Bird hazard management at Manchester Airport

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Bird strikes are a serious threat to aviation safety. The hazard at each airport is unique and a study of the habits of birds living in the vicinity of the airport is necessary before a control programme can be developed. The habitat of an airfield can be modified to make it unattractive to birds; however, the corner-stone of a control programme remains comprehensive bird detection and dispersal by a small dedicated unit.

Gulls resting at Manchester Airport

Bird strikes are a serious and expensive threat to aviation safety. Most strikes involving civil aircraft happen on, or close to, an airport, with the result that in many countries, airport companies have a legal responsibility to take reasonable precautions against the hazard posed by birds.

A wide variety of bird control measures have been developed over the years. However, a detailed knowledge of the local bird problem is necessary if their effectiveness is to be maximised. The way in which bird control is organised, and in particular, the relationship between bird control staff and air traffic controllers, is a vital element in determining this success.

The first recorded bird strike collision between an aircraft and a bird occurred in 1912 when a gull lodged in the controls of a Wright Flyer off Long Beach, California. The aircraft crashed into the sea and the pilot was killed. Since that time, the hazard posed by birds has increased due to an increase in the number of aircraft flying, increasing speeds, more precise and delicate equipment and, in particular, following the advent of the jet engine.

Today, bird strikes cost the aviation industry tens of millions of pounds every year in engineering bills and operational delays and, in addition, an aircraft crashes on average every 18 months as a result of a bird related incident.

An analysis of serious bird strikes reveals that they involve common or abundant aircraft, normal aircraft activity, common bird types, and normal numbers of birds. For many airports, therefore, a serious bird strike is likely to occur sooner or later. It is not possible, however, to guarantee a reduction in bird strikes. It is equally impossible to guarantee a bird free environment on the airfield.

The airport company does, however, have a responsibility to take action to control birds. Bird strikes are no longer

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accepted by insurance companies as an act of God, even when they occur at very small airports, and so to avoid litigation, the airport must have a properly documented bird control programme and staff with sufficient knowledge to control that programme in an industry.

Bird control must be directed primarily at a method of reducing strikes involving the use of hazardous species. However all birds are potentially hazardous, so a detailed risk assessment should be prepared for each species. In some cases the costs in economic or environmental terms or in terms of the disruption which would be caused to normal operations would outweigh the hazard posed by the birds.

The extent of bird control at different airports ranges from an inspection of the runway before selected aircraft movements to ensuring that the entire airfield is maintained as a bird-free environment. Each airport has a totally unique problem, and a study of the ecology and behaviour of birds found on the airfield and in the surrounding countryside, is a necessary prerequisite to the development of a bird hazard management programme.

This programme should aim to identify all birds in the vicinity of the airport; assess the hazard posed by each species; identify why they use the airfield and what it is about their behaviour which makes them hazardous; change the habitat of the airfield to make it less attractive; implement a bird dispersal programme; and control birds at sites in the surrounding countryside.

Bird-strike reporting systems are in operation in many countries. The statistics arising from these reports can provide a valuable insight into the bird hazard, however, they can be extremely deceptive if viewed in isolation from data on the behaviour and ecology of the birds. The following analysis of strikes reported through Manchester Airport provides an example of the type of information which can be gleaned from this source.

At least 14 species of birds were involved in 128 strikes reported during 1982-1984. Over 90 per cent of these occurred below 100ft. Lapwings and gulls (particularly black-headed gulls) were the most common cause of bird strikes, accounting for over 70 per cent of those in which the bird was identified.

Many of the remaining strikes involved individual (often small) birds, some of which were never seen on the airfield and were assumed to have been crossing it when killed. The bird hazard management programme at Manchester Airport was designed to deal primarily with gulls and lapwings and, for reasons of brevity, much of the following will deal with these two species alone.

The extent of the hazard posed by a particular type of bird is a function both of its size, and the numbers involved in a single incident (flocking birds are more dangerous than solitary species). On average, a third of lapwing and gull strikes involved more than one bird (usually two or three); however, in an extreme incident 72 black-headed gulls were found dead on the runway following the departure of a Boeing 737.

