OVER-FLYING OF BIRDS AT AN AIRPORT: DEVELOPING A METHOLOGY

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Many airfield management practices have been developed to make grassland and hard standing areas less attractive for feeding and resting birds. It is more difficult to manage the surrounding habitats and**,** consequently**,** the birds that over-fly the airfield en route to roosting and feeding areas. To more fully understand the strike risks posed to aircraft it is important to quantify these over-flying rates in relation to species, flock size, flight direction, time spent crossing the active runway, flight heights, etc., and how these factors are influenced by environmental conditions and airfield activity. This study outlines the methodology that has been developed to quantify and examine over-flying bird data at a busy civil airport. The field data are collected using a variety of observational techniques that have been applied in repeated visits throughout the past two years.

1. Introduction

The retrospective nature of bird strike statistics has an important bearing on how they may be applied to the management of bird control measures. The statistics are chiefly of value when examining long term trends or responses to changes in airfield layout or management practices. Monitoring bird numbers, species profiles and behaviour around aerodromes on an ongoing basis generates a complimentary source of data, which is more suited to the day-to-day management of bird control programmes. The important step of summarising these type of data on airfields for management use has been taken on in only a very small proportion of airports (Milsom & Horton, 1995).

One of the major factors used to assess the risk of bird strike is exposure. However in a study at six military airports in the Netherlands (Dekker and Buurma 1988) were unable to find a simple correlation between Lapwing, *Vanellus vanellus* numbers and strike frequency. It was concluded that behaviour was as much a contributing factor to risk as presence on these aerodromes. Similarly, Hahn & Weitz (1998) concluded that bird behaviour plays an important role in determining bird strike risk. Detailed description of bird behaviour at airfields would, we contend, be a move toward improving of risk assessment.

Baseline survey work carried out to assess the strike risk posed to aircraft by birds could be conducted as part of an airfield's integrated bird strike risk management plan.

In modern airfields with a zero tolerance approach to birds present on the ground and locally appropriate airfield management practices e.g. a long grass policy, the main strike risk may comprise of birds overflying the runway (de Hoon & Buurma, 2000). To describe basic avian movement patterns at the airfield it is important to quantify the overflying rate in relation to species, flock size, flight direction, time spent crossing the active runway, flight height and bird behaviour. How these factors are influenced by environmental conditions and airfield activity also requires examination.

This paper summarises the methodology that has been developed to quantify and examine overflying birds at a busy airport. Field data is gathered through a variety of observational techniques that have been applied in repeated visits during the past two years.

2. Methods

2.1. Site description

Dublin airport (EIDW) is situated in north County Dublin (53'25.87N 006'15.20W) on the east coast of Ireland. It is an international commercial airport that carries 15-20 million passengers annually. It has two principal runways: 10/28 (2637m x 61m) and 16/34 (2073m x 61m).

2.2. Equipment and baseline survey work

Our initial aim was to familiarise ourselves with the layout of the airfield. Previous work conducted at the airport focused on central area around and including the main runway 10/28. In order to build upon the store of historical data available, it was decided to concentrate bird-recording efforts to this central box', which encompasses all but the extremes of the main runway. To allow more detailed recording of data, the historical field method was adapted.

Data was collected from three sectors of the main runway. These are listed below:

Approach Zone: Defined as the airspace on the approach to the `28' end of the runway and bounded by known landmarks
Climb-out Zone: Defined as the airspace to the west of the `10' end of the runway and bounded by landmarks
Central Zone: This is the area between the east and west glide slope (ILS) aerials on 10/28. The airfield fence marks the northern and southern boundaries of this zone. This zone is over 1.7 km long and demarks the critical airspace where aircraft land and take-off. Data collection is largely focused on this area. Historical data on crossing-rates and avoidance behaviour are also available for this area.

Figure 1 illustrates how, using a series of landmarks, clearly visible from either side of 10/28, a rudimentary grid was formed and used to classify observations of birds flying over this site. Thus we divided the survey area into a grid with six large boxes. Boxes All, B1, A3 and B3 that run from runway or taxiway margin as far as the airfield fence, and other boxes, A2 and B2, that encompass portions of the runway and taxiway. A similar grid operates in the *Climbout* and *Approach* zones. The lengths and areas of these zones have been calculated from an AutoCAD drawing of the airfield.

