wildlife deterrent.

Weed control

The presence of weeds is a sign of a weak grassland sward. Weeds provide feeding opportunities and can create shorter lying areas where which birds can 'loaf'. All grassed areas should be maintained to at least 95% weed free where practicable. A programme of herbicide/manual control (cutting or removal) should be implemented as often as required to control weed infestations. Blanket applications may not always be necessary – multiple targeted treatments of key areas may reap more effective and more efficient control than single blanket sprays. Short grass areas are generally more vulnerable to weed invasion and may require additional attention.

Herbicide type

The type of herbicide used should be based on an assessment of the type of weeds present on the site, with an appropriate herbicide, or combination of herbicides used to specifically target the weeds present. Herbicide recommendations can be made directly by a BASIS qualified professional agronomist or in cooperation with an independent approved BASIS-registered professional.[8] A regular inspection of the airfield habitat should be undertaken in order to identify weed presence. If weeds are seen to be developing, then an herbicide application should be considered to cover the areas of concern.

Pest control

A programme of control measures should be developed and implemented as often as required to control pest infestations. It is important that the type of pest problem is correctly identified to ensure adequate control. Insect larvae within the soil structure can have an adverse impact on birds and wildlife deterrence. Whilst species should always be identified to ascertain management programmes first, the main pest species that require monitoring are crane fly larvae (commonly called leatherjackets) chafer beetle larvae and cut-worms. All of these have a direct effect on turf by eating the plant roots and act as a direct cause of wildlife/bird population increases by providing a high protein food source – particularly for corvids and starlings. The activities of the larvae and associated foraging by wildlife can severely disrupt the grass surface and in extreme cases they may strip an aerodrome of grass giving rise to a potential FOD risk and the necessity for costly re-seeding.

Monitoring of adult insects, alongside accurate determinations of insect larvae populations within the soil profile is vital to the accurate identification and treatment of pest problems.

Guidance should be sought from the trained habitat management specialist to determine the most appropriate programme of control, which will be based on the type of pest present. The control methods should be approved products/techniques. Given the

[8] http://www.basis-reg.co.uk/About/Who-We-Are

absence of available insecticides, if severe outbreaks occur then advice should be sought from the habitat management specialist on future maintenance and control of the pests.

Regular reviews of the airfield should be conducted to identify signs of pest presence. In addition, the aerodrome's 'bird control unit' (BCU) or equivalent, should also report any areas of heightened bird activity which should then be investigated for possible causes. If pests are found to be the cause of a particular bird hazard problem then additional control measures should be considered to cover the areas of concern.

Moss control

Moss is an attractant to bird life, harbouring invertebrates which birds will readily seek to obtain. Its presence is also a sign of a weak, poorly draining sward. Moss is a particularly common problem on areas of disused concrete around the airfield where it will readily establish and will require periodic control. A programme of moss control should include the use of approved control agents, hand scraping and removal (in the case of concrete areas) and, in the case of grassed areas, it will be necessary to identify the weakness of the habitat that is allowing moss to develop. Any control measures should be undertaken early enough in the year to ensure weather conditions are suitable to allow the sward to quickly recover. It is crucial that moss control is not undertaken late in the year as expanses of open ground may be left over the winter period resulting in increased bird presence. Scrub includes any vegetation that is not maintained under the long grass policy (or alternative grass policy) and may include rank grassland, gorse, bramble, nettle, wetland, scrub trees and bushes. Scrub is a significant issue on airfields. It provides cover for rabbits, foxes and deer and game birds and safe nesting habitat for small birds and also provides these birds (which are often only able to fly short distances between pockets of vegetation) with an opportunity to access airfield property that would not otherwise be available to them. All scrub present within airfield boundaries should be removed, and then areas reinstated to meet the aerodrome's grass policy requirements. Depending upon the type of scrub present and the type of terrain upon which it is found, a combination of flail collectors, strimmers, chain saws and hand cutting tools should be used to remove or control scrub on site. Initial scrub control (i.e. remove or to maintain within long grass policy parameters) should occur before the bird breeding season (i.e. works should be undertaken by the end of February) to prevent birds colonising. Once the initial works have been completed, repeat operations should be undertaken as regularly as necessary to maintain the scrub with long grass policy limits.

Trees

Trees inevitably pose a considerable bird attractant. Nesting birds can be found in significant numbers in just a small number of trees and the proximity of trees to runways and approach/take-off paths is a critical factor as this influences the amount of time a pilot or the aerodrome's BCU has to react to birds emerging from trees during take-off and landing aircraft operations. Ideally trees should not exist within the aerodrome boundary and any trees that are retained should be managed regularly in the form of pollarding and

coppicing to reduce their nesting potential. All retained trees, both within aerodrome boundary and those in the immediate surroundings, should be regularly monitored by the BCU for nesting birds and action taken to remove any hazardous species.

Balancing/pollution control ponds and ditches

Interceptors effectively create open water hazards, likely to be frequented by large birds (ducks, geese, swans, etc) and should, where practicable be 'bird proofed' ie covered or netted. This is of particular significance given their close proximity to runways and taxiways. The grassland around the interceptors (which generally sit within fenced perimeters) should be maintained to long grass policy standards.

Ditches within the aerodrome boundary can be a significant wildlife attractant when not maintained appropriately. Ditches should be regularly inspected and maintained to ensure throughput of water is not restricted at any time and to prevent bankside vegetation from providing a habitat attractant. Bankside vegetation may need to be cut to 50mm at least twice per year, with all arisings removed.

Ground works

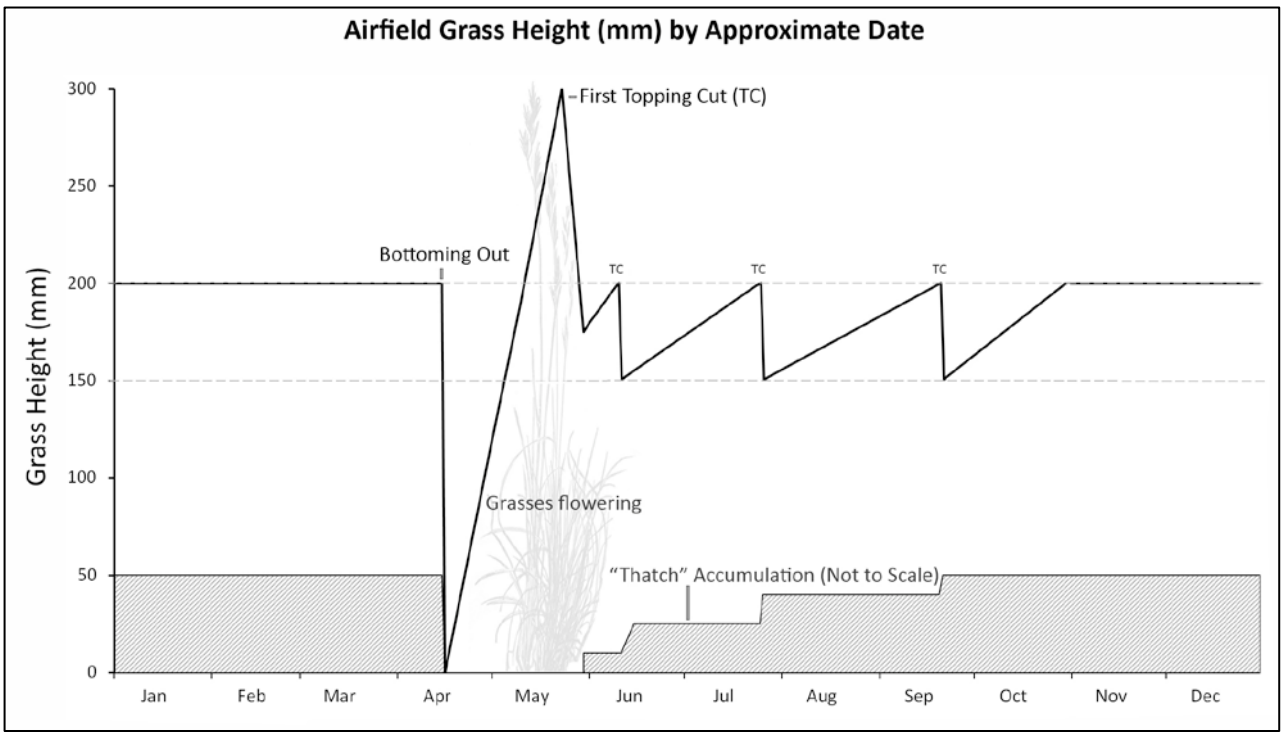
Ground works on and immediately adjacent to, the airfield can create temporary havens for birds and other wildlife. Any works requiring the removal of the grassed surface should be undertaken by competent personnel working to a reinstatement programme guided by the habitat management specialist. The airside works programme should ensure a successful and timely reinstatement. Timing of works should be carefully planned to ensure ground is reinstated with full grass cover well before the onset of the winter period.