Year	Aircraft	Location	Bird	Weight (grams)	Deaths
1960	Lockheed Electra	USA	Starling	80	62
1962	Douglas DC3	Pakistan	Vulture	~10 000	1
1962	Vickers Viscount	USA	Swan	~6000	17
1968	Falcon 20	USA	Gulls	~1000	—
1969	Douglas DC3	India	Cranes	6000	1
1973	Lear 24	USA	Cowbirds	44	—
1973	Falcon 20	UK	Gulls	420	1
1974	Cessna Citation	USA	Gulls	~1000	—
1975	NA265 Sabreliner	USA	Gulls	265	—
1975	DC10	USA	Gulls	~1000	1
1975	HS125	UK	Lapwings	216	3
1976	Lear 24	Italy	Gulls	1000	1
1976	Falcon 20	USA	Gulls	485	—
1978	B737	Belgium	Woodpigeon	485	—
1978	Corvair 580	USA	Sparrowhawk	~1295	1
1981	Lear 23	USA	Loon	3700	1
1982	Lear 35	France	Gulls	275	1
1983	Lear 25	USA	Starlings	80	—

Table 1 Birdstrike incidents involving crash and loss of life
Taken from from CAA paper 84019 Analysis of bird strikes reported by European Airlines (76-80)

Bird strikes occur throughout the year at this airport. However there is a marked seasonal variation in the number of strikes reported each month. The late summer peak in strikes corresponds with the arrival of wintering birds before British breeders have left. Further, a high proportion of the population at this time of year is composed of young birds which appear to be more strike-prone than experienced birds. In part, this distribution is also influenced by a seasonal variation in the number of aircraft movements.

The majority of strikes reported during the spring and summer months involve solitary, small birds. The peak bird strike-rate (number of strikes every 10 000 movements) for lapwing and gull related incidents occurred during the period July to January. Over 95 per cent of reported strikes occurred during daylight hours. Lapwing strikes were reported throughout the day, however, gull strikes tended to be clustered around dawn (over 70 per cent of gull related strikes were recorded within an hour of dawn).

Manchester Airport has only a single runway, yet it is noteworthy that all strikes involving gulls which were reported above 100ft occurred on approach to runway 06, or on departure from runway 24. This reflects a localised bird hazard arising from a gull flightline which passes close to the western boundary of the airport.

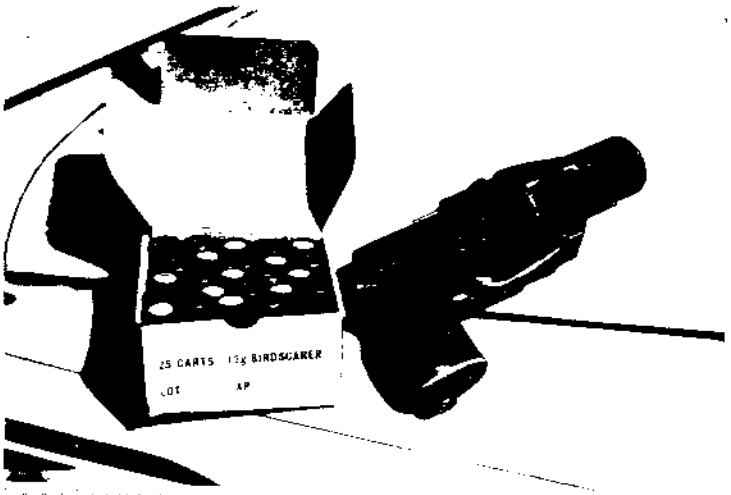
For some species, the weather influences the likelihood of a strike occurring. The proportion of gull strikes which occurred in the rain (28 per cent) was twice that found among lapwings (13 per cent), suggesting a difference in behaviour which makes gulls more hazardous in wet weather.

From the bird strike records alone therefore, it is possible to detect conditions (time of year, time of day, weather, part of airport) for each species, when strikes are more likely to occur. However, there are many limitations in these data and they provide no indication of why this variation occurs.

Prior to the establishment of a comprehensive bird hazard management programme, lapwings attempted to oust and feed on Manchester Airport from July until March each year. Numbers would build up to a peak in mid-December, when a flock containing in excess of 500 would habitually use the site. Because these birds are particularly resis-

Species	Number of strikes
Lapwing	34
Black-headed gu	19
Swallow	8
House martin	6
Swift	3
Skylark	3
Golden plover	3
Pigeons	3
Linnet	2
Starling	2
Common gull	1
Herring gull	1
Great black-backed gull	1
Lesser black-backed gull	1
Gull	17
Unidentified	24

Table 2 Bird strikes at Manchester Airport 1982-84



[illegible] dispersal, they would spend almost the entire day on the airfield being driven from site to site until air traffic pressures resulted in them being allowed to settle.