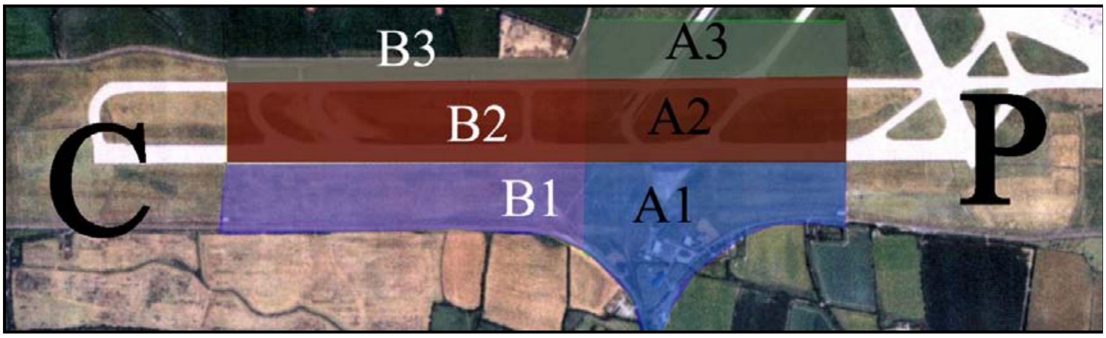


Figure 1. Aerial photograph of the main runway (10/28) at Dublin Airport. The main grid positioning system used in the field is indicated. Zones A&B comprise the central zone where most of the data are collected. A similar grid system also operates in the Climbout Zone ('C') and Approach Zone ('P').

Given the large 'volume' that the survey area encompasses, it was imperative to find a quick and accurate way to record the observations. A digital voice recorder, with two external microphones and a microphone jack adapter were employed to allow both observers to record field observations simultaneously [Sony ICD-BP150; Sony ECM-TS125]. The collected data was analysed at a later stage using Sony Digital Editor Software. All observations were made with the aid of Carl Zeiss 8x30 *Diafun* binoculars.

Field readings of light intensity are recorded using a datalogging light meter (Extech 401036) and imported into MS Excel. Additional data on the aircraft movements is supplied in spreadsheet format from Aer Rianta (now *Dublin Airport Authority*) at Dublin Airport. Weather data collected by Met Eireann at the airport have been formatted for Paradox database tables for subsequent query by example (QBE).

2.3. Novel field methods

As well as quantifying the overflying rate of birds at Dublin airport, this study aimed to understand the behaviour of these overflying birds in relation to environmental condition and airport activity. Our research has focused on a number of areas.

<u>Avoidance behaviour:</u> This area of research details the types of avoidance behaviour exhibited by overflying birds as well as the conditions under which they avoid aircraft.
<u>Flight elevation:</u> Aircraft move in a 3-dimensional space. In order to assess to number of birds that are exposed to strike risk the flight elevation of birds were recorded.
<u>Time over the runway:</u> Crossing rates alone cannot describe how long the bird is exposed to risk of strike. This field method measured the time the bird spends in the "zone of danger" when crossing the airfield.

2.3.1. Avoidance behaviour

Categorisation of avian avoidance behaviours closely follows Kelly *et al*. (1999, 2000).

Avoidance manoeuvres are classified as follows:

(i) No response

(ii) Shallow-S response - the bird(s) avoid the aircraft by flying in a shallow-s shape

(iii) Deep-S response - the bird(s) avoid the aircraft by flying in a more pronounced s-shape

(iv) Noose - the bird(s) fly a complete loop to avoid the aircraft

(v) Acceleration

(vi) Deceleration

(vii) U-shape - the bird(s) do a u-turn and do not cross the runway

(viii) Protean - a rapid alarmed zigzag flight in response to aircraft (uncommon)

Occasionally birds will combine some of the various avoidance manoeuvres or show multiple repeats of one response e.g.. a bird may fly a noose followed by a deep-s shape manoeuvre or perhaps accelerate and then perform a shallow-s shape manoeuvre before choosing to cross the runway. These compound avoidance manoeuvres are described as Combination responses.

In Spring 2004, a novel recording scheme was adopted to estimate the distance of birds from aircraft when avoidance manoeuvres commence: ‘Avoidance Distance’. A detailed scaled drawing of 10/28 is used by field observers to map the positions of the birds and aircraft (Figure 2). Data is simultaneously collected on the time, date, prevailing environmental conditions, active runway, phase of flight, type of aircraft, species and number of birds involved etc. The field data collected was subsequently digitally scanned and analysed using ImageJ (NIH, USA).