Consideration should be given to the following when undertaking ground works:

- Proximity to air traffic
- Time of year
- Control of dust generation and creation of FOD
- Soil type
- Drainage
- Grass species

Completed ground works should be signed off by the appropriate person nominated by the aerodrome operators.

Figure 6: A traditional grass management regime



Alternative grass management options

Whilst a long grass policy or adaptations of, may be suitable and recommended by habitat management specialists, it is recognised and accepted that for a variety of reasons this may not always be practicable or achievable. In any case, a prescriptive grass/habitat management regime implemented by an aerodrome falls outside the scope of both EASA and CAA regulatory requirements. It is accepted that alternative methods to manage airfield habitats may be adopted at the sole discretion of the aerodrome operator and in some cases in coordination with the ANSP. It is important to emphasise that where alternative grass and habitat management are considered, that as part of the change management process, a risk assessment is completed to ensure that any deviations would not detrimentally increase hazardous bird/wildlife populations to the airfield and pose an increased flight safety risk to aircraft operations.

Other considerations

Food waste

Waste food is an attractant to gulls, corvids, pigeon species and starlings in particular and should not be tolerated on an aerodrome. Where food waste could occur, all bins and skips provided should be of designs that prevent animals (such as foxes and rodents) and birds getting in; for example, with drop-down or swinging lids. They should be emptied before they overflow.

Signage should be used to ensure contractors and other personnel are fully aware of the issues surrounding potential wildlife attractions.

Buildings

Where practicable dilapidated buildings should be removed, proofed or repaired to prevent roosting or nesting birds from getting access. Prevention systems, such as exclusion netting of the correct mesh size and installation type for the target species or ledge spikes, should be used to prevent any wildlife accessing these sites at any time and you should be able to demonstrate that this is being achieved.

Where wildlife is observed using lighting and signage structures, proofing should again be undertaken to prevent access where possible.

When new buildings are being designed they should:

- Prevent wildlife gaining access to the interior and roof spaces
- Use self-closing doors or plastic strip curtains or other mechanisms to prevent access by wildlife
- Be without roof attractions: consider the implications of green, flat and shallow pitched structures
- Have minimal roof overhangs and be without ledges beneath overhangs or external protrusions
- Allow easy access to rooftops in case it becomes necessary to take action against nesting gulls or waders that colonise large flat or shallow-pitched roofs. Gulls will also use steeply sloping roofs where the nests can be lodged behind vents, skylights, in gullies, etc.

Derelict aircraft should be removed or otherwise rendered inaccessible, as they have the potential to provide perching and nesting sites and may result in overgrown vegetation underneath.

Specialist birdstrike advice should be sought before taking action against starling roosts, rookeries, breeding gulls and any wildlife inhabiting buildings to ensure success.

Water

Wherever possible, watercourses on an aerodrome should be culverted. Where culverting is not possible, effective wildlife exclusion or control systems such as netting exclosures extending to the aerodrome perimeter should be used as necessary. Netting exclosures are the most efficient approach and other control measures or habitat modification will no longer be needed. Open channels should be free of bank side and emergent vegetation to minimise the attraction to wildlife and damage to nets.

If large permanent water areas cannot be eliminated, wildlife should be prevented from accessing sites. Where possible, water bodies should be proofed using exclusion methods such as netting or specialist floating balls. Wires suspended above the water surface could

be used over larger areas where netting structures may not hold up. These require careful spacing to ensure that target species are effectively excluded.

Wet and waterlogged grass areas that attract hazardous wildlife should be drained or the site re-graded to eliminate hollows that hold standing water. If drainage cannot be achieved, active control measures will be needed to ensure that the site does not result in increased risk.

The following habitat controls may also reduce the attractiveness of water bodies to wildlife that are part of the safeguarding process:

- The water should be as deep as possible (over 4m) to minimise bottom-growing vegetation
- In order to reduce nesting opportunities, there should be no development of islands. Attached promontories or spits can be used to reduce the open expanse of water bodies and prevent gull roosts forming.
- Banks should be as steep as possible (preferably vertical), with vegetation only deployed to prevent wildlife from walking in and out of the water.
- A vertical fence approximately 1 m high could be constructed around the water edge to prevent wildlife such as Canada geese getting access.
- On smaller lakes, wires suspended above the surface may deter wildlife that requires long take-off and landing runs (e.g. swans and geese). The wires should be made visible with tags (10 x 6 cm minimum), to increase the visibility to wildlife.
- Dense vegetation that provides nesting cover should be avoided. The water should be surrounded with long grass or a sterile substrate.
- Water should not be stocked with fish.

Landfills, sewage treatment and disposal sites

A netting exclosure is the most effective and reliable system to control birds at landfill and sewage treatment and disposal sites with open tanks. If this is necessary, an aeronautical assessment should be carried out to determine risk to the aerodrome and any agreed netting system should include an appropriate inspection and maintenance regime to ensure its reliability. Many examples of installed nets have poor maintenance regimes resulting in large rips or tears in the exclosures and a significant hazardous bird presence.

It is essential that companies who agree to implement active bird deterrence programmes at their sites meet targets agreed by the airport for bird presence and that there are auditable standards and penalties for failure.[9] Expert advice should be sought from the

[9] http://cdn.environment-agency.gov.uk/geho0409bput-e-e.pdf

CAA about the options for controlling risk from landfill and sewage treatment/disposal sites.

Active risk management

While aerodrome habitat management is critical for preventing a strike risk from arising in the first place, effective control measures should be deployed to manage the residual risks and be sufficiently dynamic and resourced to respond to immediate issues and prevent risks arising in the event that habitat management is not feasible.