It was discovered that intensive bird control from dawn to dusk over a period of several weeks was necessary to break the habitual use of the airport. Detailed observations of the time and direction of departure of flocks was essential to the development of effective dispersal techniques.

The solution to the hazard posed by black-headed gulls was not found on the airfield. These birds arrived at the airport and dressed in approaches while passing between a winter roost 5km away and feeding sites in the surrounding countryside. The movement of birds from the roost occurred at dawn when it was dark, and the airport is quiet with the result that the opportunities for bird scaring are restricted. The answer was a fact found through observations from the airport.

As with people, birds come to an airport for one of four reasons: to eat, to drink, to roost, to breed, or to rest (loaf). Different species are here for different reasons and the same species may use the airfield for different reasons at different times of the year. Some birds, because of their behaviour, feature regularly in bird strikes, while others present on the airfield are never hit. Differences of this nature will dictate the way in which control will be achieved. Habitat management involves changing the environment of the airfield to make it less attractive to birds.

Opportunities for feeding may be reduced in a number of ways depending upon the species of the bird hazard. Many airports maintain grass on the airfield cut to 2 cm long. Selection of particular varieties of grass, coupled with a comprehensive maintenance programme ensures a tough, bristly growth which will withstand the effects of weather and remain erect.

The long grass makes soil invertebrates inaccessible to feeding birds, and many birds will not stand in it since they cannot see approaching predators, and therefore feel uncomfortable. The result is that the airfield as a whole is made less attractive to birds and the area on which birds are found is reduced and restricted to those areas which are more accessible to bird control staff.

A chemical applied to a grass strip either side of the main runway kills worms, which can be found in their thousands on the hard standing in wet weather. These are highly attractive to gulls. The general public visiting the airport must be dissuaded from feeding birds. All catering operations must be well managed to ensure that birds are not attracted by edible waste. Areas of standing water which could attract feeding birds should be filled in, treated, or restructured to reduce the diversity of animals and plants which attract birds.

Bird roosts can be made unavailable or inaccessible. A large starling roost located in the gardens surrounding the terminal building at Manchester was successfully dispersed following an extensive netting programme. Birds nesting on buildings are excluded using netting or, as in one case involving several hundred starlings, by simply closing windows.

Birds have been excluded from high mast lighting towers by using bird repellent oils. Breeding and roosting sites can be similarly treated, although bird scaring techniques and nest destruction are also effective.

Detailed observations of the birds at the airport will provide the information which will make habitat management more effective. In the longer term, the proactive approach has required the integration of bird control [illegible] into landscaping and planting [illegible] building work.

Habitat modification is an essential component of any bird hazard management programme. However, since this is never totally effective, the cornerstone of bird control remains an efficient bird detection and dispersal operation.

Although an airport is intrinsically attractive to some species of birds, others find it while flying to other sites, and may only use it at certain times of the day. Even those airports on which the number of resident birds is comparatively small can face a serious bird hazard where the environment surrounding the airport is full of birds.

The result is that, in theory, flocks of birds may appear over the perimeter fence at any time, and from any direction, and land on the runway. The only truly effective method of detection involves the provision of dedicated staff who can spend their entire working day patrolling the airfield, if the extent of the bird hazard demands it.

Those birds which use the airport on their way to other sites can often be dispersed with comparative ease. However, those species which are attracted to the airport itself will tend to be more persistent.

There is a tendency to let flocks of birds which are loafing in remote corners of an airfield rest there, sometimes at sites quite close to the runway, to be allowed to remain there if they show the least sign of persistence. This practice, which is at best short-sighted, and at worst dangerous, arises both because of the limitations on the amount of time which can be allocated to bird control, and also because bird dispersal carries with it a degree of hazard to aircraft, and air traffic controllers are sometimes unwilling to allow dispersal to take place. A good relationship with ATC is therefore essential.

All flocks of birds should be dispersed at the earliest reasonable opportunity because a flock of birds on the ground acts as an attractant to others, and small flocks are easier to disperse in a controlled manner. While a flock remains on the ground it offers no immediate threat to an aircraft (unless, of course, it is on the runway). However, it may be disturbed at any time and fly up in a dangerous and uncontrolled manner. The bird officer can select when, and in what way, to disperse the flock.

If a flock is allowed to remain on an airfield for any length of time, the birds become more resistant to dispersal action. In the short term, they learn that with a little persistence they will be allowed to settle again, in the long-term they start to include the airport as part of their daily routine. Bird dispersal may take only minutes, although a persistent flock may require continuous dawn to

Bird control vehicle in use at Manchester Airport

risk scaring for a number of days in order to break its allegiance to the airport.