Data was extracted on several factors at the time of avoidance:

(i) Distance from aircraft to bird

(ii) Distance of bird from centre of runway 10/28

(iii) Distance of aircraft from 'intercept' - point where the paths would cross

(iv) Distance of aircraft from active end of runway 10/28

(v) Angle between bird and aircraft

2.3.2. Flight elevation

Standard recording methods are not always reliable in gathering useful data on flight elevation. In order to examine the elevation profile of birds crossing the runway a number of methods were used: Categorization, Triangulation by theodolite and RADAR.

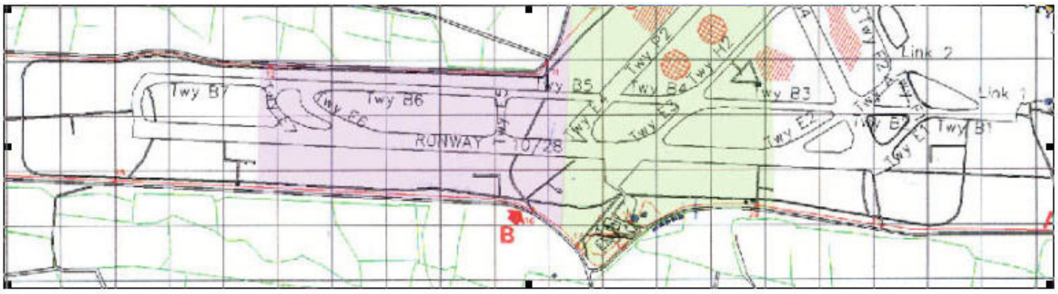
The categorization approach is a rudimentary field technique that allows the collection of a high volume of relatively crude data on flight elevation. In this method observers classify the flight heights relative to the height of the ILS (Glide-slope) aerials on the eastern and western end of the main runway. The categories were defined as follows:

a) Ground - birds flying in 'ground effect' i.e.. within 1 metre of the ground
b) Low - below the height of the ILS aerial (<17m AGL)
c) High - from 1-3 times the height of the ILS aerial
d) Very High - Above 3 times the height of the ILS aerial

The triangulation by theodolite method was employed to accurately estimate the elevation of birds crossing a runway. This is an exact but labour intensive means of gathering high-quality data. In brief, it involves spacing two theodolites a distance apart and taking simultaneous referenced angle readings (for the horizontal and vertical planes) for a bird-target flying in the airspace between the operators. This method has been used on a limited basis, as it is extremely labour intensive with a low yield of (high-quality) data.

2.3.3. Time over runway

The standard recording method does not yield accurate information regarding the actual time spent by birds in crossing the runway. To address this deficiency a number of suitable vantage points looking directly down the main runway were identified. Birds crossing the runway were timed by stopwatch. To further reduce possible parallax effects the runway crossings were timed from the median line to the runway edge lights i.e. only half the 51m distance. The setback distance from the runway also reduced the potential errors of parallax. Further, error reduction was achieved by independently timing many of the crossings on a second stopwatch. This technique does not attempt to measure flight speeds (bearings are not known) but merely the time spent by birds in crossing the runway. This variable has not been measured previously in the context of bird hazard research.



DATE/TIME ______________ OBSERVERS __________ SURVEY AREA __________

ACTIVE RW _________ AC INVOLVED _______________ PHASE OF FLIGHT ______________

SPECIES INVOLVED ___________________ NUMBER IN FLOCK _______ NUMBER AVOIDING__________

TYPE OF AVOIDANCE SHOWN ____

COMMENTS ____

____

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Figure 2. The Recording Sheet for the estimation of 'Avoidance Distance'.

3. Conclusion

By adopting a multidisciplinary approach to the assessment of bird strike risk a more useful and complete picture emerges that can further inform airfield management strategy. The methods used can be used to generate a basic 3-D picture of avian activity at an airfield. The basic field methods can be augmented by occasional labour intensive recording methods such as triangulation by theodolite or even technological data gathering such as by mobile RADAR.

In can be argued that collection of this type of baseline data should be incorporated into avian strike risk assessments. It has the benefit of giving airfield managers a fuller picture of seasonal trends in the overflying rates and species profile of birds in the active airspace. Year-on-year these data can help identify changes in the overflying pattern of the species that are commonly struck and those that are deemed especially hazardous to aviation.

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