Due to the difficulties of detecting and monitoring dispersal of hazardous birds at night and during low visibility periods, active bird control activity should be undertaken with caution during these periods; however, the overriding principle of ensuring birds and animals are not residing on operational surfaces prior to any aircraft movement should be adhered to in all conditions, where practicable.

Any system that scares birds and prevents the operator from controlling their departure from an airfield should be avoided ('scaring' vs 'control').

Deterrence

Birds respond to a variety of stimuli that can be used to disperse them from an airfield. The objective of deterrence is not to scare randomly around an airfield but to control bird movements and disperse them effectively. This can be achieved using a variety of methods, and different species respond in different ways. The ultimate objective is to 'educate' hazardous bird species that the risk of remaining in the aerodrome environment outweighs the potential rewards that the airside environment may offer. Habituation is an extremely simple form of learning, in which an animal, after a period of exposure to a stimulus, stops responding.[10] Any system used should therefore only target birds when it is necessary. Human operated (active) control is more effective than automated (static) scaring systems.[11]

Distress calls

Many birds react strongly to signals that indicate danger, distress or death. Some birds, typically social species that communicate with each other vocally (e.g. gulls, lapwings, corvids and starlings) emit piercing repeated distress calls when captured by a predator.

Different species react in different ways, but in general responsive flocks will react to a recorded distress call play-back in the field by showing alertness, lifting, taking flight and approaching the source of the call to investigate. The operator can control the behaviour of the birds by drawing them towards a vehicle, holding them overhead, then, when the broadcast is terminated, ensuring their dispersal.

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10 http://www.animalbehavioronline.com/habituation.html

11 Cleary, E.C. & Dolbeer, R.A. (1999) Wildlife hazard management at airports, a manual for airport personnel. US Federal Aviation Administration, Washington DC.

When using distress calls, the control vehicle should ideally be stationed approximately 100m upwind of the target flock, but this may require variation when considering the impact on aircraft movements. Birds will gain height and depart (gulls and lapwings), or resort to trees (corvids) or water (gulls) where they are safe. Birds should become airborne within 20 seconds and approach the speaker. Throwing a lure up (white for gulls and black for corvids), which resembles a struggling victim, can stimulate a flock to lift if necessary. Also noteworthy that foxes may approach the sound of a distress call as they investigate a possible food opportunity.

Volume settings should be low enough that they will not attract birds onto the aerodrome from distance. It is good practice to start the broadcast at a low volume and increase it until the target birds starts to respond if this is likely to be of concern.

The specific distress call of the target flock species should be used if possible.[12] If several species are present, play the distress call of whichever species there are more of first. Species that do not have distress calls will sometimes follow the lead of those that do.

Once airborne, you will need to keep the distress call playing to give the flock enough time to approach and investigate the source of the calls but no more than 90 seconds.

Lapwings will often take flight and fly around in wide circles at some distance (as they are seeking the safety of an open environment to avoid danger but will try to return to the airside environment) in which case it may be necessary to subsequently use pyrotechnics to ensure dispersal.

Starlings commonly fly directly away from distress calls and it may be necessary to follow them slowly to prevent them from re-alighting. Local birds, especially corvids, may start to depart immediately once the distress call has been used a few times and may eventually habituate, so it may be necessary to reinforce non-lethal control techniques with lethal control.

Dispersal by a pyrotechnic bird scaring cartridge (BSC)

Use of a BSC is a common means of dispersing bird at aerodromes. Also commonly known as a 'shell cracker', a BSC is typically a 12 bore shotgun cartridge case with the shot replaced by a projectile containing an explosive charge and delayed fuse/light trace, so that the projectile detonates at some distance from the gun. Birds will usually fly away from the detonation so it is possible to control their direction to some degree - detonations behind birds can hasten their departure, and to either side can keep them on track and to hold a flock together. A BSC fired high in the path of an approaching flock will cause it to pause and orbit. However, birds will often avoid a significant headwind and they will eventually turn back.

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[12] Baxter, A. T.; Bell, J. C.; Allan, J. R.; and Fairclough, J. (1999). The Interspecificity of Distress Calls. 1999 Bird Strike Committee-USA/ Canada, First Joint Annual Meeting, Vancouver, BC. Paper 8. http://digitalcommons.unl.edu/birdstrike1999/8

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

- Have a range greater than 80 m when fired at a 45° elevation (i.e. a flight time of four to five seconds before detonation) to allow firing from outside the runway strip and to provide a reasonably effective area
- Have a bright tracer component that is clearly visible in sunlight throughout its flight
- Detonate between maximum and ½ maximum height when fired at a 45° elevation
- Produce a sharp, loud 'crack', with a bright flash

The effect of a BSC is significantly improved by using a trace, especially when trying to control their direction. The trace should be visible in sunlight throughout its flight.

Several types of signal pistol with a 12 bore liner and a few purpose-made 12 bore pistols are in use at UK aerodromes. The pistol should be fit for purpose 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. Use of BSCs and rockets may present a FOD hazard to aircraft which should be managed accordingly. Operators should also be competent in their use, comply with relevant firearm and munitions legislation, and be provided with appropriate personal protection equipment (PPE).

In many circumstances, you may not be allowed 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 the approach path.

One large flock of birds is more likely to leave the aerodrome using this method than several smaller ones. However, firing directly into a flock will probably fragment it and the individuals may not re-group, so this should be avoided unless they have ignored previous dispersal attempts. A very close detonation may be useful to disperse birds that re-group quickly, such as flocks of starlings. A BSC should not be fired immediately before or during a distress call broadcast.

Aerodrome managers should consider whether the benefits of being able to respond to dynamic situations could be hindered by the need to contact Air Traffic Control on each occasion a BSC is fired.

Manual dispersal techniques

Many birds are afraid of humans, especially those that are commonly shot as pests (e.g. corvids and pigeons) and traditional quarry species (wildfowl and waders), so you can try other approaches including exiting a vehicle and slowly raising and lowering the outstretched arms.

Arm waving may not cause birds to move very far, but they will leave directly away from the person. This is effective against all common species, and can be used at short notice,

especially where noise or pyrotechnics are unacceptable because of proximity to people or livestock, or because of fire risk.

Lures

A lure is a leather pad with an attached wing on a string. Waving it can be effective, but throwing it high into the air so that it falls to the ground with wings ‘fluttering’ will cause target flocks to fly up and directly away. This can work at ranges of several hundred metres. Birds react as if the lure is an individual 'in trouble' and may even approach to investigate and it also enhances responses to distress call broadcasts. Traditional falconer's lures, dead bird effigies, and even a tennis ball fastened in the corner of a black or white bin bag can prove useful tools.

Other methods and techniques

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

- Flags
- Plastic tape that vibrates and hums in the wind
- Weighted plastic balls on water
- Bird scaring rockets

Birds of prey (falconry)

Use of falcons can be suitable and effective for both civil and military aerodrome bird control and is used at some European and North American airports and airbases. Dogs such as Collies are also used at many US military bases and at some European airports.

The use of birds of prey is an additional technique that can be integrated into a bird control program at any aerodrome.

Birds of prey can undoubtedly cause changes in the behavioural patterns of some bird species that regularly frequent or habituate aerodromes and the vicinity, and when employed correctly may enhance other techniques.

Falconry in the true sense is defined as the art of hunting wild quarry with a trained bird of prey. This procedure can be complex and time consuming and can in some instances result in a falcon being under a reduced amount of control. Consideration of their use during periods without aircraft movements is therefore important.