Birds are most easily dispersed if attacked before they have settled on the airfield. Observations of the movements of different types of birds will indicate the direction in which they will most easily be driven off. This requires the maintenance of detailed records, and also an intimate knowledge of the local bird populations.

A variety of techniques are used to scare birds, the most effective being the Very pistol and cassette tapes of birds in distress. The Very pistol, which fires an explosive flare, is fast-acting and can be used to shepherd a flock, but its use can be limited in the vicinity of aircraft and buildings. Distress tapes have a longer lasting effect but are limited in their use by ambient noise and high winds which distort the sound being broadcast. The birds can become habituated to the sound if it is used repeatedly without reinforcement.

Birds of prey are used at some airports although they are costly to maintain, cannot be flown in extreme weather, and are not effective against certain species of birds. Finally, of course, they do constitute a bird hazard in themselves, and in some countries are banned for this reason.

Automatic bird scaring equipment has a number of major limitations and yet it is still regarded as a cheap and convenient method of control. It is non-directional, it can be dangerous and go off at the wrong time (when an aircraft is taking off or landing), and it does not respond to the reactions of the birds. As a result, the birds become habituated to, and ignore, the equipment, particularly if the scaring is never reinforced with human intervention and the use of a shotgun.

Birds have brains which are far more sophisticated than even the most complex microchip-controlled bird scaring device. By and large, such equipment is ineffective in comparison to the results which can be achieved by trained bird-control staff. However, it is of use at sites in remote corners of the airfield which are difficult to gain access to.

A culling operation has been introduced to reduce the size of a rookery on the southern boundary of Manchester Airport. In general, the trapping, shooting, or killing of birds has limited value and while the shotgun is a very useful adjunct to other types of scaring equipment, the large scale slaughter of birds unacceptable environmentally, legally, and politically. Where protected species are involved, a programme of trapping and removal to another suitable site should be considered.

The extent of the bird hazard at an airport is a function of both the attractiveness of the airfield itself and the diversity and richness of the countryside in which it is set. Since gulls will fly 20 km or even 40 km each day in search of food, the extent of the hazard on the airfield can be determined by conditions of sites many kilometres away, which therefore must also be considered for bird control activities. The identification of such sites and the action which can be taken against them is discussed by D. Thomas (Royal Aeronautical Society Symposium, *Bird Hazards in Aviation*, 1987).

Action required to reduce the bird hazard at Manchester Airport has included the encouraging of the closure of waste disposal sites, the production of information for farmers on how to modify their farming practice, the development of a programme designed to disperse the night roost from the nearby lake, and an agreement with the local water authority that sewage spraying on farmland close to the airport be stopped during the winter months. This has disrupted the traditional dispersal pattern of the birds from their night roost, and in so doing has reduced the bird hazard on the airfield.

Manchester Airport created the post of Bird Control Officer and in so doing became the first civil airport in Britain to allocate full-time staff to this problem. Following a study, a bird hazard management programme was drawn up and a three-person bird control unit was established.

The work of this unit has resulted in a decline in the bird-strike rate, a reduction in the proportion of strikes involving gulls and lapwings, a decline in the number of birds which regularly use the airfield, and a reduction in the effort required to disperse those birds which do come (as measured by the number of bird scaring cartridges used). This has a secondary benefit in providing significant financial savings.

The hazard posed by birds to aircraft is a complex biological problem with environmental and operational implications. It cannot be properly assessed by engineers or airport managers without training in this field. At many airports, the level of bird activity is so low that the risk of a serious incident is almost zero. However, at most airports it is necessary to employ a suitably qualified individual to carry out a short-term study as a pre-requisite to the development of a comprehensive bird hazard management programme, which should then be implemented by a small, dedicated team.

Year	1983	1984	1985	1986	1987	1988
Bird control	part-time			full-time		
No of strikes	38	38	38	30	28	28
No of movements	86 265	92 096	95 600	111 576	126 000	144 715
Bird strike rate	4.4	4.1	4.0	2.7	2.2	1.8
Number strikes involving gulls and lapwings	18	27	19	12	8	2
% total strikes	47%	71%	50%	40%	29%	7%
Cartridges used	14 417	10 329	4 210	3 000	1 841	2 402
Approximate cost	£12 891	£9 193	£3 747	£2 670	£1 638	£2 138

Table 1. The effectiveness and costs of bird control at Manchester Airport

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