As with dogs, falcons are a natural predator and therefore most species of bird will react quickly to their presence. Like other techniques, falcons that are persistently used and do not present a threat to target birds can result in habituation. Undoubtedly, birds of prey and dogs require dedicated, experienced, trained, competent and well motivated personnel to manage them, so all the techniques used with should only be carried out by persons with demonstrable sector significant experience.

Lasers

The use of lasers for bird dispersal on aerodromes has increased since early 2000. In the UK, use of lasers is subject to the requirements specified in ICAO Annex 14 Volume 1 and CAP 736 Guide for the Operation of Lasers, Searchlights and Fireworks in UK Airspace and EASA Rules concerning 'laser-free zones'. CAA approval or consent is not required to introduce and use lasers for bird control. However, aerodrome operators and or their third party contractors should conduct a thorough safety assessment prior to introduction. Risk assessments should include information on the class of laser and the type and degree of harm they pose to both public and flight safety, and develop a safety procedures and an outline of the scope of work for which use of the laser is intended to be used. Details of such assessment and subsequent use should be shared with other airport users, ANSP and local emergency services and consider use promulgating bird control lasers in via NOTAMs or in the AIP.

The following specific values should be included in any risk assessment:

- Eye hazard distance: Nominal Ocular Hazard Distance (NOHD)
- Flash blindness distance: Sensitive Flight Zone Exposure Distance (SFZED)
- Glare distance: Critical Flight Zone Exposure Distance (CFZED)
- Distraction distance: Laser Free Flight Zone Exposure Distance (LFFZED)

Trials have shown that green lasers (with wavelength around 532 nanometre) may be a useful bird dispersal tool in bird control operations as part of a bird hazard management program where trials indicated that effective bird dispersal may be achieved in low light conditions, whereas lasers with a higher output power (up to 500mW) maintained their effectiveness in brighter light conditions.

The range of portable systems developed specifically for bird control extends beyond 1.5 km. This requires the use of additional safety features allowing the user to safely operate bird control laser products. A scope or sight can be attached to ensure that the user is always aware of his projection area. A horizontal safety system which shuts off the laser when tilted above a preset angle should be considered when procuring devices as this helps limit any likelihood of unintended exposure of the laser beam to aircraft, airport personnel and the general public.

All operators of lasers should be aware of the EU safety recommendations according to International Standard IEC60825 and Accessible Emission Limit (AEL) safety recommendations for Class 3B laser products. The British Standard user guide for laser safety (PD IEC TR 60825-14:2004) recommends a laser safety officer is appointed where class 3B lasers are used and the operators followed a laser worker course. The main manufacturers of laser equipment offer laser worker and laser safety officer training courses. All laser class 3B products should have at least the following safety requirements:

- Key control

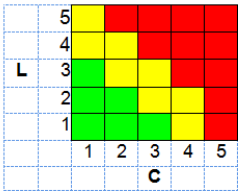
- Visible or audible output indicator
- Remote interlock switch

Figure 7: Laser risk assessment

Subject: Airside Bird Control Laser Usage	**Work Activity and Location: Bird control on the airfield**
Reference number:	**Dept / Section: Airside Operations**
Date completed:	
RA team members:	**Responsible Manager:**
	Review date:

Hazards Identified, Harmful Consequences, Persons at Risk	Existing Control Measures	Residual Risk			Actions Required	Target Date	Person Responsible	Predicted Residual Risk			Completion Date & Initials
		L 1-5	C 1-5	R RAG				L 1-5	C 1-5	R RAG	

lote: Residual risk:
= Likelihood ranking: 1=Improbable; 2=Unlikely; 3=Possible; 4=Likely; 5=Probable
= Consequence severity: 1=Minor injury; 2=Moderate injury; 3=Significant injury; 4=Single fatality; 5= Multiple fatalities
= Risk level: (R = red, A = amber G =green - see matrix opposite)



Repellents and passive deterrents

Repellents that are used elsewhere in the world include sticky gels and filaments, used against roosting and nesting species on ledges and beams on buildings. Otherwise, lines strung over restricted sites, such as marshy areas and bird spikes can be effective on aerodrome signs, lights, building edges and ledges. All injurious and lethal substances are illegal for use in the UK for aviation purposes.

Lethal control

When habitat management and active wildlife deterrence fail to reduce risk, the implementation of lethal control can reinforce the effect of non-lethal control techniques. It can also be used to reduce numbers and sick or injured birds, or to deal with an immediate problem.

It is possible for species to habituate to the use of lethal control particularly the deployment of shotguns. These have a limited range (circa 40m) beyond which some species will behave as if they are safe.

All activities involving the use of firearms should be independently certificated by the local police/licensing agency. Applications for firearms permits should be made and certified before use. Safe use, storage of guns and ammunition and record-keeping require

separate and specific training by competent and qualified persons, security procedures and skills sets and are covered under separate firearms legislation.

Special legal provisions exist that licence the shooting of certain birds/wildlife on aerodromes, and are subject to specified conditions. They require an operator to be able to demonstrate that acceptable non-lethal measures have been attempted first. Stupefying or poison baiting is not licensed for use on aerodromes in the UK.

Population control

The implementation of lethal control to reduce or eliminate the presence of hazardous wildlife on or around an airport requires a full understanding of the behaviour of the species being targeted and you should seek expert advice. Gulls in winter, for example, may have migrated to the UK from anywhere between Northern Scandinavia and Eastern Europe and move long distances between sites, so attempting to cull them is unlikely to result in a satisfactory risk reduction. Conversely, the removal of a population of feral pigeons that reside in airport buildings on the airfield may be essential before proofing and preventing further infestations in that area.

During the breeding season, the effectiveness of egg control will vary with species. Feral pigeons, if the conditions are suitable, can breed all year round and require permanent monitoring and action to have any effect. Gulls and many wading bird species will re-lay if eggs or nests are destroyed (removed, oiled or pricked) just once in a season. Successive visits are therefore necessary between April and August to ensure breeding does not occur. Alternatively, species such as Canada geese can be controlled by a single action to prevent hatching after which the adults need to moult and do not have sufficient time to breed again.

Trapping and removing wildlife from an airfield requires specialist skills and experience and the law may limit some actions, and you should consider whether it will influence on-airfield wildlife activity; for example, providing baited traps on an airfield can attract other wildlife.

In some locations, small mammals 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. Lethal control may therefore be an essential requirement for the removal of species that can both influence habitat and create an attraction in their own rights. Any lethal control should ensure that all carcasses are removed from the airfield and disposed of appropriately to avoid becoming a carrion attraction themselves.

Safeguarding

Virtually all land types and land uses (including natural habitats) attract wildlife in some way. Safeguarding should therefore address developments that could become wildlife attractants with the potential to increase the wildlife strike risk at a nearby aerodrome.

ICAO recommends that the appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem. Where the elimination of existing sites is not possible, the appropriate authority shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.

Where an assessment shows that the wildlife strike risk may increase or could increase under certain conditions in the future, and the aerodrome certificate/licence holder and developer are unable to agree a solution, the aerodrome operator may object to the planning application on aviation/air safety grounds. Local knowledge of wildlife populations and activities or an appropriate similar safeguarding case to support any objection can be used and objections withdrawn when measures implemented to manage risks are deemed acceptable (to the airport operator). It may be possible to modify a development (e.g. exclusion of food wastes from a new landfill) or impose planning conditions. Where a safeguarding case is resolved through the imposition of planning conditions, it may be appropriate for the conditions (and 'wildlife control/reduction management plan') to be subject to a legal agreement between the planning authority and the developer or property owner, or its successors.

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

Although the notification, designation, classification and listing of national, European and internationally protected sites, such as Sites of Special Scientific Interest (SSSIs), European Sites (SACs and SPAs) and Ramsar Sites, do not require planning permission, the creation of new conservation sites is usually associated with other developments that require planning permission and, as applicable, safeguarding consultation. Many nature reserves are created to protect particular flora or invertebrate communities, which do not represent an increase in wildlife strike risk; however, others, such as estuarine reserves, may be major wildlife sites. It is essential that the aerodrome operator establishes contact with agencies responsible for the management of sites, such as the RSPB, as a simple change in design may help prevent hazardous species using the new area.

Informal safeguarding agreements may exist to prevent the large-scale release of racing pigeons for the purposes of racing near aerodromes, without notifications. Releases of over 40,000 birds at a time can occur and as such represent a specific and major hazard. Releases are therefore prohibited within 13 km of 28 major aerodromes in the UK 16.[13] In agreement with the Royal Pigeon Racing Association (RPRA), any proposed release of racing pigeons associated with a sanctioned race, within 13 km of a licensed aerodrome

[13] http://www.rpra.org/racing-handbook/rulebook

should be notified to the aerodrome authority or air traffic control provider at least 14 days before. Aerodrome operators should contact the RPRA to confirm contact details to ensure this information is transmitted. In addition, the ANSP (ATC unit) should be notified by telephone at least 30 minutes before a given release time, in order to confirm the number of birds, intended destination and direction of flight. Aerodromes can then pass on information via ATIS or NOTAM, as necessary. If required, the ATC manager may request a delay in the release by up to 30 minutes (or longer in exceptional circumstances). Racing pigeons can travel at speeds of up to 60 mph (depending on the head or tail wind), hence an aerodrome should be able to ascertain the approximate position of flocks of birds once the release location and destination details are known. CAA recognises that for training flight pigeon releases, the issue concerning prior notification is problematic; however, the CAA continues to engage with the RPRA and other to ensure that necessity communication of releases is brought to the attention of its members and associate Homing Unions.

Chapter 6

Reporting of occurrences

Changes to regulation

Implementation of EC Regulation (EU) 376/2014[14] concerning the reporting, analysis and follow-up of occurrences in civil aviation has been implemented within the UK. The Regulation updates legislation for the UK Mandatory Occurrence Reporting (MOR) and the UK Air Navigation Order (ANO) accordingly. The EU regulation places additional requirements on organisations, as well as 'competent authorities' and EASA, beyond what is currently contained within existing legislation for both external occurrence reporting and internal occurrence reporting systems.

Specific items within the new regulation include:

- A widening of scope to include ground handling organisations for mandatory reporting;
- Organisations being required to ensure that their internal safety reporting systems are compatible with the European Co-ordination Centre for Accident and Incident Reporting Systems (known as 'ECCAIRS') software and the Accident/Incident Data Reporting (ADREP) taxonomy.
- Organisations being required to ensure that preliminary results of any analysis of a MOR are submitted to the competent authority (CAA) within 30 days and the report of the final result of analysis, within three months.

Consequently, there have been significant changes concerning birdstrike reporting when compared to previous processes and procedures. Such changes include: what is reportable; who is obligated to report; what constitutes a reportable occurrence and details concerning voluntary reports. Further information is available on the CAA website.

Reporting

All bird and wildlife strikes occurrences should be reported to the CAA, this includes confirmed, unconfirmed, near miss or significant event; such reports should be annotated as such in the relevant narrative headings or content.

The table below provides additional guidance further details of which can be found here within the MOR code.

[14] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014R0376&from=EN

EU 376/2014 or IR2015/1018 Reference	Question	Interpretation, guidance and key attributes
Wildlife strike including bird strike	Does this now mean all birdstrikes?	Yes, this includes all wildlife and birdstrikes **with or without** damage. Suspected Birdstrikes or encounters with flocks should also be reported. Key additional attributes required: **Species** (of bird/wildlife if identified and **location of damage** (on the aircraft).

Data management and information sharing

Historical birdstrike data is provided on the CAA website.

Requests for the release of any bird/wildlife strike data, or other occurrence data requests must be submitted to CAA via form SRG 1605.

Species identification

To enable effective and detailed risk assessment and trend analysis, it is essential that accurate bird species information is provided when a report is submitted to the CAA. Aerodrome Wildlife Hazard Management Plans should clearly set out procedures for obtaining species identification for this purpose. Where species identification cannot be achieved locally by trained personnel, the management plan should detail what other means and methods might be used (i.e. employing the services of third party specialist organisation for wildlife remains identification). Remains can be identified via digital photographs of whole birds, major bird parts or feathers. Details of the aircraft type, phase of flight, location, time, date and aircraft altitude may all add valuable information that may help to confirm an accurate identification.

Bird identifications can be achieved when even the smallest amounts of remains are left, but care needs to be taken during collection. Appropriate protective gloves should always be worn when collecting any sample and handling dead wildlife remains. These should then be double bagged and sent to the appropriate selected organisation together with full details.

Chapter 7

Aerodrome ornithology

Wildlife identification

Each wildlife species has unique features, behaviour patterns and actions. Published field guides usually include practical information on how to observe and record the various characteristics of birds that enable them to be identified.

Good field guides cover the different groups of birds in a generally accepted taxonomic sequence. Field guides that illustrate birds with photographs or paintings of birds in varied poses should be avoided, but coloured paintings with birds in similar poses, and with plumage variations for each species described or illustrated, are more useful for identification.

Important differences between species should be made clear, and 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
- Nesting behaviour

Wildlife ecology

Behaviour varies with season, time of day, weather and other factors. Its 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. These factors all help with identification.

Birds have sharp eyesight, communicate vocally and have good hearing over a similar range of frequencies as humans. They are unable to hear ultrasonic sound devices and most birds found on UK aerodromes have little or no sense of smell.

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.

The following species represent the most commonly encountered birds on UK aerodromes. Their numbers will vary depending on season, time of day and location of the aerodrome and good field identification guides should provide further details.

Specific bird behaviour

Gulls

Common UK gulls fall into two broad groups: small (black-headed and common) and large (herring, lesser and great black-backed). Gulls feed predominantly on soil invertebrates, especially on disturbed ground, but can be found scavenging waste or hunting insects in the air.

Most often they are encountered crossing an airfield when moving between their breeding or roosting sites, and feeding sites. These can include farmland, playing fields with short grass, sewage works, and landfill sites where food wastes are tipped. They will also forage along coastlines, estuaries, river banks and in parkland where they will readily adapt to take food from people. When not feeding, flocks may spend long periods on open undisturbed sites and commonly use aerodromes for security. During the breeding season, gulls of all species may be found nesting on rooftops of buildings both on and off the aerodrome.

Gull numbers in the UK increase each winter because of migration. Numbers generally rise from July through to November and fall in March. Previously, lesser black-backed gulls would largely leave the UK in winter, returning to breed each spring. However, evidence suggests that many now remain in the UK, in large numbers, and therefore may be a birdstrike risk at any time[15]. Ploughing fields nearby may cause short-term influxes of these species during the autumn months.

Lapwing and golden plover

Lapwings prefer open habitats with low or sparse vegetation, especially grassland. In lowland Britain, numbers are usually at a minimum during the breeding season. Flocks begin to build in June or July as local birds disperse from breeding sites and others migrate to the UK. Some aerodromes provide attractive habitats 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 moulting.

Once harvesting and ploughing are underway from August, lapwing numbers on aerodromes decline as they move to exploit these seasonal feeding opportunities. They remain relatively scarce on aerodromes until October or November when large flocks reappear. Unless hard weather settles in, numbers can remain high in winter until spring migration in February and March. However, prolonged frozen ground or snow cover

[15]CAA birdstrike data indicates that gulls are struck most frequently in July, August and September

prevents lapwings from feeding and they are forced to move to seek better conditions further south or at the coast. The most effective tool for preventing lapwings residing on airfields is an effective LGP.

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 may also attempt to feed and roost on aerodromes at night. CAA data show both species have been struck far less frequently in recent years.

Other waders

The oystercatcher is primarily a coastal species but moves inland to moors to breed and to lowland water bodies in winter to feed. On aerodromes, particularly those near the coast, they will nest on gravel islands surrounding lights and marker boards, broken up paved surfaces, fresh drains and disturbed ground, such as rabbit holes. They will may also use shingle flat roofs that provide an ideal substitute for coastal shoreline areas.

The curlew is often found 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. Nesting curlews defend a large territory against other curlews and, therefore, aerodromes rarely have high densities of breeding birds. They are very obvious and present a potential wildlife strike 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, but wintering flocks often do.

Other waders may appear on coastal aerodromes, especially when on migration in spring and autumn or on any aerodromes where damp ground or sedge is present. An effective grass policy and active control are the best methods for preventing waders using aerodromes.

Corvids

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 soil. They nest colonially, forming rookeries in tall trees, where they return for security. Dawn and dusk flight lines and pre-roost assemblies may increase the risk of a wildlife strike 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 are largely sedentary but continental birds boost the UK winter population, especially in the east.

Carrion crows and hooded crows are involved in relatively few wildlife strikes despite a ubiquitous presence on aerodromes. Their presence, however, signals to other wildlife that the area is safe and may result in greater risks than initially appears. Their diet includes carrion, small mammals and birds, eggs, animals, soil invertebrates, grain and fruit and waste food. On aerodromes, 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.

Although common, jackdaws are involved in very few wildlife strikes, they commonly associate with other corvids and significant numbers may nest and/or roost in hangars. Jackdaws are very gregarious, often in mixed flocks on farmland and aerodromes. Their diet is similar to that of rooks, but on grassland jackdaws feed on surface-dwelling invertebrates, rather than digging for prey. They also take small mammals, eggs, waste 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.

The most effective way of controlling corvids on aerodromes is a good LGP along with suitable habitat controls to prevent nesting opportunities, after which active control as per other species should be carried out.

Waterfowl

Waterfowl include the wildfowl (ducks, geese and swans) and also herons and cormorants etc. Some, such as geese and swans, are large birds and present a significant risk to aircraft operations. However, provided that any water habitats on aerodromes are effectively managed to exclude waterfowl, their presence is restricted to flight lines across the aerodrome, which in itself can be hazardous if not checked and understood.

The numbers of some species of geese have increased rapidly since the 1950s and flocks may occur on or near aerodromes. Canada geese are gregarious, roosting on lakes and ponds, and travelling several kilometres daily to feed on farmland, parkland and 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.

‘Wild’ geese commonly winter in Britain, notably in northern and eastern areas. These 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. They rarely venture onto airfields and are best dispersed using active deterrence measures if located.

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. Swans may mistake runways for water bodies and can occasionally be found in damp conditions walking around an airfield after crash landing on the runways. Birds should be dispersed by manual control efforts when aircraft movements permit, or captured (they may often be reluctant to fly off) and released some distance from the airfield.

A variety of species of duck spend the winter in the UK - many are relatively large, heavy birds that tend to fly in close formation, with the potential to cause damage to aircraft when struck. By far the most numerous duck species is the mallard, frequenting rivers, lakes and small ponds, often feeding in fields (in ponds, water courses or when flooded) around aerodromes and often at night.

The grey heron can sometimes be found hunting mice and voles on aerodromes.

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.

The most appropriate tool for preventing water birds from accessing aerodromes is to proof all water bodies.

Pigeons

In recent years, woodpigeons have been involved in an increasing number of birdstrikes, as the national population has undergone a significant increase. Woodpigeons are most numerous on well-wooded farmland, feeding on cereals, clover, rape, peas and other crops, weeds, acorns and beech-mast. They are found at 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 flight lines 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.

Stock doves are often misidentified as woodpigeons or feral pigeons. Birdstrikes involving stock doves tend to be in the early summer when they are attracted by weeds. Stock doves can occur as pairs or in small flocks, often with woodpigeons. Their food includes weed seeds, and stock doves are particularly attracted to very long grass with many wild flowers, especially vetches.

Feral pigeons are known to live on aerodromes, often roosting and nesting in disused buildings and hangars. In such sheltered environments they can breed year-round.

Racing pigeons may be present a birdstrike risk during the racing season, generally between April and September.

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 or around aerodromes.

Management and control of pigeon species may be best achieved through an effective LGP and thorough ‘bird-proofing’ of buildings and general good housekeeping within the aerodrome environment that reduces the availability of food sources to hazardous species.

Starlings

Although the starling is involved in a relatively small percentage of birdstrikes in the UK, they can form large and dense flocks during feeding bouts or 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 waste. However, grassland is the most important feeding habitat and 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. crane fly, ants).

Starling roosts can contain thousands of birds. Typically they roost in dense vegetation (not necessarily tall but usually difficult to penetrate) such as thorn thickets, game coverts, young un-thinned conifer plantations, reed beds etc. Starlings may travel long distances between roost and feeding areas. They nest between April and July in holes in trees, buildings and occasionally aircraft.

The most appropriate forms of bird management practices vary from an effective grass policy through to proofing of nesting areas and removal of roosting habitat. Starling roosts can be dispersed by scaring action at dusk on several consecutive nights. Considerable effort and resources (and specialist advice) may be necessary to evict starlings from roosts using pyrotechnics, distress calls and/or lasers.

Birds of prey

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, bird or wildlife populations.

The kestrel is a small falcon, which hunts small mammals 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 habitually hovers motionless on rapidly beating wings.

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 and is less commonly seen over an open airfield.

The buzzard is a much larger bird of open country, but may also be seen hovering over the open grassland on aerodromes.

It has seen a national population increase and is present throughout the UK and increasingly involved in birdstrikes. It soars on long broad wings and takes carrion, rabbits and other small ground-dwelling animals as well as feeding on grassland insects and invertebrates, which may be indicative of detrimental or poor grass and habitat management at the aerodrome.

The red kite is similar in size to the buzzard and has undergone a highly successful conservation release programme throughout the UK. As such it is now present in many areas around aerodromes and has featured in the CAA's national birdstrike records in recent years. This is a scavenging species where good housekeeping will be essential to prevent them attempting to use aerodromes. Active dispersal of these species is difficult to achieve yet they will often attempt to feed on an airfield when grass cutting or 'bottoming out' procedures are being implemented.

The peregrine falcon is a large falcon that hunts birds such as feral pigeons in the air. Peregrines may indicate that hazard management action is needed to remove their food sources.

Effective aerodrome habitat management is critical for the control of birds of prey. Active control of rabbits may help to reduce buzzard presence although they are equally adapted to feed on voles and soil invertebrates such as worms and beetles. Proofing of perching areas will reduce opportunities for birds to reside on airfields. Active and rigorous deterrence is necessary and removal under appropriate licence conditions may be necessary to prevent wildlife strike risks occurring.

Game Birds

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.

Grey and red-legged partridges are both squat, ground-living birds, often found 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. They prefer very long grass or ruts and divots on an aerodrome. Management is difficult however advice from Natural England or other statutory bodies should be sought.[16]

[16] E.g. Natural England Technical Note 105; Game birds: managing the bird-strike risk at airports and airfields

Swifts, swallows and martins

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 crane fly over grass. Large numbers of swallows and martins can sometimes sit on runways in autumn in between feeding on aerial prey over airport grass.

Swallows nest 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. The key to managing these species is a good long grass policy that includes suitable insecticide activity to prevent the presence of aerial insect emergences in the first place.

The swift nests in holes in buildings and only alights at the nest. Swifts do not respond to dispersal actions.

Mammals

Based on UK strike data over the past 20 years, due to the very low probability of strikes to aircraft by mammals, this guidance document does not discuss detailed information on control measures involving animals. Where aerodrome operators are presented with issues concerning the control of wildlife other than birds, specialist advice should always be sought.

Red fox, deer species, sheep, hare, cat, rabbit, badger, hedgehog and bat have all been involved in wildlife strikes at aerodromes in the UK. Some species have been involved in occurrences which have resulted in aircraft damage (deer and fox). Very small herbivorous mammals – rodents, such as mice and voles – represent no direct strike hazard to aircraft but, as discussed elsewhere in this document, may attract predatory birds (and omnivorous species such as corvids) to the airfield, particularly when grassland populations of voles are high.

The rabbit constitutes a negligible strike risk to aircraft due to its small size and its behaviour. Their control is, however, recommended to prevent habitat damage or attraction to birds of prey.

A long grass policy may attract hares, with strikes peaking in late winter and early spring. This species typically weighs 3-4 kg but although there have been reported strikes there have been few reports of damage to aircraft in the UK.

To date, only a small number of collisions between deer and aircraft have been reported in the UK. From the reported incidents on record, the risk is higher during the hours of darkness. In the event of deer on the aerodrome it is advised that the entry route onto the airfield is identified and closed off and any scrub or tree plantations that provide cover for deer should be removed or substantially thinned out. Shooting deer must be approached

with extreme caution because of the firearm and safety requirements; hence deer management experts should always be consulted when such issues arise.

Chapter 8

Personnel training

As part of the EASA Aerodrome Operator Management System requirements, an obligation is placed on the aerodrome operator to establish and implement a training programme for personnel involved in the operation, maintenance and management of the aerodrome and for persons working unescorted on the movement area, or other areas.

In accordance with EASA Aerodrome Means of Compliance (AMC) it is necessary for aerodrome operators to ensure that personnel have demonstrated their capabilities in the performance of their assigned duties through competency or proficiency checks at adequate intervals, in order to ensure a continued competence. Attendance on a refresher training course does not necessarily mean competence. Training programmes should therefore be bespoked to incorporate some level of assessment and test as part of the syllabus, ideally not open-book, with a set target pass grade of at least 70%, for example.

Aerodrome Operators should ensure that only adequately qualified and experienced instructors and assessors are used for implementation of birdstrike training programmes and that they maintain appropriate qualification records to demonstrate compliance with the requirements, during audit.

Service level agreements between the aerodrome operator and any external, or third party training providers should be established that require the competency of training providers to be demonstrated and that the contents of all training programmes and syllabus are established to meet the requirements both of the aerodrome and to also satisfy any regulatory requirements.

The CAA has supported industry stakeholders developing a standardised training syllabus for airport operations personnel covering a wide range of airside operations subjects, including Wildlife Hazard Management. Further details can be found via the National Certificate in Airside Operations, via People1st.

Alternatively, the following topics may be considered to form part of locally agreed training syllabus as part of a WHM training programme, which supports EASA's Guidance Material at GM3 ADR.OPS.B.020:

Background to wildlife strike hazards

Nature and definition of wildlife strikes, nature and extent of the aviation wildlife management problem; characteristics of the aerodrome, including coastal aerodromes, inland aerodromes, grass aerodromes or tarmac aerodromes.

Roles and Responsibilities

How a wildlife control unit should be structured and who has responsibility for what roles and who the relevant people are, for example, air traffic control, air crews and external agencies.

Assessment of Risk

Understanding methods for evaluating wildlife strike risk and how this can be applied to the aerodrome environment.

Wildlife Identification

Correctly identifying aerodrome wildlife and understanding what to look out for when identifying species.

Aerodrome Ecology

Evaluating and understanding the features and factors on and around an aerodrome that attract hazardous species.

Habitat Management

An understanding of how to maintain an environment which is unattractive to birds and other wildlife.

Wildlife Ecology

An understanding of how wildlife could respond to different control methods: lively and immediate dispersal; temporary and unsettled dispersal; leaving aerodrome; removal to alternative area of aerodrome; following favoured routes of departure etc.

Passive and Active Scaring Techniques

An understanding of how to disperse birds and other wildlife and the benefits and advantages of using different active and passive management techniques on and in the vicinity of an airfield and the applicability of techniques to different situations including health and safety aspects relating to all equipment and methods used.

Wildlife and the Law

An understanding of the law of the devolved UK, what can and cannot be done to resolve wildlife strike issues within the law including local bye-laws affecting the way operating bird scaring equipment might be utilised.

Wildlife Strike Reporting

An understanding of the requirements of reporting and what constitutes a wildlife strike. Collection, preservation and identification of strike remains.

Wildlife Recording

How to maintain a wildlife control log and what to record. Systems and procedures for reporting and analysing data.

Safeguarding

Understanding the importance of managing the off-airfield environment and monitoring the impacts of wildlife hazards in the vicinity of an aerodrome.

Training and Certification

To ensure that wildlife/bird control personnel maintain competence, Annual refresher or another system of monitoring should be implemented by the aerodrome operator.

A written certification should be provided to those who successfully pass the test(s). If a published training procedure is not provided by the trainer the certificate should attest to the fields the trainee has successfully completed.

APPENDIX A

Avian radar

The use of avian radar is increasingly being deployed and considered by a number of major commercial air transport airports around the world.

The information provided in this appendix discusses the background, tactical use and capabilities. Aerodrome operators and other stakeholders should contact organisations with experience in avian radar in order to learn more about the capabilities and limitations in order to suit local issues, both tactical and strategic.

Background

Avian radar systems are increasingly being used around the world to monitor hazardous bird movements in relation to aircraft safety. From the 1950s through to the mid-1990s radar developers have tried to relate their findings to birdstrikes, often for the military, which led to the rise in Europe of the 'BIRDTAM' system, a Notice to Airmen message, advising of the general location of increased bird activity measured by long-range radars as a secondary function to their use for air traffic control.

In the late 1990s work by the United States Air Force led to the development of small dedicated avian radars using equipment sourced from the marine radar industry. Initially these were used to develop historical models of where and when birds hazardous to aircraft were active at bombing ranges and on airfields. These projects demonstrated that the technology was rapidly maturing whereby biological targets could be tracked and activity records stored in databases for developing historical models as well as to be used in real-time for birdstrike risk reduction. In 1997 the USAF Avian Hazard Advisory System (AHAS) was developed to use data from more than 140 long range weather radars, isolate returns from biological targets and use that information to identify areas of increased birdstrike risk, as a means to reduce the potential for loss of aircraft training on low-level routes, bombing ranges and other military training areas including the area around airfields.

More recently, dedicated avian radars have emerged which do not rely on the use of sub-optimal marine radars, but which are purpose-built for bird detection. This ensures that each part of the radar data processing chain is optimized for finding bird targets. Many of the new generation radars have tracking capabilities for individual birds.

Moreover they have added classification between small, medium and large sized birds and flocks.

Operational use

The first dedicated avian radar system for an airfield was deployed in the UK, at RAF Kinloss in Scotland and was integrated into air traffic control and approach radar rooms using displays that were similar to those commonly used in Precision Approach Radars (PAR). These PAR-like displays showed the position of birds on one image of the display in range and elevation (side view) and on the other image in azimuth and range (top down). The two images were located one above the other so that the position of targets could easily be determined from one to the other in the exact same way that controllers were used to in managing aircraft arrivals and departures. The concept of operations was then modified to execute procedures to wave off an aircraft on arrival or delay departures if flocks were located on or near the flight corridors.

Today, commercially produced avian radars from various manufacturers in the US, Canada and Europe are in operational use by the US Air Force, NASA (for space shuttle launches from 2006 to 2011), by the US Navy and at several commercial airports in the US, Europe and Africa. The US Federal Aviation Administration (FAA) is also currently evaluating systems from various manufacturers and has published an Advisory Circular 150/5220-25.

The effectiveness of avian radar for detecting different bird species at various distances is highly dependent on the quality of the hardware and software (algorithms). To know the capabilities, and the limitations of the avian radar, it is highly recommended to perform an extensive system comparison and a thorough validation in the field. The insight in what the system can detect at which distance is fundamental to inform decision-making about birdstrike prevention based on avian radar.

Avian Radar Concept of Operations

It is important to make a distinction between the tactical operational use in real-time of bird radar compared to strategic use, non real-time, giving long-term and trend data analysis:

Tactical use of Avian Radar

- Real-time informing the bird control on the airfield with early warning detection of potential birdstrike risk to aircraft;
- Automatic activation of bird deterrent means by avian radar.

Strategic Use of Avian Radar

- Providing an insight into spatial and temporal distribution and in trends of bird migration patterns crossing in the near vicinity of the airport;
- Support of habitat management by providing insight into roosting and feeding areas and on hot spots of high bird concentration areas;
- Measurement of near-misses as precursor indicators of birdstrike;

- Providing specific and precise information of birdstrike risk to pilots as used by ATIS and NOTAM;
- Measurement of the effectiveness and durability of bird control actions providing insight in habituation of existing bird deterrents;
- Providing information supporting the optimal planning of bird control personnel.

The concept of operations for avian radar systems is crucial to their effective utilisation on an aerodrome. Information on the activity of large birds or large flocks of birds hazardous to flight operations can be acted upon in real time if the concept of operations is modified to use procedures similar to those utilized for missed approaches, runway incursions by vehicles or personnel or severe weather, windshear and even volcanic ash clouds.

In the years since 2002 significant advances have been made to create concepts of operation that include using radar data to show where and when bird control personnel need to be deployed to scare away birds based on recent trends in activity or in real-time. Real-time indicators are particularly important at night when personnel cannot easily see the birds they need to remove from runways, taxiways and flight corridors.

Following the initial year of deployment, most avian radar systems installed at a new location may detect at least one bird activity pattern that was previously unknown. Birdstrikes are relatively infrequent occurrences and strike statistics often don't readily identify larger night-time activity patterns that are readily apparent to radar. Radar allows mass tracking of bird hazards to be assessed.

A clear concept of operations needs to be established to know where and when conditions are occurring that are likely to result in actual risk and the procedures that will be implemented by air traffic control to deal with them. Options for using data to support bird control operations and identify bird activity patterns to improve the response times and the resulting effectiveness of bird control operations, especially at night, are also available.

The establishment of long-term trends and spatial distribution of bird activity around airfields allows identification, documentation and management of birdstrike hazards that evolve and change over time as a result of the changing nature of bird populations, migratory patterns, agriculture, land use and climatic conditions. It is impossible to manage this critical risk without data on the timing and level of the risk which radar can provide. Radar systems are the only surveillance technology currently available that provide consistent 24/7 risk assessment of the airspace in the majority of weather conditions.

Modern bird detection radars are now being deployed at airports around the world that provide a unique opportunities to help monitor, detect and evaluate (birdstrike) risk at aerodromes. Expert guidance should be sought from independent specialists on how bird detection radar technology could be used to help manage (birdstrike) risk at UK aerodromes.

APPENDIX B

Wildlife strike hazard at small non-commercial or General Aviation aerodromes

Operators of General Aviation (GA) aerodromes are recommended to take practicable steps, proportionate to the identified hazard and assessed risk, to remove and or disperse birds both from:

- The aerodrome itself
- In the near vicinity beyond the airfield boundary fence where local 'safeguarding' arrangements exist and where deemed necessary

The best practice standards outlined in this document apply predominantly to aerodromes operating commercial air traffic, irrespective of aircraft movement frequency or type of aircraft involved. However it is reasonable at aerodromes not conducting commercial air traffic, such as non-public transport, VFR flights and at those aerodromes operating as flying training establishments, to be aware of the risks to flight safety posed by birds and other wildlife and as such the measures outlined may be used proportionately as applicable.

In order to meet this objective the CAA recommends an aerodrome should have in place:

- A named individual responsible for wildlife hazard management;
- A list or map of habitat types on and bordering the airfield that have the potential to attract birds;
- A record of the species and approximate numbers of birds recorded within these habitats;

To assess the risk of a bird or wildlife strike, the aerodrome should confirm hazardous birds on or in the vicinity of the runway and detail the desired options for managing and reducing any risk that is presented.

Risk Control

The aerodrome's policy and records should document and demonstrate when or whether any habitat management is undertaken to reduce the presence of birds that are considered to cause risk.

Such procedures could include cutting grass in accordance with a LGP (as described in Chapter 5, Risk Management), requesting farmers to plough fields with spilt grain in or asking gamekeepers not to rear pheasants adjacent to the airfield fence, for example.

The aerodrome's record keeping should document whether and when any active dispersal of birds is undertaken on the aerodrome. For example, this could include warning pilots of bird issues, driving a vehicle at any birds seen on the aerodrome prior to aircraft movements or deployment of any of the more formal or typical bird dispersal methods.

Training

GA aerodromes are unlikely to have the resources to train staff in formal bird hazard control and may not perceive a need, based on records of strike incidents. However, any deterrence activities should result in a reduced risk. Familiarisation and awareness of the aerodrome and its surrounding habitat is therefore considered an essential element.

Where deemed necessary, support from a professional bird/wildlife strike prevention specialist should be sought and documentary evidence of this process, its implementation and outcomes should be recorded.